BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
July 24, 1974

EXAMINER HEARING

IN THE MATTER OF:	
Application of Texaco Inc. for a Special Allowable, Lea County, New Mexico.	Case No. 5286

BEFORE: Richard L. Stamets, Examiner.

TRANSCRIPT OF HEARING

A P P E A R A N C E S

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I N D E X

E X H I B I T S

MR. STAMETS: The Hearing will please come to order. We will call at this time Case 5286.

MR. CARR: Case 5286. Application of Texaco Inc. for a Special Allowable, Lea County, New Mexico.

MR. STAMETS: Call for appearances.

MR. KELLY: Booker Kelly of White, Koch, Kelly & McCarthy, Santa Fe, on behalf of the Applicant and I have one witness.

MR. STAMETS: Other appearances?

MR. KELLAHIN: If the Examiner please, Jason Kellahin, Kellahin & Fox, Santa Fe, appearing for Phillips Petroleum Company, we will have one witness.

MR. BRANNEN: Jeffrey R. Brannen appearing for Shell Oil on behalf of Montgomery, Federici, Andrews, Hannahs & Buell. We will have no witnesses but we will ask to make a statement at the close.

MR. COOTER: Paul Cooter of Atwood & Malone in Roswell appearing on behalf of Marathon Oil Company. I introduce to the Commission at this time Jack McAdam, who is house counsel for Marathon of the Houston office. Marathon will have no witnesses but would make a statement at the conclusion of the testimony.

MR. STAMETS: Any other appearances?

If all the witnesses will stand at this time and be sworn, please.

(Witnesses sworn.)

MR. STAMETS: Mr. Kelly, you may proceed.

MR. KELLY: All right. Mr. Examiner, I have already furnished you at the end of the table with a list of our six exhibits. I have two extra sets here which I guess I will give to Mr. Kellahin.

MR. KELLAHIN: Thank you.

MR. KELLY: We can share the others, gentlemen? I am sorry that I don't have another set.

(Whereupon, a discussion was held off the record.)

MR. KELLY: Are you ready, Mr. Examiner?

DOUGLAS STANLEY SPRAGUE

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

DIRECT EXAMINATION

BY MR. KELLY:

Q Would you state your full name and your employer and the position that you hold?

A My name is Douglas Stanley Sprague, I am employed by Texaco, and I am currently in the capacity of Reservoir

Engineer in Midland, Texas.

Q Have you previously qualified as an expert witness in that field before this Commission?

A No, I have not.

Q Would you give the Examiner a brief summary of your professional and educational background as it relates to the field of Petroleum Engineering?

A I graduated in 1952 with a Bachelor of Science Degree in Petroleum Engineering from New Mexico Institute of Mining and Technology. Immediately following graduation I was employed by Texaco and for the past 12 years I have held various engineering assignments with them, and I am currently in the capacity of Reservoir Engineer, Midland, Texas. My particular emphasis has been in Reservoir Engineering.

Q As part of your work have you had occasion to study the reservoirs involved in this Application?

A Yes, I have.

MR. KELLY: Are the Witnesses qualifications acceptable?

MR. STAMETS: Are there any questions? They are.

BY MR. KELLY:

Q All right. Now, referring to the plat of the area,

would you give the Examiner a background on what is involved here and basically what Texaco is after and relating to the earlier case that set up this pressure maintenance project?

A Exhibit 1 is a plat showing the unit boundary for the Vacuum Grayburg-San Andres Unit and is depicted in red. The project was authorized by Order No. R-4442 and the Unit became effective on January 1st of 1973. Now,at the original hearing for the Unit we had requested approval of the Unit, permission to infill drill the project and had requested a 75 percent bonus allowable for the anticipated project area of 39 wells. This would give us a top allowable for the project of 5460 barrels per day. Now, the Commission granted approval of the project and the project area was set equal to the Unit area. We were also granted an allowable of 80 barrels of oil per day times the number of wells in the project with the exception of the lease-line wells being limited to 80 barrels per day until substantial response to injection could be demonstrated.

We were also granted the ability to request additional infill wells in the project administratively. The project injection was started in January of 1973, and

subsequently received administrative approval for the drilling of 8 additional infill wells and there has been a total of 23 infill wells drilled in the project to date: 11 injection wells and 12 producing wells. There are a total of 58 wells in the project. They are numbered consecutively from 1 through 58 starting on the south end of the project reading from left to right as you progress toward the northern boundary.

We have now received response in the project and this is the reason for appearing before the Commission and asking for additional allowable.

Specifically what we are requesting is first, a 50 percent response allowable, or 2320 barrels of oil per day, to be added to the current top allowable of 4640 barrels per day incrementally as response from the producing wells dictates, and secondly, we are going to establish an allowable of up to 240 barrels of oil per day on the lease-line wells that have demonstrated substantial response to water injection.

Q In that connection, you will give to the Commission a formula to use on those lease-line wells, is that correct?

A Yes, we will.

Q All right. What is the current producing rate of this Unit and what is the top allowable that can be obtained under present rules?

A The current producing rate of the project is 4640 barrels per day which is the top allowable that is permitted under the current rules for the project.

Q What was the capacity of this Unit at the time of unitization prior to water injection?

A It was 4348 barrels of oil per day, and this included the production from the 12 infill-producing wells that were drilled.

Q What is your present capacity as far as the Unit as a whole?

A Presently the Unit has a capacity of 5110 barrels of oil per day plus some additional capacity on lease-line wells that cannot be measured due to equipment limitations.

Q All right. Now, referring to what has been marked as Exhibit 2, what is your opinion as far as the increase in production capacity is concerned?

A The increase in production capacity in this project is the result of injection; we are experiencing response to the injection. Exhibit 2 is a performance

curve upon which we have plotted the average daily hole production by months along with our average daily water production, our water injection, and our gas-oil ratio. The significance here is the gas-oil ratio curve which shows that the gas-oil ratio has declined from approximately 2200 to 1 to the present level of about 1650 to 1.

Q Would you explain to the Examiner why Texaco feels it is necessary to have an injection response allowable for this?

A Well, it is essential that we be allowed to produce all response oil as it reaches the producing wells and this is for efficient and maximum recovery from the project. If you'll refer to our next two exhibits, Exhibits 3 and 4. Exhibit 3 is a cross section across the northeastern portion of the Unit and the line of cross section is indicated on Exhibit 1 by a green line. This cross section is demonstrating the amount of pay zone continuity that is existing in this portion of the reservoir, and Exhibit 4 is a schematic diagram which further illustrates this and shows that the ratio of continuous pay to total pay is approximately 60 percent. You can see on this Exhibit 4 that with injection creating response, say in that middle zone, which is discontinuous

if we are not allowed to produce all the response oil as it reaches the producing well, it is going to migrate on past the producing well into the primary depleted portion of the pay which is noncontinuous to the other producing wells. This oil that is resaturating this noncontinuous portion of the pay will be trapped there.

Q Do you have an estimate of the loss that would be involved?

A Yes. We estimate that this loss in the Unit could be in the order of 1,000,000 barrels. This is a conservative estimate and it could be even more than that. Now, we had considered one alternative to this problem, and that would be to limit the injection rates. But first of all, limiting of production is not consistent with our current energy needs, and in addition to that, the limiting of injection rates would have a detrimental effect upon our injection profile. This is due to the heterogeneity of the reservoir. Under curtailed injection rates the injection profile would deteriorate and water would not enter all of the vertical interval that we desire it to do so.

So, in order for us to maximize recovery from this project, we must be able to operate at optimum

injection rates and be able to produce all of the response oil as it reaches the producing wells. This will limit the loss of reserves.

Q All right, now, going back to your Exhibit No. 1, your plat, let's discuss these lease-line wells for a minute. What wells on the lease line, in your opinion, have experienced responses?

A We have 4 lease-line wells which have exhibited response and it is necessary that we be allowed to produce these wells.

Q Can you first locate them for the Examiner on your Plat No. 1?

A Yes. They are Wells Nos. 52, 54, 55, and 57; they're all along the northern boundary of the project.

Q Now, 52 and 54 off-set what well?

A They off-set Well No. 4 on Phillips' Emmy Hale Lease, and off-set 54 is an off-set to Phillips' Emmy Hale No. 3.

Q And the other two wells are off-set by Texaco's own wells, is that true?

A Yes, they are.

Q Okay. Now, what is the reason that you need a higher allowable than 80 barrels per day for these lease-

line wells that have shown response?

A Well, as previously discussed, we need the additional allowable to prevent the migration of oil into these nondiscontinuous portions of the reservoir and we also need the response allowable to prevent the migration of oil from one of the unit areas onto the adjoining properties which are under primary depletion.

Q And what method does Texaco propose to set the allowable for these lease-line wells?

A Well, we propose that a decline in GOR together with a productive capacity be considered as evidence that water-flood response has occurred. Now,there are some wells in the reservoir that have capacity in excess of 80 barrels per day without injection response, however, a decline in the gas-oil ratio in a high capacity well can only be attributed to the repressuring of the reservoir through water-flood response. The limiting gas-oil ratio for the Vacuum Field is 2500 to 1 and almost all of the off-sets are leases in this portion of the field and are producing at or near their limit for primary operations. We propose that as the GOR declines that the allowable for the lease-line wells in the Vacuum Grayburg-San Andres Unit be set according to a formula where the allowable would

equal 2500 divided by the measured GOR times 8. For example, if the GOR of a well declined to 2000 to 1 the allowable would equal 2500 divided by 2000 times 80 which would equal 100 barrels of oil per day. In this way all parties concerned would be certain that the wells are indeed responding and that the allowable increases are in accord with this response. It's further requested that the provision be made so that the allowable for the lease-line wells be increased automatically up to a maximum of 240 barrels of oil per day based on this previously mentioned formula. On this basis a 240 barrel per day well would be producing with a GOR of 833 to 1. In our next exhibit, which is Exhibit No. 5, is a graphical illustration of how the allowable would be determined for the wells. On this we show the major GOR on the vertical scale versus the allowable. From this the allowable would be determined for the wells.

Q Now, what is Texaco's basis for recommending a lease-line well allowable of 240 barrels per day at this time?

A Well, we're simply recommending this as an intermediate step until water-flood operations are initiated on the adjoining properties. At that time that water-flood

operations are initiated on adjoining properties, and there is cooperation, we would propose that the lease-line allowable restrictions be removed.

Q Are we talking about water-flood operations or pressure-maintenance operations?

A The Vacuum Grayburg-San Andres is classified as a pressure-maintenance project.

Q What would you be talking about on the off-set operations here; pressure maintenance or water flood?

A It would fall in the classification of pressure maintenance project.

Q All right. Now, referring to Exhibit 6, could you explain to the Examiner what your basis of contention is that the four wells you have previously identified have experienced response?

