

BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
April 8, 1954

EXAMINER HEARING

IN THE MATTER OF: Application of Sinclair Oil
and Gas Company for special pool rules, Lea
County, New Mexico. Applicant in the above-
styled cause, seeks the establishment of special
pool rules for the North Vacuum-Pevonian Pool,
Lea County, New Mexico, including a provision
for 80-acre spacing.

Case No. 3022

BEFORE: Daniel S. Nutter, Examiner.

TRANSCRIPT OF HEARING

DEARNLEY-MEIER REPORTING SERVICE, Inc.

FARMINGTON, N. M.
PHONE 325-1182

SANTA FE, N. M.
PHONE 983-3971

ALBUQUERQUE, N. M.
PHONE 243-6691



MR. NUTTER: We call Case 3022.

MR. PURRETT: Application of Sinclair Oil and Gas Company for special pool rules, Lea County, New Mexico.

MR. KELLY: Booker Kelly, of Gilbert, White and Gilbert in Santa Fe, appearing on behalf of the applicant, Sinclair. I have one witness for sure, and one possible witness. I'll ask that they both be sworn at this time.

MR. RUSSELL: I am John F. Russell, attorney, representing Texas Pacific Oil Company, in opposition, and I have two witnesses to be sworn at this time.

(Witnesses sworn.)

(Whereupon, Applicant's Exhibits 1 through 6 marked for identification.)

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

DIRECT EXAMINATION

BY MR. KELLY:

Q Would you state your name and position and employer, please?

A My name is Douglas Cunningham. I am employed as a petroleum engineer by Sinclair Oil and Gas Company, in Midland, Texas.

Q Would you state what Sinclair seeks by this application?

A Sinclair seeks 80-acre proration units consisting of two contiguous quarter-quarter sections in a single governmental



section. It seeks well spacing within 150 feet of the center of either quarter-quarter section, and also seeks 80-acre allowables based on a proportional factor existent with the Oil Conservation Commission wells.

Q Have you previously testified before this Commission as an expert petroleum engineer?

A Yes, sir, I have.

MR. KELLY: Are the witness' qualifications acceptable?

MR. NUTTER: Yes, sir, they are.

Q Would you now refer to what has been marked as Applicant's Exhibit Number 1 and go through this for the benefit of the Examiner?

A Exhibit Number 1 is a structure map of the Devonian reservoir in the Vacuum North Devonian Pool. The presently designated acreage in the Vacuum North Devonian Pool includes the southeast quarter of Section 7, includes the southwest quarter of Section 8, and the Northwest quarter of Section 17, all in Township 18 South, Range 35 East, Lea County, New Mexico.

We have applied for an extension of the field to include the north half of the northeast quarter of Section 17. I believe that this is presently included in the defined limits of the Vacuum North Devonian Pool. The production figures for our State Lease 403 No. 6 are carried currently in the Commission's data book as being in the North Devonian.



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The map is contoured on top of the Devonian formation and we believe that this is a reasonable interpretation of the Devonian structure, based on the control which is afforded us by the nine wells which have been drilled in this area that have penetrated the Devonian.

The reservoir limits have been definitely established in the area of two dry holes; one of these dry holes is Humble State "BV" Well Number 1, which is located in Section 18, 18 South, and 35 East, and Texas Pacific Oil Company's State "AF" Number 2, which is located in Section 8 of Township 18 South, Range 35 East. Both of these wells on their initial test produced only water. The oil-water contact has been established by production data by these two dry holes, and by log interpretation as being at minus 7,900 feet.

MR. NUTTER: Mr. Cunningham, that second dry hole you mentioned, is that the well that's shown as a location in the southwest-southeast of 8?

A Yes, that is correct.

MR. NUTTER: Since the exhibit has been prepared, that has been found to be a dry hole?

A Yes. The oil-water contact is depicted on our map at minus 7,900 feet by a heavy blue line. I would like to point out that the Vacuum North Devonian Pool is located approximately midway between the South Vacuum Devonian Pool and the Vacuum Devonian



Pool. The North Vacuum Devonian Pool is approximately two miles from each of these other pools. I would also like to point out that these pools are on 80-acre spacing and 80-acre allowable rules.

Q In the case of the Vacuum Devonian, that has just recently gone on permanent 80-acre spacing?

A I believe that is correct. They held a hearing during March.