A Exhibit 6 is a tabulation of well tests both prior to water injection in the project and our current tests. The four wells that we are requesting additional allowables on the lease line at this time are shown on the bottom of the second page; Wells 52, 54, 55, and 57. These wells have all demonstrated the substantial reduction in the gas-oil ratio. In utilizing the formula that we have proposed, the allowables assigned to these wells would be

88, 104, 240,and 240 respectively.

Q Two of those wells would actually still be under their capabilities, is that correct, with that formula?

A Yes. Wells Nos. 55 and 57 currently are testing for a 280 and 282 barrels per day consecutively.

Q What point do you feel this Unit is in as far as response? Are we just experiencing early response at this point?

A Yes. We are in the very initial stages of response.

Q And I assume that your opinion is that the lower GOR is the most effective way of showing response at this time?

A Yes, I do.

Q Now, as I understand it, if this Unit were classified as a water-flood project you would not have any limitation on your allowables for your lease-line wells, is that correct?

A That is correct. Water-flood projects are allowed to produce at their maximum capacity.

Q Now, would you say that the right to have maximum capacity for all wells, including lease-line wells, is necessary to assure maximum recovery and to protect the correlative rights of operators in water-flood or pressure

maintenance projects?

A Yes, definitely, because without this rule, all would be lost in discontinuous stringers and it would also be swept from the project area to the adjoining properties.

Q I assume that the mere fact that this is classified as a pressure-maintenance project does not affect the result of the adverse effect that you described; it would have the same engineering principles involved?

A Yes.

Q What, in your opinion, is the difference between this pressure-maintenance project and a water-flood project?

A Well, it is my opinion that there is very little difference. The program that is being conducted in the Vacuum Grayburg-San Andres Unit is in effect a water flood. The only difference is the stage of depletion at the time water injection was initiated. To qualify as a water-flood project, wells must be considered to be in the stripper stage, which is an average of 10 barrels of oil per day per well, or less, and when we initiated injection in the Vacuum Grayburg-San Andres Unit the average production from existing wells was 76 barrels of oil per day per well.

Q Now I assume that Texaco made a determination

then when they instituted this project that the best way to produce this reservoir was by going through a secondary recovery or water-flood-maintenance project prior to reaching stripper stage?

A Yes.

Q Do you feel this has resulted in a more efficient and complete capture of the oil that's in place?

A Yes, we definitely do. By flooding the reservoir at the higher pressure, secondary recovery will be increased by approximately 2.4 million barrels. This additional recovery is due to two facts: First of all, at the higher reservoir pressure you have a higher formation volume factor which means there will be fewer stock-tank barrels remaining as residual oil, and secondly, at the higher-formation pressure you have a more favorable oil viscosity and the mobility ratio is more favorable, which will result in increased sweep efficiency in recovery.

Q All right. Mr. Sprague, in summary, is it Texaco's position that you have shown initial response through your pressure-maintenance project? In that correct?

A Yes.

Q And that the response is now being picked up in all of your wells because you have an allowable that is limited

under the capacity of these wells to produce them?

A That is correct.

Q Is it your testimony that all the actual perimeters show that the production, on the basis of the capability of these wells to produce, is not hurting the reservoir?

A That is correct, there is no damage to the reservoir.

Q And as I understand it, if this were classified as a regular water-flood project you would be dealing with a capacity allowable?

A Yes.

Q Now, what effect do you feel your lease-line allowable and your formula would have on the effect of correlative rights of operators on the other side of the lease line?

A I feel that it will not affect correlative rights of the other operators.

Q You feel that with the present limitation of 80 barrels per day that Texaco's correlative rights would be affected?

A Yes, I do.

Q Adversely?

A Yes, I do.

Q Were Exhibits 1 through 6 prepared by you or under your supervision?

A Yes, they were.

MR. KELLY: We move the introduction of Texaco's Exhibits 1 through 6 at this time.

MR. STAMETS: Without objection they will be admitted.

(Whereupon, Texaco's Exhibits 1 through 6 were admitted into evidence.)

MR. KELLY: We pass the Witness.

MR. STAMETS: Are there questions of this Witness? Mr. Kellahin?

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Sprague, on your Exhibit No. 1, that shows a lot of wells that are not in production at this time?

A Yes, it does. There are 58 wells within the Vacuum Grayburg-San Andres Unit and it does show what was completed in other productive horizons in the Vacuum Pool, and that is true for surrounding properties also.

Q The Exhibit is not limited to just the San Andres Wells then?

A No, sir.

Q Now, I take it that the green line is your cross section?

A Yes.

Q The same as shown on your Exhibit No. 3. You did not include Well No. 55 on that?

A No. In preparing these cross sections we utilized the wells that had the best data available on them. In other words we had high quality logs on the wells that are included on the process.

Q Do you have logs on the other wells in the Unit?

A On all of the new wells, yes, we have top quality logs on existing wells. Our original wells in the project area, some of the logs are old electric logs which were not suitable for preparing a cross section.

Q Well, now, as I understand your Exhibit No. 3 it was designed to show discontinuity of the reservoir across that area?

A Yes, sir.

Q And you have only included, essentially, the north half of Section 1 plus one well in Section 6?

A Yes.

Q But you didn't prepare an exhibit to show the situation clear across the Unit?

A No, sir.

Q And you did not prepare an exhibit that would show the actual reservoir situation in other places within the Unit?

A No, sir.

Q Can you testify of your own knowledge that there is actually discontinuity between the Texaco Wells in Section 2 and the Phillips Wells to the north in Section 35?

A Based on my knowledge of the reservoir in other work that we have done in other portions of the reservoir, I would say that this continuity exists throughout the Vacuum-San Andres Field.

Q Did you say continuity or discontinuity?

A Discontinuity exists.

Q If discontinuity exists along there, what you do whether you get the increased allowable or not it's not going to make any difference as far as Phillips is concerned, is it?

A The discontinuity would just affect, this has the effect of all being trapped in the discontinuance members. This would be the primary concern of the Unit.

Q That would be the concern of the Unit?

A Yes.

Q But awhile ago you said oil would be swept past your wells and on to the Phillips' lease as I understood you.

A In the continuance portions of the pay, yes, this would occur.

Q If there are any.

A There are.

Q There are? Do you have anything here to support that?

A The Exhibit 3 that we have, our cross section, shows both continuity of pay and discontinuity.

Q But that only is confined to the north half of Section 1?

A Yes, it is.

Q On your Exhibit No. 2 you show water injection barrels per day -- I'm sorry, I'm not too good on graphs -- can you tell me what your total injection is, what your current injection rate is?

A The current injection rate is approximately 14,000 barrels of water per day.

Q Do you have a cumulative figure for water injection?

A No, I do not have that handy.

Q What is your current oil production per day?

A It is the top allowable of 4640 barrels per day.

Q Did I understand you correctly, 14,000 for water?

A Yes, 14,000 for water injection.

Q And what is your cumulative oil production since January the 1st of '73?

A I don't have that number.

Q Now, on your gas-oil ratio, it would appear in, probably in May, your gas-oil ratio started going up again. Can you account for that?

A Yes I can. This was the result of a work-over on Well No. 28 on the east side of the Unit. This Well was fractured and following the fracture treatment we had a substantial increase in gas production. However, at the present a packer has been set in this Well and the gas-oil ratio has been reduced, so that was just a temporary situation.

MR. STAMETS: Then, is it in fact an unflooded zone?

MR. SPRAGUE: Fractured into a zone with high gas saturation.

MR. STAMETS: The zone identified on your Exhibit No. 3?

MR. SPRAGUE: Yes, it would be the lower portion

of the Grayburg, immediately above the San Andres, top of the San Andres.

MR. STAMETS: Could you identify that on one of these wells?

MR. SPRAGUE: Okay. On the Vacuum Grayburg-San Andres Unit Well No. 43 there would be this interval from 4312 on down towards the top of the San Andres, which is indicated by the marker.

MR. STAMETS: About a 20-foot section there?

MR. SPRAGUE: Yes, 20 to 30 feet.

MR. STAMETS: I'm sorry.

MR. KELLAHIN: That's all right.

BY MR. KELLAHIN:

Q Mr. Sprague, getting back to your Well No. 28, you had figured the increase in the GOR for the entire project solely from that one well?

A That is the majority of it.

Q Where is the rest of it?

A There are smaller wells on this tabulation that have had an increase of gas-oil ratio.

Q That's on your Exhibit No. 6?

A Yes.

Q Point those out, please.

A This would be on Exhibit No. 6.

Q If you would give us the ones where they have shown an increase.

A Well, to start with, No. 1 has had an increase, No. 2, No. 3, No. 4, No. 12, No. 20, No. 26, 27, and of course 28 stands out, No. 37, No. 38, No. 40, 42, 43, 46, No. 51, and No. 58.

Q That's 17 wells that have shown an increase, is that right?

A Yes.

Q And how many producing wells are there?

A Let's see, there's 58 wells in the project and we have 11 injection wells, so that would be 47 producers.

Q Mr. Sprague, would you identify by number the edge wells along the east side of the Unit?

A Along the east boundary?

Q Yes.

A Starting at the northeast corner we have No. 58, No. 43, moving south, No. 28, and No. 13. Those are the San Andres completions.

Q Are those wells carrying 80 barrels allowable?

A I have to refer to my Exhibit 6. Yes, they have 80 barrel allowable; that's not necessarily the test on the

well. But they are restricted to an 80-barrel-per-day allowable per well.

Q The well is producing at the rate of 42 barrels?

A Yes.

Q Do you consider that showing a response?

A Not on the Well No. 13 because we are tying response in with both a decline in gas-oil ratio and an increase in production capacity of the well.

Q Well, how do you arrive at the increase in productive capacity of the well?

A From well tests.

Q Isn't this your current well test that you show on Exhibit 6?

A Yes.

Q It shows a capacity of 42 barrels say on the No. 13 Well?

A Yes. It was making 89 barrels of oil per day prior to water injection and it is now making 42.

Q So its production has gone down instead of increasing?

A Yes, it's not responding.

Q Do you have a summation of two columns shown on the Exhibit, oil, water, gas, and totals?

A On the current tests to total is 5110 barrels of oil per day which was previously stated in the testimony as being the productive capacity of the Unit.

Q How about the water?

A I have not got a total on the water. The total on the water could be obtained from Exhibit No. 2, the performance curve.

Q Now, could you give us the same totals on the tests prior to water injection?

A I do not have those totals.

Q Were they more or less than the current tests?

A They would be less.

Q Less oil production?

A Yes, less oil production.

Q But you don't have the figures?

A That would be that 4348 barrels of oil per day given in testimony as the capacity of the Unit prior to water injection.

Q But you don't know whether that's the total of the figures shown on your Exhibit or not?

A Yes, it is.

Q It is?

A Yes.

(Whereupon, a discussion was held off the record.)

BY MR. KELLAHIN:

Q Now, on your Exhibit No. 5, your edge-well allowable would be what, 80 barrels?

A Yes, lease-line wells at the present are restricted to 80 barrels.

Q That is in excess of the actual capacity of these lease-line wells, isn't it?

A Yes.

Q What is the necessity for an increased allowable when they won't make the current allowable?

A Well, we're only requesting an increased allowable on lease-line wells on the four wells, four of the lease-line wells.

Q Oh, it's confined to those four wells?

A Yes.

Q I see. Now, what is the capacity of those four wells?

A They are shown on Exhibit 6.

Q That is your 88 barrels on No. 52?

A Yes.

Q And --

A (Interrupting) 54 is 104.

Q 104?

A 55 is 280, and 57 is 282.

Q Only two of the wells then would really be in excess of the current level in appreciable amounts?

A Appreciable amounts, yes.

Q Do you have any current reservoir pressure data on this project?

A The only reservoir pressure data that we have is from dynamometer surveys where we've measured pump intake pressures at present.

Q What are they, could you give them to us?

A I would like to point out here that these pressures now are pressures under operating conditions. These are not shut-in pressures.

Q Do you have pump pressures at the time the water injection was instituted, where we can make a reasonable comparison of the two?

A On some of the wells, but not all wells.

Q This is a pressure maintenance project?

A Yes.

Q Don't you survey the pressures in order to see the results of your projects?

A The results of the project, as far as response goes, we can see from our performance and our gas-oil ratio.

Q Pressure doesn't have anything to do with that in your opinion?

A Yes, it does. We are repressuring the reservoir with our injection or we would not be receiving a declining gas-oil ratio.

Q That's exactly what I want. I want to know how much you're repressuring grades.

A We do not have recent reservoir pressures.

Q So you can't give me that information?

A No, I cannot.

Q Now, you keep referring to a response. Does this reservoir have a natural water drive?

A No, sir. It's a primary solution gas drive reservoir.

Q You have never found any indication of water drive?

A No, we have not.

Q Prior to your injection were you producing any water?

A A very small amount along the southern edge of

the project where the formation is dipping and our completions are very near the oil-water contact.

Q What caused that? Is there no water encroachment, or is there water encroachment?

A We could see no evidence of water encroachment.

Q Did you have any pressure surveys prior to your injection program which would indicate there is or is not a water drive?

A Yes, there were reservoir pressures taken for a period of years in the reservoir, however, there is a big lapse of data over the last 10 years, and every bit of engineering data that we have indicates that the reservoir has produced primarily as a solution gas drive.

Q Now have you made any reservoir voidage calculations on this project?

A Are you referring to injection-withdrawal ratio or something of this type?

Q That's right. Do you have that information?

A The injection-withdrawal ratio on the project at the current time is approximately .51.

Q Your injection is .5 to 1?

A .5 to 1.

Q .5 to 1. In other words you are withdrawing

twice as much as you are injecting?

A Yes.

Q How does this build up or maintain pressures?

A Well, when we look at this injection-withdrawal ratio .5 to 1, this is calculated on a reservoir as a whole. Now, this is a heterogeneous reservoir and we have quite a bit of permeability stratification and our injection water will preferentially flood the higher part of the intervals, and this is where we are receiving our response, in the zones that are currently taking the injection water.

Q Have you made an injection profile on any of the injection wells to determine where the water is going?

A Yes. Injection profiles have been run on the project.

Q Do you have those here?

A I do not have those with me.

Q But, on the basis of .5 to 1, your actual reservoir voidage is greater than what you were injecting in the reservoir as a whole?

A Yes, it is, the reservoir as a whole.

Q I see. Mr. Sprague, we do have a little confusion here. I believe you said there were 39 wells when

this Unit was tapped, is that correct?

A That was the area that we had originally anticipated would be set out as the pressure maintenance project area, which included the direct and diagonal off-sets to the proposed injection wells. As it has turned out, we were granted a project area equivalent to the entire unit area.

Q How many wells were there in the entire unit area?

A Initially?

Q Yes, sir.

A There were 35 wells in the project.

Q And then you were counting --

A (Interrupting) We were counting the infill wells that we would drill.

Q I see. That explains it. Now, Mr. Sprague, the allowable you're requesting is for the total unit, is it not?

A The 50 percent response allowable, yes.

Q How about the line wells?

A On the line wells we're only requesting at this time the increased allowable for the four wells with the provision that the allowable for the remaining line wells would be increased in accordance with the formula that we

have previously presented.

Q That would then include the wells on the east side which we have discussed?

A East and west.

Q On around the perimeter of the project, is that right?

A Yes.

Q Now,if those wells are unable to make that allowable, would you transfer it to other wells within the project that could make it?

A Yes. The way the project is set up at the present, we have 80 barrels of oil per day times the number of wells on the project, and we can produce this allowable anywhere within the project except that the lease-line wells are restricted to the 80 barrels.

Q I'm afraid you misunderstood. If you get the lease-line allowable you are requesting here, you're asking 240 barrels as I understand, and a lease-line well would not make that allowable, say it would make a hundred barrels, would you transfer the balance back into the reservoir?

A No.

Q You would not?

A No.

Q On your Exhibit No. 2, as I understand this project, the well has to either be a producer or an injector in order to receive an allowable?

A That's right.

Q But on your Exhibit No. 2 you show the number of active injectors dropped the early part of this year by one well.

A This, though, was Well No. 11 -- no, excuse me, it's not Well No. 11 -- it is injection well No. 5 which was shut in. That well was still an injection well in the project. It was shut in because we have a direct channel of water to producing well No. 11.

Q Is it still shut in?

A No, it is active now.

Q During that period there was no production in your oil production, or your allowable, was there?

A For the project?

Q Yes, sir.

A No, sir.

Q Project allowable?

You didn't answer, Mr. Sprague, did you not get my question?

A Would you repeat it please?

Q What I'm saying is, there is a reduction of one well in the project during the early part of 1974, but was there a comparable reduction in the allowable for the project?

A No, sir. This well was periodically shut in. We were testing to determine the source of this water channel.

Q During that period it was neither an injector nor a producer, is that correct?

A It was classified as an injection well.

Q But there was no injection in it?

A Not every day.

Q Now, just in summary, as I understand, you have taken no pressures which would reflect the effect of your water injection; no comparable pressures are available from the beginning of your project to the present time?

A No.

Q And you are not replacing reservoir voidage?

A Not on the project as a whole.

Q Your measure of the success of this project is based solely on your gas-oil ratios, is this correct?

A On gas-oil ratio and increased productive capacity

on several wells.

Q Now, on this increase in productive ability in these wells, was there any remedial work that went into any of these wells which would account for part of that?

A Are you referring to line wells?

Q All of them. I'm talking about your project as a whole.

A Yes, there has been remedial work within the project.

Q And that is included in your figures on Exhibit No. 6?

A Yes.

Q So, figured on your Exhibit No. 6, your 5110 barrels don't necessarily reflect the response from the water injection?

A Yes,it does reflect response of water injection.

Q Part of it you already said was due to work-overs, of remedial work?

A We have increased production capacity due to stimulation of the wells, but we have also seen a corresponding reduction in gas-oil ratio in increased production rates. There is no reason for the gas-oil ratio to decline in this reservoir unless we are receiving stimulation from

injection.

Q Well now, the gas-oil ratio is not a dependable figure when you have such wells as Well No. 28, is it?

A Well No. 28 is the one that had the tremendous increase.

Q Yes.

A Well No. 28 is the well that had the tremendous increase in gas and did not have an increase in oil production.

Q But you testified a while ago that that well caused the increase in GOR as shown on your Exhibit No. 2?

A The majority of it.

Q The majority of it, so the GOR for the project is not really a very reliable figure for measuring the success of your water injection, is it?

A This is where we have to start looking at the gas-oil ratio on the individual wells.

Q And you have an increasing gas-oil ratio in 17 wells?

A Yes, we have some wells within the project that are receiving stimulation from injection and others that are not, and this is not unusual in a pressure-maintenance or a water-flood project.

Q Now in your remedial work, did any of that result in a reduction of GOR?

A Not to my knowledge.

Q Do you know. You say not to your knowledge; do you know whether it did or did not?

A I do not know for sure.

Q Now, do you know whether it opened up any additional zones which had not theretofor been produced?

A We did deepen some of the wells, is that correct?

Q That could account for some of the increase in production too, could it not?

A Yes, it could.

Q Now, of the wells that showed response, which ones did you do remedial work on?

A Okay, I have a tabulation that -- just on the lease-line wells is the only tabulation that I have on remedial work with me.

Q All right. Give us those then if that's all you have.

A There was two of them, Well No. 28, which I previously mentioned, and Well No. 57, which is a lease-line well on the north boundary.

Q On your Well No. 57 you showed a reduction of

GOR from 2400 to 646, is that due to remedial work?

A No, it was not. It was due to response from the injection.

Q Well No. 28 with the tremendous increase, was that due to remedial work?

A The tremendous increase in gas-oil ratio was, yes.

Q It was.

MR. KELLAHIN: That's all I have Mr. Sprague, thank you sir.

MR. STAMETS: Are there any other questions of this Witness?

MR. McADAMS: I have one.

CROSS EXAMINATION

BY MR. McADAMS:

Q Mr. Sprague, I don't understand what you propose to do with respect to the lease-line wells, say the ones that are bordering Marathon's Lease to the east side over here. I don't understand what type of order you propose to enter which would grant you a higher allowable on lease wells, but you lose me there when you say you only want that on four wells across the north half. What type of order would they issue with respect to the other lease-line wells?

A The allowable on all of the lease-line wells would be controlled by this formula we propose.

Q Which could go up to 240 barrels?

A Yes.

Q You wouldn't have to come back to the Commission to get any increase in these wells; you could make your own determination with respect to when the response had been shown and when you would increase the allowable?

A This would be controlled by the Commission. They would grant the allowable according to this Exhibit 5 that we presented, which was a graph of the gas-oil ratios versus allowables.

Q Okay, I have one other question; have you done any remedial work on Well No. 55?

A No, sir.

Q I understood you to say a while ago that you had done remedial work on Well No. 57?

A Yes.

Q What did that remedial work consist of?

A That was a fracture job.

Q You have a jump in productivity there, I don't have your Exhibit, where you --

A (Interrupting) Exhibit 6.

Q I believe it was a productivity of 81 barrels, September of '72, and then in June of '74 it had an increase of 282?

A This was not --

Q (Interrupting) Soon after remedial work it had jumped to 282?

A No, it did not. It went to 143 barrels of oil per day, and then we had been experiencing response which brought it up to the 282.

Q But you haven't received any response in say Well No. 56?

A No, sir.

Q How do you account for this skipping that this response has done, like 57, skip one well, and you have 55, and you have 54, skip another well, and you have another well that you claim is showing response?