Q Now, referring to what has been marked Applicant's Exhibit 2, the schematic sketch, would you go through that?

A Exhibit Number 2 is a schematic cross section of the Vacuum-North Devonian Pool. The well bores on this exhibit are represented by vertical lines. Immediately above each well symbol we have given the operator, the lease name, the well number, the location and the elevation of the wells. The Devonian top on each well is designated and the Devonian top as it proceeds across the cross section is marked in two places as top of the Devonian. The perforated intervals in each of these wells is also marked. I would like to point out that the perforated intervals in these wells occur within one hundred feet of the top of the Devonian. This exhibit shows that the productive pay zone in the Devonian formation occurs directly below and within one hundred feet of the Devonian top.

Q You have prepared exhibits showing the well completion data and production data, which would be Exhibits 3, 4 and 5.

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Would you go through those and briefly explain them to the Commission?

A Yes. Exhibit 3 is a tabulation of the well completion data; where I have given the operator, lease and well number, the elevation, the total depth, the oil string size and the setting depth, the completion interval, both subsurface and subsea, the treatment, initial potential data and initial completion data on each of the wells.

Exhibit 4 is the production data from each individual well in this pool, and is also tabulation of the production data from the total pool. This is in barrels of oil, MCF of gas and barrels of water.

Exhibit 5 is a graph of the production data contained in Exhibit 4. In addition to having the oil, gas and water production graphed on Exhibit 5, we have graphed what we know of the bottom hole pressure performance, and we have also included a number of producing wells graphed there. About the only thing I want to point out on Exhibit 5 is that the oil curve shows that possibly in December of 1963, with the production of 43,000 barrels of oil that month, it appears that this pool may have already surpassed its peak production limit.

Q The exhibit that you have just referred to would indicate that there appears to be only three wells in the pool that could be classified as top allowable, is that correct?



A Yes, that is correct. Sinclair's State Lea 4011 Number 1, Tidewater's State AN Number 8 and Texas Pacific Oil Company's State AF Number 1 are the only wells in the pool which could be currently classified as top allowable wells.

Q You have prepared an exhibit showing the oil reserves and economic data, marked Exhibit 6. Would you go through that and explain to the Examiner how you arrived at the various indexes and explain that to the Examiner?

A Yes, Item 1 on Exhibit 6 is the data used in calculating the oil reserves from an average well in this pool. We have a core analysis on Sinclair's State Lea 403 Well No. 5. To my knowledge this is the only core analysis in this pool.

Q Would you identify for the Examiner the location of that well, just on Exhibit 2?

A I can do it on Exhibit 1 which is the structure map.

Q Exhibit 1, excuse me.

A Well, Number 5 is the southernmost well in Section 17 there. This is the well that we have the core analysis on. Looking at this core analysis I found that we cored 31 feet of Devonian; the core was not begun at the top of the Devonian, we were already approximately 22 feet into the Devonian when we started coring. We drilled below the cored interval. I took the sonic log that was run on our State Lea 403 Well Number 5 and compared it with the core data on Well Number 5.

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When I looked at the core data on Well Number 5 I saw nine feet out of the thirty one feet that we cored which had permeability in excess of one-tenth of a millidarcy. I considered that one-tenth of a millidarcy was pretty poor reservoir rock and that I should delete all one-tenth and under permeability footages from these cores in this manner. I determined nine feet of what I would call net effective pay out of the thirty one feet cored. I then averaged the effective porosity measured for that nine feet and I determined a porosity percentage of 3.07 percent.

In a similar manner I looked at the water saturation depicted on Sinclair's core data on their Well 403 Number 5, and I estimated from the nine feet that I considered net pay that the average water saturation was 40 percent. Our formation volume factor of 1.24 barrels was measured from the reservoir fluid sample on the State Lea 403 Well Number 4.

With respect to the average net effective pay thickness I had quite a bit of difficulty in determining the actual amount of Devonian reservoir which would put oil into the well bore. I looked at all the logs that I had available and I looked at our core on our State Lea 403 Well Number 5 and I was unable to pick in each individual case what I would consider an average net pay thickness. So, in order to come up with what I considered possibly an average net pay thickness, I assumed that all operators had perforated what they considered the best portion of the Devonian. I

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then took the perforated interval in the seven producing wells and I averaged the perforated interval and I came up with 37 feet that I could possibly use as an average net pay thickness. It would be my opinion that 37 feet is a little bit more pay than the average well has; however, I think the use of 37 feet would indicate that we had a larger oil recovery under both 40 and 80 acre spacing.