A This is a characteristic of the San Andres carbonate reservoirs, the heterogeneity of the reservoir; some wells responding while others are not.

Q What do you base your claim on that Well 52 and 54 have had response; what are you basing that on?

A It is the decrease in gas-oil ratio and the increased productive capacity.

Q Well, 52, that's part of your Exhibit No. 6, isn't it; increased the capacity by one barrel and Well No. 54 has four barrels? Is that what you call a significant response?

A The response is mainly being detected there by the decrease in the gas-oil ratio. I know that is not a significant response in oil production, but it has increased.

Q Is this Well 57 a pumping well?

A Yes, it is.

Q Have there been changes in pump size?

A No, sir.

Q As a result of its work load?

A No, sir.

Q What about Well 55? Have there been changes in pump size there?

A No.

MR. KELLAHIN: I think that is all I have.

MR. STAMETS: Mr. Brannen do you have any questions?

MR. BRANNEN: No, I don't.

MR. STAMETS: Mr. Nutter?

MR. NUTTER: Yes.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Sprague, first of all, I'm not just sure exactly what Texaco is seeking here in this Application. You currently have an allowable of 4640 barrels per day for the project, is this correct?

A Yes, sir.

Q And this is based on 80 barrels of oil for 58 wells?

A Yes.

Q Okay. Now, you're seeking a 50 percent injection response allowable, 50 percent, which would be another 2320, which would give you a total-maximum-project allowable of 6960, is this correct?

A Yes.

Q Okay. Now in addition, in your Application, you say, point 2, that you want the Commission to establish an allowable of up to 240 barrels per day for the lease-line wells that have demonstrated a substantial response to water injection. Now does that mean that you want an allowable to be assigned to those wells in addition to this project allowable of 6960, or does the 240 barrels per day for the lease-line wells come out of the 6960?

A I don't understand your question, sir.

Q Well, let me rephrase it then. You are asking

for a maximum project allowable of the current 4640 plus and additional 50 percent or a total of 6960?

A Yes, that's correct.

Q You are also asking for the establishment of an allowable of up to 240 barrels a day for the lease-line wells that have received a response?

A Yes.

Q Now, does that come on top of the project allowable or does it come out of the project allowable?

A It comes out of the project allowable.

Q It comes out of the project allowable.

A It is a limitation.

Q It's not an additional allowable then, it's a limitation on the allowable that could be transferred to the lease-line well?

A Right. The lease-line wells are restricted now, so we need additional allowable on them.

Q You need not an additional allowable, you need a higher ceiling is what you're seeking for, transfer of allowable to them?

A Yes.

Q Okay. Now, with regard to your current injection withdrawal ratio, you're taking out twice as much as you

are putting in right now. Now I notice that you have increased your injection rate recently and you got it back up to 14,000 barrels of water per day. You got 11 injection wells operating so this would be an average per-day injection of 1273 barrels into each of the wells. It appears that the high rate of injection was back in maybe July or August of 1973, when you peaked up at approximately 29,000 barrels of water per day, is that correct?

A Yes, it is.

Q Why did you decrease the rate of injection?

A The reason for this is equivalent pairs. We start out with two injection pumps there and the electric power company that serves this project did not have sufficient voltage to run both pumps and we ended up burning out the motor and having equipment failures and we're in the process now of obtaining additional pumps and reestablishing the higher rate of injection.

Q You plan to build it back up then to something like it used to be, is this right?

A We're planning on reaching at least 23,000 barrels of water per day.

Q What would that be average per well, about 2,000

barrels of water per day then?

A Yes.

Q You don't intend any more injection wells beyond the current eleven?

A There will be when secondary recovery operations are needed in the offset properties; there will be some additional wells drilled along the lease line, both injectors and producers in the Vacuum-San Andres Unit.

Q I see. How many projects do you know of in southeast New Mexico today that are averaging even as high as 12,073 barrels of water per day per well?

A I don't know of another project, but this project has outstanding reservoir characteristics for porosity and permeability, and it has experienced excellent performance on primary. We have not had any difficulty at all with injecting water at these rates.

Q Do you think that any order of the Commission regarding your lease-line wells should also include the lease-line wells of other operators that offset you so if their wells should happen to show a decline in GOR they would be entitled to an increase in production?

A No, I do not.

MR. NUTTER: I believe that is all, thank you.

CROSS EXAMINATION

BY MR. STAMETS:

Q You spoke earlier about the energy crisis and the need for more oil. Were you suggesting that the Commission should ignore its statutory responsibility to protect correlative rights and prevent waste to get more oil out of the ground?

A No, sir.

Q If the capacity of these wells should exceed 6960 barrels tomorrow, would Texaco be back in requesting additional allowable?

A Yes, sir.

Q So really there is nothing magic about 6960 barrels, it will just suit your needs at this time?

A No. 6960 barrels is what we had estimated at the present time to be sufficient to cover the ultimate peak producing rate from this project.

Q So you don't expect it to go any higher than this?

A Not at this time, no,sir.

MR. NUTTER: Not until you get that additional injection pump anyway.

BY MR. STAMETS:

Q What was the solution gas-oil ratio in this pool?

A Approximately 625 to 1.

Q 625?

A 625 to 1.

Q And what is the bubble-point pressure?

A Bubble point is around 1120 psi.

Q And if we have any reservoir pressures we would know how close you were to that point in these wells, but we don't have such pressures.

A Yes.

Q You spoke about oil resaturating the noncontinuous pay. I presume if you said resaturating,that it must have been saturated some other time?

A It is a portion of the reservoir that had been depleted under primary operations, and this response oil is pushed from the injection well to the producing well if it is not produced it will re-enter these noncontinuous sections.

Q What would happen to it then? Could it not be produced under the same means where the zone was originally produced?

A A portion of it would be but due to the pressure

gradients established in the reservoir from your injection well to your producing well, a portion of that oil will remain trapped in those noncontinuous members.

Q Pressure gradient on those zones, and where would this pressure come from in the individual well?

A Well, our injection wells are our pressure source. This is where we have a high pressure build up near the injection wells. As you progress away from them toward the producing wells you have a decline pressure.

Q That's correct. And we are speaking about producing wells I assume; we're talking about resaturating the reservoir, so if we're going to resaturate it must be near a producing well. Now, what pressure gradient will keep the oil from flowing out of that resaturated zone into that well bore and being produced as the original oil in place was?

A Well you're going to have a higher pressure at your producing well. Between your responding producer and your injection well you're going to have the highest pressure. Then from your producing well on into the reservoir in this noncontinuous interval that has been pressure-depleted on primary, you're going to have very low pressure with no pressure source, to say, that would

help you reproduce this oil that goes in there to resaturate it.

Q Looking back at the potentials you show on the Exhibit No. 6, I see a well with a two-barrel potential -- and I saw another one there -- there's one with 10 barrels, another one with 20 barrels. Most everything else appears to be 31 barrels a day or more. Does that look like depleted wells?

A Could you point out the specific wells?

Q Well No. 1 has 2 barrels, Well No. 2 has 20, Well No. 3.

A Yes, these Wells are wells that were completed on primary and are very near completion and they are also located on the south edge of the project in a portion of the reservoir that has poor reservoir quality.

Q Okay, that's three wells. What about No. 4 with 29, No. 7 with 55, No. 10 with 80?

A These are in the same situation, of course.

Q Depleted?

A They are near primary depletion. No, they are not completely depleted, no sir. They are at a much more advanced stage of depletion.

MR. NUTTER: Those wells on the south flank

never did have the potential that the wells further north had anyway, did they?

MR. SPRAGUE: That's correct.

BY MR. STAMETS:

Q Are all of the zones that you show on Exhibit 3 as being discontinuous zones open to production in the Unit?

A Yes.

Q Now,you indicated that you need to maintain this rate of injection in order to keep a good injection profile and that this would be bad at low rates. Do you have any evidence that this is the case, and how critical is your rate?

A I have no evidence of this in this specific project, but in other areas we have seen where curtailed injection rates do have a detrimental effect on injection profile.

Q Are there reservoirs identical in this San Andres reservoir?

A San Andres reservoir, specifically I could mention the loss of the San Andres Field in West Texas.

Q Any evidence on New Mexico fields?

A I have none available.

Q How critical is your injection rate?

A Well, our response is going to be a direct function of our injection rate. Now, the higher the injection rate that we can maintain, the quicker we will fill up the project and we will have a better profile; we will be able to maintain or achieve a higher producing rate.

Q How about ultimate recovery?

A The ultimate recovery would be affected too if we curtailed injection rates. If we allow our vertical-sweep efficiency to deteriorate we would reduce recovery from the project.

Q There was some discussion here about water flooding and pressure maintenance and how you get more oil by a pressure-maintenance project than a water flood in allowing it to be depleted on primary. Theoretically, if the reservoir were reduced on primary and instituted water flooding in there to screw it up, will they leave more or less oil in the ground than if they instituted a pressure-maintenance project to screw it up?

A I object to the question. It is beyond the realm of anything except pure speculation.

Q The question may be self evident. I will forget it.

Q What is your injection pressure?

A Roughly 900 psig.

Q What would your injection pressure be when you start injecting 23,000 barrels a day or whatever?

A As we pressure up the reservoir we are anticipating it to come to 1500 to 1800 psi.

Q That would be well below the fracture pressure of the reservoir?

A Very near it.

Q Very near it?

A Yes.

Q How about the fracture pressure of the cement surrounding the casing in the injection well?

A I don't believe it would have any effect on that at those pressures.

Q Do you have any evidence to tell what the failing pressure of the cement would be on those wells, do you have those records?

A We have records as to the type of cement that the well was cemented with.

Q Have you made calculations to determine whether or not that cement has sufficient strength?

A I have not, personally.

Q Do you know if anybody has?

A I'm not aware of it.

Q In response to a question you indicated that Well No. 5 had channeled to Well No. 11. Why did that happen?

A In this portion of the project we found a lost circulation zone when we did our infill drilling and there is a zone in the lower part of the reservoir there that is causing this in this particular instance.

Q You indicated in response to another question that the reservoir has outstanding reservoir characteristics. Is this outstanding for a heterogeneous reservoir or any reservoir?

A In comparison to other San Andres reservoirs.

MR. STAMETS: Any other questions of the Witness?

MR. KELLAHIN: I have a couple more, Mr. Examiner.

MR. STAMETS: Mr. Kellahin.

FURTHER CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Sprague, in response to a question by Mr. Stamets you said if you increase your injection you will be able to fill up. Do you mean that you will replace the reservoir voidage, or what do you mean by that answer?

A Yes, we will be able to replace the reservoir

voidage and get our injection-withdrawal ratio above 1 to 1.

Q At the present time you said it is .5 to 1?

A Yes, sir.

Q Now, if the allowable,which you are seeking, is granted by the Commission, to what extent would you increase your water injection?

A We plan to increase our water injection to the 23,000 barrels of water per day.

Q Will that be sufficient to give you a 1 to 1 ratio?

A Yes, it will.

Q Have you made a calculation on that, Mr. Sprague, or is that just a guess?

A This is based on some calculations.

Q Now, if it is not filled up at the present time, and you're going to get to a 1 to 1 ratio, you would have to over-inject in order to fill up would you not?

A Yes, or injection would have to exceed our withdrawals or voidage.

Q What is your injection capacity?

A We will get up to 23,000 or beyond that when we get this additional pump installed.

Q Would you get your injection up to the point it

will exceed the 1 to 1 ratio?

A Yes.

Q By how much?

A I don't have that number.

Q How soon would you achieve this?

A The pump is to be delivered in the latter part of this month and hopefully by mid August.

Q That will give you the capacity you've been talking about, this one pump?

A Yes, with the two pumps in operation.

Q One additional pump?

A Yes. We have one in operation now; we'll have one additional.

Q Now, do you know of your own knowledge that injection at 29,000 per day will replace your reservoir voidage you are projecting?

A From calculations that I have seen, yes.

Q You didn't make them yourself?

A No.

Q Do you have them here?

A No, I do not.

MR. KELLAHIN: Thank you Mr. Sprague; thank you Mr. Stamets.

MR. STAMETS: Mr. Sprague, would you be willing to supply the District Office in Hobbs with the cement-strength calculations on those injection wells before these pressures reach that limit?

MR. SPRAGUE: Yes.

MR. STAMETS: Any other questions of this Witness?

MR. KELLY: I have a couple more, Mr. Examiner.

REDIRECT EXAMINATION

BY MR. KELLY:

Q Mr. Sprague, as I understand the present allowable of this Unit, it allows you to produce 4640 barrels per day, is that correct?

A Yes.

Q And it is your testimony that the present capacity of the Unit is 5110?

A Yes.

Q So you are, even at an early stage of response, you are already past your allowable, so far as the capacity of this Unit to produce?

A Yes.

Q Now, do you expect if there is no change in the allowable that the capacity will continue to increase and

get further and further out of line?

A Yes, I do.

Q And, is it your opinion that as you get out of line some substantial portion of this oil will be lost entirely or be passed by on to other off-set operators?

A Yes, it definitely will.

Q If you had come in with this Application, say 6 months from now, do you feel that you would have more definite evidence of response?

A Yes, we would.

Q But by the same token you would have probably lost that amount of oil that would have been either trapped in unproductive zones or passed off to other leases?

A Yes.

Q And it is your opinion that producing this Unit basically at capacity is the most efficient way to get the most oil and gas out of these zones?

A Yes, I do.

Q And is there any evidence that you found that shows that the reservoir is being hurt by basically a capacity allowable?

A No, there is no evidence to that.

Q As I understand it, the original order that was

issued in this Case specifically did provide you were to come to the Commission for a bigger allowable on your lease-line wells when they showed a response?

A Yes, that is correct.

Q And at this time you are proposing a higher allowable for the four wells that show response and the formula where the Commission can calculate response and increase the allowable up to 240 barrels per day?

A Yes.

MR. KELLY: That's all I have, Mr. Examiner.

MR. STAMETS: Any other questions of the Witness? He may be excused. Do you have any other witnesses, Booker?

MR. KELLY: No, that is all that I have.

MR. STAMETS: We will take about a 15 minute recess.

(Whereupon, a short recess was held.)

MR. STAMETS: The Hearing will come to order, please. Mr. Kellahin?

MR. KELLAHIN: I would like to call my Witness, Mr. Mueller.

WILLIAM J. MUELLER

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

MR. KELLY: Mr. Examiner, before we start I would like to ask for a complete set of Exhibits.

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Will you state your name, please?

A William J. Mueller.

Q By whom are you employed and in what position?

A I am Senior Reservoir Engineer with Phillips Petroleum Company in the Southwest Region of West Texas.

Q Does the Southwest Region include the area involved in the Application of Texaco in this Case?

A Yes, sir.

Q Have you ever testified before the Oil Conservation Commission and made your qualifications a matter of record?

A Yes, sir.

Q And have you made a study of the Vacuum Grayburg-San Andres Unit, which is the subject matter of this Hearing?

A Yes, sir.

MR. KELLAHIN: Are the Witness' qualifications acceptable?

MR. STAMETS: Any questions? They are.

BY MR. KELLAHIN:

Q Mr. Mueller, referring to what has been marked as Phillips' Exhibit No. 1, would you identify that Exhibit, please?

A Phillips' Exhibit No. 1 is a daily-average production for the year of 1973 in oil-gas-water for every well in the Texaco-operated Vacuum Grayburg-San Andres Unit, and the offsetting Phillips wells to the north and the bottom row of wells in the Texaco State-owned lease.

Q Is that comparable to the Exhibit offered by Texaco in technical form, or have you had an opportunity to check it?

A Well, this being a 1970 total year daily average, I don't believe they --

Q (Interrupting) They did not show it?

A No.

Q This is '73.

A Right, excuse me.

Q Do you have any comments on the Exhibit?

A Yes, I would like to state here in going over the

Exhibit, we feel that the original case that approved this pressure-maintenance project, under the Commission's find, stated that Texaco hoped to and anticipated a maintenance of about 1500 barrels of water per day injection capacity, and reviewing the bonus or project allowable that was granted this Unit initially, Phillips felt the 1500 barrels per day water injection would have been sufficient to replace the voidage attributable to the bonus allowable granted Texaco in the formation of this Unit through the drilling of in-field wells and the assignment of top-unit allowable to all wells regardless of their ability to produce. In looking at this Exhibit you will notice that there are only four wells in the Texaco-operated unit that injected over 1500 barrels of water per day. These are Wells Nos. 19, 17, 31, and 49. Only four of the eleven wells for the whole year of 1973 averaged the 1500 barrels of water per day that was expected as injection, and yet this is some -- let me get my figures here right -- they have a total of eleven injection wells, which means their injection should have, for the year, averaged about 16,500 barrels of water per day per well. Actually their injection only averaged 12,999 barrels per day, so they had an under-injection of

about 3500 barrels of water per day.

The other thing on this Exhibit I wish to point out was that under the project allowable assigned this Unit they receive 80 barrels of oil per day allowable for every well completed in the Grayburg-San Andres, whether they are injection or producing, and therefore we feel that this Unit currently has a pretty good bonus allowable insofar as we feel that there are 35 proration units in this total Unit which would give it a normal allowable of about 2800 barrels of oil per day. For 1973 there were 7 units along this southern row that were not able to make their 80 barrels of oil per day and the inability of these wells to break 80 indicates the normal unit allowable should have been 2800 minus the inability of those wells, or about 2476 barrels of oil per day. In reality, this Unit produced 4300 barrels of oil per day, or had a bonus allowable of about 42½ percent of its production was actually bonus allowable already. They received the bonus allowable under the provisions of the Commission order that set up this but they did not maintain the injection rate that was stated in the findings of that order.

Q Now the injection rate was stated in the findings of this Commission which approved the project?

A Yes.

Q During 1973, by this Exhibit, did they or did they not maintain it?

A No.

Q Now, referring to what has been marked as Exhibit No. 2, would you identify that Exhibit, please?

A Exhibit No. 2 is actually the same data on a per-day average for the first four months of 1974. This is the latest record we have available through the New Mexico Engineering Committee monthly reports, January through April. Here again, this time in the first four months of 1974 there are only two wells that exceeded 15,000 barrels of water per day injection, this being Well No. 17 and Well No. 31. By the New Mexico Engineering Committee report, injection well No. 19 was shut in in excess of three months, yet it appears to have received an 80-barrel allowable that was produced for it. The actual injections during these four months on a per-day average was 12,300 barrels of water per day was injected. This is some 4,200 under the 1500 barrels per day per well, or approximately 25 percent underneath the findings of the Commission in the original order. Yet, during this same four months the actual production from

the Unit was 4640 and had it operated under non-unitized competitive operations, this allowable would have been 2493, or received a bonus allowable of 2147, which is 46.3 percent of its actual production.

Q Does that complete your testimony on Exhibit 2?

A Yes.

Q Turning to what has been marked as Phillips' Exhibit No. 3, will you discuss that Exhibit?

A Phillips' Exhibit No. 3 is just a yearly tabulation of the production from the area covered by the Texaco-operated Vacuum Grayburg-San Andres Unit from 1960 through 1973. This shows the well count year end, showing how it was 33 wells through '64 and 35 through '72 and 58 into '73. It shows the total annual production from the unit area in barrels of oil, the average barrels of oil per day on a yearly basis, the total barrels of water, the average barrels of water per day, total mcf, average mcf, gas-oil ratio cumputed on mcf over barrels of oil, and the average bottom-hole pressure as set out in the New Mexico Engineering Committee Report, their annual summaries, and these pressures are the average of the wells reported on the Texaco wells in this unit area. In other words, the figure in parenthesis is the number of wells inside this unit

area that were pressured and this is their average. Coming down here you see in 1960 the average pressure was 1032 to 1037, 800, 925, 974, on down two wells to the last pressure report in the annual summaries was 680 pounds on a survey of three wells. This is just an arithmetic average of the three wells surveyed. The pressures then extrapolated on this Exhibit, which were formed by just taking a pressure time, plotting the previous pressure the first time and extrapolating them forward on just kind of a best-fit, straight-line method.

Q Is there any pressure information available for the years 1972, '73?

A Not that I know of. In static bottom-hole shut in pressures, no.

Q Would you continue with your discussion of the Exhibit?

A The Exhibit then goes on to show the year-end cum production, the total cumulative production, in barrels of oil from this unitized area, 18,362,014 barrels through 1973.

Q Now, on the gas-oil ratios, does that figure show a decline in gas-oil ratios?

A No, sir. The last GOR of the unit area was in 1973.

Q If there has been a decline in gas-oil ratios it would be in isolated wells, would it not?

A Yes. This annual summaries of the unitized area does not reflect it.

Q Do you have anything else in connection with Exhibit 3?

A No, sir.

Q Turning to what has been marked as Phillips' Exhibit No. 4, would you discuss that?

A Yes. Phillips' Exhibit No. 4 is essentially a graphical plot of the same data presented in Exhibit No. 3 inasfar as it shows the mcf of gas produced per day, the oil production per day, gas-oil ratio, water production per day. They've add one other calculation and this is total reservoir barrels of voidage based on these annual average-year production figures, and it shows that the reservoir barrels of voidage occurring in this unit area increased to a maximum in 1972 of about 18,000 barrels per day and then jumped in 1973 under unitized operations to a total of 36,000 barrels per day, and the mark noted by the little red arrow is the average water injected by Texaco during 1973 of 13,000 barrels of water per day or a total net reservoir difference of about 23,000 barrels

per day of net reservoir voidage has occurred.