So, for the purpose of my calculation of oil in place in recovery of oil reserves, I used 37 feet. I estimated the recovery efficiencies of 50 percent of the original oil in place which we would expect in a water drive. This possibly is optimistic. In using the data exhibit and of Item 1 of Exhibit 6, I calculated a recoverable oil reserve. I calculated an oil in place of 115 barrels per acre foot; a recoverable reserve then based on 50 percent of the recovery of 57.5 barrels per acre foot; then using 37 feet of pay I came up with 2,130 barrels per acre. This gave me an oil recovery on 40 acres of 85,000 barrels and an oil recovery on 80 acres of 170,000 barrels.

From then on down to Item 3 on Exhibit Number 6, the economics of 40 and 80 acre spacing, using the gross sale price of three dollars and a penny a barrel, I came up with the gross value of recoverable reserves for a 40-acre well of \$256,000.; on 80-acre, \$512,000. The charges against the well, royalty, direct taxes, operating costs and the cost of drilling and equipping a Devonian

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well, I came up with the total costs for a 40-acre well of \$323,370.; on an 80 acre well, \$404,740. This gave me a net loss on 40-acre spacing to the operator of a well, of \$67,370.; a net profit on 80 acres of \$107,260. I would like to point out that these net profits or net losses in this case are undiscounted.

Q Apparently you have, at least on your estimate of effective pay thickness; in your estimate of recovery efficiency you have chosen what would be the most optimistic figures as far as recoverable oil?

A Yes.

Q Using what could be classified as more realistic figures you might come up with a more dismal economic picture, at least as far as 40-acre spacing was concerned, and 80-acre also?

A Yes.

Q In your opinion, based on your study of this pool with the nine control wells and the core analysis, would you consider that this pool could be efficiently and economically produced on 40-acre spacing and allowable?

A No, sir, I do not believe that the pool could be economically developed on 40-acre spacing and allowable.

Q Do you think that, based on the information that you have available to you, a prudent operator would drill on 40-acre spacing?

A No, sir.

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



direction?

A Yes, they were.

MR. KELLY: We move their introduction.

MR. NUTTER: Sinclair's Exhibits 1 through 6 will be admitted in evidence.

(Whereupon, Sinclair's Exhibits 1 through 6 were admitted in evidence.)

MR. KELLY: If the Examiner pleases that would be all I would have for direct at this time. I would like to reserve the right to call another witness on rebuttal if the case takes that turn. We don't know just what to expect.

MR. NUTTER: You'll have that right, Mr. Kelly.

MR. KELLY: I'll turn the witness over for cross examination.

MR. NUTTER: Are there any questions of Mr. Cunningham?

CROSS EXAMINATION

BY MR. RUSSELL:

Q Referring to your Exhibit Number 1, the contour map, and referring you to Tidewater's "AN" Well Number 9, what is the status of that well at this time, do you know? What is it producing?

A Well, I believe I have February's production on Exhibit Number 4. During February that well made 1,600 barrels of oil.

Q It does not make a 40-acre allowable, does it?

A No, sir.

Q Yet you did recommend to the Examiner that they assign



an 80-acre allowable to it?

A Yes, sir, I did.

Q And in your opinion with this well in this condition, will it make such an allowable?

A It will not make an 80-acre allowable. It will not even make a 40-acre allowable based on our exhibit here.

Q But you do recommend assigning 80 acres to it?

A I do indeed.

Q Now, going to Tidewater's "AN" Well Number 8, what is it producing at this time?

A Again I will refer you to Exhibit 4. During February it made 6,438 barrels of oil.

Q Is it producing water at this time?

A Yes, it is.

Q Do you know how much water it is producing?

A During February it produced 599 barrels of water.

Q Was it producing water at the time of its initial completion?

A No, sir, it was not.

Q Referring you to Sinclair's 4011 Well Number 1, that is a top allowable well, is it not?

A It is.

Q Now, as to those three wells which I have referred you to, being Tidewater's Wells 8 and 9, and your Well Number 1, are



the locations of these wells standard, in accordance with the spacing you are requesting in your application?

A No, sir, they are not. They were drilled under the state-wide rules.

Q Of 40-acre spacing?

A Yes, sir.

Q And they are surrounding T. P.'s "AF" Number 1, are they not?