Q Are you saying that the production from the reservoir, including water and oil, has exceeded the water injection by 23,000 barrels?

A Yes, sir.

Q So you would have a net voidage which has not been made up by the water injection?

A That is right. This should continue a pressure decline in this area because (a) in the reservoir voidage under non-unitized operations at 18,000 barrels per day, jumping from 18 to 36, there has been insufficient water injection even to replace the bonus allowable granted this Unit.

Q Now, does that constitute, in your opinion, a pressure maintenance project?

A No, sir.

Q Do you have any comments on the gas production?

A No, sir.

Q Turning to what has been marked as Exhibit No. 5, would you identify that Exhibit, please?

A Exhibit No. 5 is a tabulation by months of the Texaco-operated Grayburg-San Andres Unit operations showing the number of wells, the oil produced, the average

water, water per day, total mcf of gas, average mcf per day, gas-oil ratio, total reservoir voidage in barrels per day, total injection, average injection per day, the hydrocarbon reservoir voidage, which is the reservoir voidage attributed just to the production of oil and gas from this unitized area, the net barrels of water injected, which would be the total gross injection minus the barrels of water produced, and then the net injection in barrels of water per day. What this data tends to show, at the bottom it is written into the voidage formula we use in these calculations, it shows that the total reservoir voidage is the oil-producing rate times the formation-volume factor for that oil plus the producing ratio minus the solution ratio times AG or the formation-volume factor for the gas, plus the water producing rate.

Now, in hydrocarbon-voidage calculations it is the same except the water-producing rate is left off. In other words, the first series of that equation is the hydrocarbon voidage and then the water-producing rate is the second part of the equation. Actually, in showing here for the first four months of 1974 we calculated the average reservoir voidage due to hydrocarbon production of the bonus allowable at 15,400 barrels of water per day, excuse

me, barrels per day, and yet the average water injected rate this first four months was only 10,750, giving a net voidage -- what do I want to say -- net excess voidage of 465,000 per day, 4650.

Q Is that a calculation based on the figures which are shown on Exhibit No. 5?

A Yes, yes.

Q Would you repeat what the net voidage is again, please?

A The net voidage for the first four months of 1974, shows a net voidage of 4650 reservoir barrels per day -- excuse me for a minute -- this is attributed to the bonus allowable only is what I thought we were --

Q (Interrupting) Oh, please explain that.

A It is not the voidage attributable to the total oil and gas production, that is shown here as being 31,000, 25,000, 28,000, 26,000 on a per-monthly figure. The net figure I spoke of was in going back and taking what we consider this bonus allowable produced by this Unit during the first four months in 1974, this being the 80 barrels of oil allowable for each of the infill wells plus an 80 barrel of oil allowable for wells inability to produce along the edge. The voidage due to that bonus

allowable is 15,400 barrels per day. With the net injection being over 10,750 it means that they lacked 4650 barrels per day of being able to make up even their bonus allowable.

Q Now, in dealing with the bonus allowable, you are assuming they're entitled to the full-normal-unit allowable, right?

A Right.

Q Is this the basis of your figure?

A As a maximum with the capability of producing it with the limitation as normally.

Q Do you have anything else with Exhibit No. 5?

A No, sir.

Q Referring to what has been marked as Phillips' Exhibit No. 6, would you identify that, please?

A Exhibit No. 6 is the graphical presentation of essentially the same data, only it carries it forward two more months. This morning I picked up May and June productions here at the Commission's office and it shows the reservoir voidage in barrels per day on a per-monthly average, the barrels of water injected, the mcf of gas produced, oil production, gas-oil ratio, and the water production. This shows that the oil production rose from

in January of '73, approximately 3300 barrels per day to its total project allowable of 4640 by July of '73. It shows the gas-oil ratio increasing from January of '73 to a high -- I'm speaking of gas ratio -- increasing to about 1400 gas-oil ratio there in January to about 2200 there in August and then declining to a low in April of around 1450 and rising again in May and June to about 16, 17, and the water production has increased from a low reported in March and April of about 430 barrels per day to a high in June of '74 of 2350 barrels per day.

Q Now the reservoir-barrel voidage for this project during May and June has shown an increase, has it not?

A Yes, due to the increase in gas-oil ratio.

Q And that does not reflect the comparable reduction in water injection, does it?

A Comparable reduction in water injection?

Q Yes.

A No, sir.

Q Has there been an increase in the water injection sufficiently to make up the difference in the reservoir-barrel voidage, in your opinion?

A No, not up to now in this Unit the total reservoir-barrels voidage has not been made up nor the bonus

allowable voidage.

Q Nor the bonus allowable voidage?

A In other words, the red arrow on this Exhibit points to a figure of 16,500 barrels per day which would be the eleven injection wells times the 1500 barrels of water injected per day per well as the initial case. Now, you can see that in only six months was that figure equaled or exceeded.

Q Now you heard Mr. Sprague's testimony that they anticipate getting water injection up to 29,000 barrels. Would that replace, in your opinion, the reservoir voidage of their current allowable?

A Of their current allowable?

Q Of their project allowable which they are requesting I should say.

A If they increase their water injection up to 29,000 -- I would have to calculate this -- take their water, they're currently producing 2300 so that would give them a net water injection of about 2660 and their voidage at that rate of production, current rate of production, is 33000. No, it would not replace it.

Q It would not replace it?

A No, sir.

Q It wouldn't even replace it under their current allowable?

A No, sir.

Q Not to mention the increased allowable they are asking for?

A That's right.

Q So, in your opinion, would the, as Mr. Sprague testified, get this on a 1 to 1 reservoir voidage basis?

A No, sir, not with any of the data we have available.

Q Would they reach fill-up as he testified?

A No, never could.

Q Now, referring to what has been marked as Exhibit No. 7, would you discuss that Exhibit, please?

A Exhibit No. 7 is the oil and gas formation volume factors and the gas solubility used in our voidage calculations. The formation-volume factor and the solubility curves were determined by a technical committee many years ago and are still used by, I think, the current two technical committees studying this field for unitization. The bcg is a calculation replaced on here and is just the mathematics of taking 1000 cubic feet to surface tubes bottom-hole-reservoir pressure, and this bcg happens to be calculated in reservoir barrels per mcf.

Q Do you know what the original bottom-hole pressure was in this reservoir?

A I think about 1650 pounds.

Q Okay. Do you take pressures on your wells, Mr. Mueller?

A Yes, sir, we have taken several.

Q Do you take them on a current basis?

A We try to annually or so.

Q Do you have pressures on your wells off-setting the producing wells referred to in Mr. Sprague's testimony?

A Yes, sir, we ran bottom-hole pressure in Well No. 3 and in Well No. 6, our two shut-down wells.

Q And what were those pressures?

A The average of the two was 620 pounds.

Q Is that comparable to pressures throughout the rest of your wells?

A I think it is comparable to pressures in this area. I also have been informed that Marathon ran a bottom-hole pressure in their No. 1 and got 650 and Shell had a 650 in their B-1.

MR. STAMETS: Which two wells were those, please, I would like to mark them.

MR. MUELLER: The two Phillips Wells?

MR. STAMETS: Yes.

MR. MUELLER: Well Emmy Hale No. 3, located in Unit P, it's a shut-down well, and --

MR. STAMETS: (Interrupting) What was the shut-in pressure on that one?

MR. MUELLER: The average of the two was 620; I think I had a 640 and a 590.

MR. STAMETS: Okay. That's fine.

BY MR. KELLAHIN:

Q Now, do these pressures indicate a continued --

MR. STAMETS: (Interrupting) Were there two wells?

MR. MUELLER: Yes.

MR. STAMETS: I didn't get the other one, Jay.

MR. MUELLER: Oh, I believe the pressure in the one was 640 and the pressure in the other was 600 or something like that.

MR. STAMETS: Which was the other well? I got No. 3 marked.

MR. MUELLER: Oh, Emmy Hale No. 6, is the two shut-down wells on that lease.

MR. STAMETS: Thank you.

BY MR. KELLAHIN:

Q Does this indicate a normal pressure decline for a reservoir of this type?

A Yes, sir.

Q And it compares to the figures shown on your Exhibit No. 3, including the extrapolated figures for the Texaco Wells, does it not?

A Right. For the Texaco Unit in the 1973 average we assumed a bottom-hole average pressure of 665 pounds I believe.

Q Mr. Mueller, without pressure information, is it possible to determine whether migration of oil or the potential for the migration of oil exists in a reservoir of this type?

A No, sir, not without pressure information.

Q Is such information available to you?

A No, sir, it isn't.

Q Have you heard the testimony of Texaco's Witness that they did not have such information?

A Yes, sir.

Q On that basis, is there any basis on which you could determine that oil would migrate off of Texaco's lease onto Phillips' lease?

A Without the pressure data I don't see how they can state it would actually migrate out of the unitized area.

Q Now, is this true for equivalent producing rates and equivalent allowables? If you have higher allowables on one side of the lease-line than you do on the other, would that have any effect, in your opinion?

A Oh definitely, if you're not replacing the void-age than the wells with the high allowable are going to suck it out from the other boys.

Q So, in your opinion, if the allowables are granted as requested by Texaco, will that have any adverse effect on Phillips?

A Definitely. We feel it would cause a continued or greater pressure sinking of the Texaco Vacuum Unit and would be in violation of correlative producing rights.

Q Were Exhibits 1 through 7 prepared by you or under your supervision?

A Yes, sir.

MR. KELLAHIN: At this time I would like to offer in evidence Exhibits 1 through 7, inclusive.

MR. STAMETS: If there is no objection they will be admitted.

(Whereupon, Phillips' Exhibits Nos. 1 through 7 were admitted into evidence.)

MR. KELLAHIN: That completes direct examination of the Witness.

MR. STAMETS: Are there questions of the Witness? Mr. Kelly?

CROSS EXAMINATION

BY MR. KELLY:

Q Now, is it your testimony, sir, that there has been no reduction on GOR in the Texaco Unit since this pressure-maintenance project started?

A No. I showed that there was a reduction in GOR. I have the GOR production curve by months, and it did rise to a high there in October and then reduce to a low in April, but then rise again through May and June.

Q That is shown on your Exhibit No. what?

A I believe that would be Exhibit No. 6 and also it would give it on No. 5.

Q Now, is it true that that is consistent with what you would expect in a pressure maintenance project that you got response?

A Coupled with other things, yes, you would normally see a gas-oil ratio decline.

Q And one of those other things would be coupled with the increase in production wouldn't it?

A Yes.

Q Now, you are not stating to this Commission that Texaco has not had any response from their water project are you?

A I don't believe I could say whether they have had it or not. This would be a top allowable area; I mean many of these wells were top allowable before formation of this Unit, we have top allowables off-setting it; Phillips has wells capable of producing from 100 to 200 to 300 barrels per day on the Hale Lease and I know that I can take wells that I have on several and run liners and produce and complete them low and stay out of the gas, so I know that GORs also function in reconditioning wells.

Q Well, what other explanation would there be for falling GOR except response to the water floods?

A It could be a reconditioning treatment also or just the ability to move your production around from one area to another.

Q Now, if the well had not been reconditioned, than you would, I assume, not rely on that argument?

A That's right.

Q What was your other possibility?

A The ability to take productions from various portions of the unit where the lowest GOR exists. In other words, not having to produce every well.

Q Well now, if an individual well showed an increase in production and a decrease in GOR, without a work order, then the only logical conclusion would be response?

A Yes, sir.

Q Now, wouldn't you also agree that the most efficient way to produce any kind of a pressure maintenance in water flood project is to get the oil out as it passes the well bore? In other words, in capacity allowable?

A No, not necessarily in pressure maintenance. I don't understand what you mean by "Get it out as it passes."

Q Well, as it reaches the well bore.

A Pressure maintenance is really built upon no maintaining or increase in pressure and these wells all had high capability before you started injection. So, you attempt to get a fluid to sweep the reservoir at a higher formation volume factor, leaving less residual stock-tank barrels in place. But whether or not you actually got more oil, that would be a function of sweep

efficiency at that rate.

Q That's right, and of course that's the purpose of pressure maintenance, to have an efficient sweep?

A Yes, at the outset.

Q Now, do you agree with Texaco's testimony that this particular pool is not continuous throughout, that it does have noncontinuous segments?

A I believe that the porosity development throughout the San Andres occurs in different subsea intervals within the San Andres but I don't know that this porosity zone blanks out, you know, zero over here, that it is not also the same when it occurs lower over here.

Q You're not able to tell us then one way or the other about whether oil that's being pushed toward your lease line is going to cross that lease line or not?

A If oil being pushed toward my lease line is going to cross it; It would probably cross it.

Q And if you did have a combination on lease lines with wells that have a lower GOR and higher production, you have said that that would be a fairly good indication of response.

A Yes.

Q Now, as that oil goes by and is not produced by

those lease-line wells, then it would necessarily go on to another lease, wouldn't it?

A Yes, but I don't know which way the oil is moving though because of the lack of pressure data. In other words, you could be seeing response in a well off-setting my Hale Lease, that where you saw increase in capacity and reduced GOR, but without the actual pressure data to pin it down I don't know where that oil came from.

Q What would you expect to happen to your GOR if you were going to drain?

A It would increase.

Q Do you have figures you can give us for your GOR on the individual wells that off-set the Unit.

A Well, for 1973 the daily averages are on here, on this plat. I believe it is Exhibit No. 1. I have the oil and barrel per day in mcf and mcf per day per well on each one of our wells.

Q Can you say, in general, whether your GORs are increasing or decreasing?

A In general I would say we are increasing.

Q And that would be consistent with the conclusion that you were not getting any response from the pressure maintenance project conducted to the south?

A Yes.

Q You wouldn't expect to request from this Commission any kind of a bonus allowable if you're not conducting a pressure maintenance project, would you?

A I don't expect anybody to request a bonus allowable and not replace the voidage in conducting a pressure maintenance project.

Q Now, are you aware that Phillips has been involved in a study of this pool and the area where your particular wells are.

A Yes.

Q With the idea of unitization?

A Yes.

Q With Texaco?

A Yes.

Q Are you aware that that engineering committee has determined that unitization would be the best thing and a pressure maintenance project would be the best thing?

A Yes.

Q I assume that it would be your position that if --

A (Interrupting) Well, that engineering committee has not formed a final recommendation that has been approved by all the members.

Q I understand, but that is their preliminary thinking?

A Right.

Q I take it that it would be Phillips position that if they -- if your wells were unitized and pressure maintenance project started that you would want to have a capacity allowable?

A That's right.

MR. KELLAHIN: If the Examiner please, I think this is going beyond the scope of this Hearing. This is speculative, a possible unit, and what might be done under the terms of that unit depends on many many hours of negotiations which this Witness couldn't even answer.

MR. KELLY: I think he can give us some idea of what Phillips' position would be. He has already gone through an engineering study, it's --

MR. KELLAHIN: (Interrupting) I say it is immaterial.

MR. STAMETS: Objection sustained.

BY MR. KELLY:

Q Sir, you're not testifying that because there has been under injection or that all the fluids that have been removed have not been replaced, that you cannot have

response in particular zones?

A No, sir.

Q You do not testify that there hasn't been response in individual wells in this particular zone?

A No, sir.

Q You are basing your analysis on looking at the Unit as a whole?

A Right, total unit as a whole.

MR. KELLY: That's all I have on cross examination.

CROSS EXAMINATION

BY MR. STAMETS:

Q Mr. Mueller, you heard Texaco's argument that oil would be lost and wasted in these resaturated zones. Do you have an opinion as to that testimony?

A That's a hairy area and I have seen this presentation done in major reservoirs where they talk about discontinuous pays and if in-fill drilling helps locate it. How much resaturation there is, though this would really be determined by how big that noncontinuous pay zone is horizontally as to how much oil that well can grab as it goes by it. In other words you get into calculations that involve the drainage radius of that well you know as this oil is going by. Does a barrel of

oil going by two feet away, yes, are you going to get it going by 100 feet away, I don't believe you'll ever get it, even at capacity.

Q If the higher allowables were granted to the wells along the northern margin of the project and indeed the oil was being drained across the lease line from your wells to Texaco's wells, what effect would you see on your wells?

A I should see a productivity high and increase in GOR and a drop in pressure.

Q Would these things be detectable in sufficient time for you to seek remedy before the Commission before a great amount of damage was done?

A Not hardly with the bottom-hole pressure decline. If you look at barrels produced, you know it has been like this, it came from 1600 to 600 to 650. Now we use in--40-some-odd years--this field was discovered in the early '30s, so I think that many barrels of oil could be produced from the area south of our row of wells represented by 4, 10, 3 are producing wells between those row of wells and our lease line before I would see a substantial noticeable pressure difference. With the accuracy of bottomholes this is four and five times.

well, what action, what reasonable action could be taken to assure protection of Phillips' correlative rights along that least line? What test could be required on say Texaco's wells in that area?

A I think there would have to be a witness testing, I could say a thoroughly substantiated total productivity increase that they would not be reading pumping equipment or change out or things like this. There would just be the test used prior to the response was at the wells capacity to test used now is at the well's capacity. The witness testing some increase in bottom-hole pressure of course is the best one I feel like.

Q Of course, time for taking such tests as you're talking about has already passed. We have a situation now existing where the productivity, as Texaco has testified, has increased. So that sort of test is not practical at this stage. What about a bottom-hole pressure test that be taken on these wells before the higher allowable would be granted. Would that be good?

A That would be good, yes, sir.

Q What would this have to show; that their bottom-hole pressure was higher than yours, or at least as high?

A I think that would at least give me more confidence

that there isn't a net voidage occurring drastically off-setting us.

Q Then would you think that some sort of an annual pressure test should be required.

A Yes, sir. If you're going to keep up with a pressure maintenance project that due to voidage, with the withdrawal rates this Unit has, it should have an annual bottomhole pressure, particularly where bonus allowable has been granted, because unless the total reservoir voidage occurring, due to any bonus allowable, is replaced by injection, there is a violation of correlative rights.

Q Have you been to the field and actually seen Texaco's wells along the lease line?

A No, sir.

Q You don't know if they are set up to do this without some equipment modification?

A He stated they were all pumping and I believe they are pumping well, so shut-in pressures are going to be hard to obtain, it's going to require pulling of pump tubing, standing valves, and then let the well stabilize after you've dumped all the fluid from the tubing on the formation.

Q So that's rather time consuming and expensive

process?

A Well, oil is worth a lot now, and if your're going to go from 80 barrels a day to 240, that's a lot of dollars per day.

Q What about sonic bottom-hole pressure surveys?

A Very poor quality in this reservoir due to the producing gas-oil ratio. The solution ratio shown by our curve here, you know, shows that at 1400 pounds this oil only had about 500 cubic feet of gas in solution. From these producing ratios now, 1500 to 2000, there is just so much free gas that the froth in the annuluses, that the sonic measurements are very poor. I realize that they have a problem but it's not my fault that they do, it is their own.

MR. KELLY: I would ask that that last gratuitous remark be stricken from the record.

MR. STAMETS: That remark should be stricken from the record, yes.

BY MR. STAMETS:

Q Mr. Mueller, have you had experience in water flooding in the San Andres reservoirs?

A Only as a Phillips' representative on other operators' units. I have not actually been in charge of

a San Andres water-flood project. I'm in charge of a marginal water-flood project, but where we operate we're into the Grayburg sands rather than into the actual San Andres.

Q What do you think about Texaco's formula for determining the allowable to be assigned to these lease-line wells?

A I couldn't quite understand the formula insofar as it was going to be a function of gas-oil ratio and the gas-oil ratio was too small to measure it would go as high as 240 then if the well only made 88 we are going to limit it back to its ability and this is what Phillips has been contending all along, that they have had no limitability on any of these units now, I don't know why it would come into this one is what concerns me. In other words, they're able to take any well inside this unit and whether it produces two barrels of oil a day they get an 80 barrel allowable. So on the formula he proposed that, he said the gas-oil ratio came down to 1000 he was going to take 200 barrels of oil a day from that well but if the well is only capable of 100 its allowable would be held back to 100, so to date there has been no holding back of allowables based on ability of the wells to produce in this Unit. In other

words, as we spoke of there is injection wells shut down and they still get 80 barrels of allowable; they worked over one well here, I think off-setting No. 28, and many of these wells along the edges show a well test much less than 80 but they are getting 80 barrels of oil allowable.

Q Considering that what we would be talking about here would be a production limitation, do you think that this formula would provide protection to Phillips by limiting the production on these wells to 240 barrels a day maximum or to some lesser figure should the gas-oil ratio be higher than 800 and some odd --

A (Interrupting) I feel that a permissible allowable up to 3 times normal unit allowable is excessive, particularly where there has been, you know, infill development. The second row of wells off-setting Phillips is not 1980 back but it's only 1320 back as far as they drilled infill wells right along the edge of these proration units that off-set Phillips or off-set any operator outside the unit area. So, although in New Mexico many times it's permitted to produce perimeter wells up to twice the allowable, this unit is not in as bad a shape regarding that requirement as other units where they do not infill drill.

In other words, looking at my plat, say Texaco 53 and 54, well, just 1320 from that north line is Well No. 46 that they can produce at wide-open capacity. So by their production injection they can hold back the production of those edge wells.

Q If their formula was applied to Phillips' wells along the edge or along the lease line, would Phillips be able to produce more than 80 barrels per day?

A Yes, sir. My gas-oil ratio appears in Exhibit 1 -- 80 into 123, 80, 146 -- it appears my gas-oil ratio is in the 1800 range, so I would have an allowable in the neighborhood of 130 to 150.

Q And this is without any response to pressure maintenance or water flooding?

A Yes, sir.

MR. STAMETS: Are there any other questions of this Witness? Mr. Kelly.

FURTHER CROSS EXAMINATION

BY MR. KELLY:

Q Do you have a copy of Texaco's Exhibit 6 handy? On the second page there, Mr. Mueller, the two Texaco wells that off-set the Phillips' wells, as I understand it they are No. 52 and 54, is that correct?

A 52, 53 and 54, yes. Those three wells off-set our three wells.

Q You do understand that Texaco is only seeking this increased allowable on those wells they claim response for and they are not claiming response on 53 at this time?

A Yes, but they are seeking permission just to go to it as soon as they see response, yes.

Q Under the formula.

A Right.

Q Let's limit ourselves to the ones that would be affected now, 52 and 54. You do find there a substantial decrease in GOR from the time you began this project to the latest GOR tests, is that correct?

A Yes, they recorded a GOR of 2042 here in April, September '72, and to one now showing too small to measure in June of '74.

Q And then also in 54 you go from 1890 to about half of that, is that correct?

A Yes.

Q Now that would certainly be consistent with response, wouldn't it?

A They have the GOR decline but they have no pro-

ductivity, very slight productivity increase.

Q Of course it does determine what would have happened without?

A Yes, sir.

Q You're not concerned about the extra 8 barrels a day on No. 52, or the extra 24 barrels per day on No. 54; is that the basis of Phillips' concern?

A The basis of Phillips' concern I can say is not the 8 or the 24 but is the fact that next month you may submit a test and you will be at 240 and I won't know about it until three months later after it has produced.

Q Well, you would get to 240 if we had a substantial increase in production, right?

A Right, if you had a test, right.

Q And your suggestion to this Commission is to resolve all doubts in favor of Phillips and let you take our oil rather than any kind of a balancing procedure, is that right?

A No, sir, it's not that at all. I think (1) that there has to be voidage replacement here for all this bonus allowable and the data that we have available to us indicates it has not been.

Q Even though you admit that you can get response on a sporadic basis?

A Yes, sir.

FURTHER CROSS EXAMINATION

BY MR. STAMETS:

Q Mr. Mueller, Texaco's formula was based on approval of a GOR of 2500 to 1, that is the first figure that they entered. Do you feel that this formula might be better if the average gas-oil ratio of the wells on the leases off setting the unit area were used rather than a pool GOR?

A Yes. It should be. A factor of 80 here should come up at a gas-oil ratio of an off-setting producing well would be much more equitable.

Q If that was done then your wells would not be entitled to any additional allowable based on the formula, or essentially none.

A Right. But if the off-set well inside the unit showed a ratio lower than that they could receive additional allowables.

MR. STAMETS: Mr. Kellahin, did you have additional questions?

MR. KELLAHIN: Yes, I did. I would like to ask a

couple of questions brought out on cross examination.

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Kelly was inquiring about the off-setting wells I believe, 52 and 54, showing a decline in the gas-oil ratio. As a reservoir reaches the bubble point, and subsequent to that, is it not consistent that the gas-oil ratio would decline as you complete the reservoir?

A Only in the very late stages of completion would you anticipate a GOR decline in primary completion. Normally the GOR will increase to a maximum and in the late stages of completion it will decline.

Q Now if you did have an oil increase and you did have a drop in gas-oil ratio, you'd have a loss of gas, would you not, in the reservoir? There was no increase in the oil production from these wells, was there?

A Right. There was very little increase in oil production but a drop in gas-oil ratios so they are withdrawing less gas from those wells.

Q They're withdrawing less gas, but is that consistent with a response from a pressure-maintenance project?

A Possibly. Normally it's got to be coupled with a pressure increase and a productivity increase for it to be

significant.

Q Now if they were getting a response from the pressure-maintenance project, normally you would expect an increase in the productivity of the well?

A Yes, sir.

Q And not just a drop in GOR?

A Right.

Q Now, Phillips, does it have excess capacity on the wells off-setting the project?

A Yes, sir.

Q So, in response to Mr. Stamets question as to how soon you would know whether you were being drained or not, you wouldn't know anything about drainage until you fell below, your capacity fell below the current level, would you?

A That's right.

Q There would be no way for you to know?

A I could see a drop from it -- the wells are actually 150-barrel-a-day wells and they drop to 100 I wouldn't know it until like say they got below --

Q (Interrupting) Below the allowable.

A Because the equipment existing on those wells isn't capable of pumping much more than 80, 90, 100,120 barrels

is all.

MR. KELLAHIN: That's all the questions I have, thank you.

MR. STAMETS: Any further questions? The Witness may be excused. Do you have anything further, Mr. Kellahin?

MR. KELLAHIN: That's all we have, thank you.

MR. STAMETS: Does anyone else wish to present any evidence in this Case? We will accept statements at this time. Mr. McAdams?

MR. McADAMS: Marathon at this time would, with respect to Texaco's request for allowables on lease-line wells of 240 barrels per day within the Vacuum Grayburg-San Andres Pool would amount to a triple allowable, Marathon would strongly oppose granting of such triple allowable because it does not believe that the correlative rights of off-set operators could be protected with such allowables in this field. Marathon would even oppose the granting of double allowable to lease-line wells until those wells have shown a substantial response to the injection of water. We do not believe that Texaco's evidence in this Case has shown a substantial response by the lease-line wells and therefore Marathon respectfully opposes the Application with respect to the lease-line wells.

MR. STAMETS: Other statements?

MR. BRANNEN: Mr. Examiner, Shell Oil Company objects to the excessive lease-line allowable requested by Texaco, being 240 barrels per day, and suggests that an increased allowable should be based on a reservoir-voidage replacement formula and that such should be considered, and therefore, are in opposition to the Application before the Commission.

MR. STAMETS: Mr. Kellahin?

MR. KELLAHIN: Mr. Examiner, we're dealing with a rather peculiar animal here. We're talking about a pressure-maintenance project with no pressure information, which is, I think, something unique. The only pressures that have been offered to the Commission are those submitted by Phillips in this Case and I think they very clearly show that there has been no real response to the so-called pressure-maintenance project, and the Witness has already testified that the reservoir voidage is far in excess at a ratio of .5 to 1 to their water injection. Under those circumstances it can scarcely be called a pressure-maintenance project. Now they claim response to the project which appears to be based solely on the change in the gas-oil ratio. We don't really know what caused this

change in the gas-oil ratios; an isolated response, possibly, from one injection well to one producing well; there had been remedial work and certainly gas-oil ratio for the project showed a decided jump with the Well 28's increase in gas-oil ratio, showing that the total figures for the reservoir are scarcely dependable for any determination that the project has been beneficial to the gas-oil ratio. The natural capability of the well to produce, of the area to produce, the isolated response, and the remedial work, don't indicate a response to the pressure-maintenance project. Now , on the basis of our testimony and evidence, I think we have rather clearly shown that a 240-barrel allowable off-setting the Phillips' Well can only result in drainage. We don't know exactly what the situation is because the Applicant hasn't given us any pressure information and we don't know what they've got. They may already be draining us, we don't know; we would really like to know, and I think as a pressure maintenance project they should be required to submit this information.

In summary, Phillips opposes the total Application. We don't think it is timely, we think it would have an adverse effect on our correlative rights, and we ask the Commission to deny the Application in total.

MR. STAMETS: Mr. Kelly?

MR. KELLY: Mr. Examiner, trying to return to the question of fact rather than fantasy, we have put on a case which clearly shows, and I think that the fact that there have been engineering committees, consisting of all of the companies represented at this table, that urge that this project be expanded or under unit form, that we have a successful pressure-maintenance project. Texaco has been asked to -- is being attacked and penalized because they had the forethought to go into a pressure-maintenance project that they felt would be beneficial for the reservoir as a whole. Now, it is true, as our Witness pointed out, that we could have waited six months later and showed a much more dramatic response, a response that is much more uniform throughout the reservoir, and also one that reflected the injection rates after our mechanical problems were solved, but the fact remains that there is no way to explain the dramatically increased production on individual wells like the current dramatic reduction in GORs. Exhibit No. 6 does not show an isolated example of increased production, it shows an amazingly consistent one considering how early we are into this project,and as far as your lease-line wells, they're conveniently overlooking

the fact that two of the four that we are talking about had gone a substantial increase from about 100 or 80 barrels a day up to 280 and 282 with a substantial decrease in GOR. Now there is no other explanation for that other than that you are having effective response.

The order that the Commission entered, and none of these gentlemen would bother to make an appearance in objection to it at the time, specifically instructs Texaco to come in after response to get an additional lease-line allowable, and that is what we are doing, and we are limiting ourselves properly on each of those wells which we feel has a response, With the use of the formula such as Texaco has outlined, you're going to protect the correlative of operators outside. It is one thing to protect the correlative rights of an operator that is too timid or not imaginative enough to go into their own section with these projects, and another to penalize,when you obviously have response, the operator, and let the oil that he is pushing go across the lease line. I would like to point out that though there are some differences, the basic philosophy of a pressure-maintenance project and waterflood project are the same, and we would not be dealing with these kind of arbitrary situations if we were in a

water-flood project. Texaco has made the proper engineering decision that it would be best for this reservoir to go under pressure-maintenance during full primary production rather than wait. And again, there is certainly no reason to penalize them for that decision.

The only thing that Mr. Kellahin can offer us is a situation where they would get all the benefit of oil crossing the lease line, and we would be penalized. We submit that there has been no effective opposition whatsoever to our testimony as to the increased allowable generally, and as far as your lease-line wells we have submitted a proposal to the Commission that would effectively protect the correlative rights of all parties.

MR. KELLAHIN: I would like to correct just one statement that Mr. Kelly made. He said nobody objected to the original Application, and a check of the records of the Commission will show that Phillips Petroleum Company did enter a letter stating they had definite objection to the proposed lease-line allowable and asked that it be limited to one-unit allowable, not to exceed one-unit allowable without notice of hearing.

MR. KELLY: I meant that there was no one who

bothered to come.

MR. STAMETS: If there is nothing further we will take this Case under advisement and the Hearing is adjourned.

STATE OF NEW MEXICO)
) SS.
COUNTY OF SANTA FE)

I, RICHARD L. NYE, Court Reporter, do hereby certify that the foregoing and attached Transcript of Hearing before the New Mexico Oil Conservation Commission was reported by me, and the same is a true and correct record of the said proceedings, to the best of my knowledge, skill and ability.

RICHARD L. NYE, Court Reporter

I hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 5286 heard by me on July 24, 1974.

Richard L. Stamets, Examiner
New Mexico Oil Conservation Commission

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