A Yes, sir.

Q And they will drain oil from that 80 acres of T. P. will they not?

A I don't believe that that would necessarily be true.

Q But if they were on a standard 80-acre spacing location they would not be taking as much oil from the T. P. Lease as they would at their present location, isn't that correct?

A I believe that probably the drainage from leases here would be compensatory. Texas Pacific is presently drilling a well Number 3 on their State "AF". This well is closer to our 4011 Well than an 80-acre location would be. This well would drain from the 4011 the same amount of oil probably that our 4011 Number 1 would drain from your Number 1 Well.

Q But Texas Pacific in drilling in accordance with the State rules have two wells on their 80-acre unit, do they not?

A This is true.

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Q And under existing rules each of those wells would be assigned a 40-acre allowable, is that correct?

A This is true.

Q Which combined is less than the 80-acre allowable which you would be receiving, is that correct?

A Would you rephrase the question?

Q The two 40-acre allowables is less than the one 80-acre allowable?

A No, sir.

Q It is not less?

A It is more.

Q Let's go down to your discovery well, which I believe is Number 4. What is the status of that well at this time?

A That well is currently being put on pump. We took off, the well off production, it was off production in January and February. It made no oil effectively. We attempted to rectify a water entry into that well by squeezing the Devonian perforations and reperforating the well, and then retreating it. We were unsuccessful in stopping the water and we proceeded to run a pump into this well to produce this well.

Q Did it make water when it was initially completed?

A No, sir, it did not.

Q When was it completed?

A Our State Lea 403 Number 4 was completed 4-30-63.



Q 4-30-63?

A Yes.

Q Just a little over a year ago?

A Yes.

Q And you are asking that an 80-acre allowable be assigned to that well?

A Yes.

Q And it is offsetting T. P's "AF" Number 1 on the basis of having drilled on a 40-acre pattern, is that correct?

A Well, the well is 510 and 510 from the section lines there.

Q Let's go down to -- First, will you give me some detail as to the reworking that you did on that Number 5 Well; what did you actually do?

A The Number 4 Well?

Q Number 4, yes.

A I have the detail drilling report here somewhere.

Apparently we actually began the work on February 9, 1964. I have here about four pages, five pages of work that we did on this well. Would you like for me to read each individual step that we went through?

Q No, I think if you would just generally run through it without great detail.

A Okay. We first squeezed the Devonian perforations. We



drilled out our cement, tested the perforations. We then reperforated the Devonian from 11,752 to 11,754 and squeezed again. We drilled out our cement, tested our perforations squeezed one more time. Would you like to have the cement that we used on these squeeze jobs?

MR. YURONKA: Just the perforations.

A The first perforations that we squeezed were from 11,652 to 11,720. That was the entire perforated interval in the Devonian. We squeezed them twice and then we drilled the cement. We drilled cement to 11,800; we then jet perforated from 11,752 to 11,754, which is a two foot interval in the very top of the original perforations. We then squeezed those perforations twice.

MR. NUTTER: Mr. Cunningham; in the top of the original perforations, that would be below your original perforations, wouldn't it?

A Oh, I beg your pardon. Yes, it is, 11,752 is 32 feet below the original top of the perforations. That two feet perforation is below the original perforations. After we had squeezed below the original perforations we drilled the cement again and we perforated the Devonian from 11,700 to 11,761. This is in the original lower seat. We then ran tubing back in the hole; we mud washed the Devonian with 500 gallons of acid and swabbed the well. We swabbed ten barrels of new oil, one barrel of acid water and 115 barrels of sulphur water or salt water.

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We continued to test. The well flowed, it alternately flowed and swabbed some oil and lots of water. We then went in, set a cast iron bridge plug at 11,678; this would be above that perforated interval, and we jet perforated the Devonian in the upper part of the Devonian from 11,655 to 11,664, nine feet. This interval compares to the top interval originally perforated. We then mud acid washed the Upper Devonian. We had the Lower Devonian first bridged, plugged off and we tested the well, and swabbed 50 barrels new oil and 12 barrels of lode water in 12 hours. Then we acidized the Devonian with 1500 gallons. Then we flowed 129 barrels of new oil in 22 hours. Then we flowed 109 barrels of new oil in 24 hours. We acidized the Upper Devonian from 11,655 to 11,664, with 4,000 gallons and on subsequent tests then we swabbed the Devonian 74 barrels of new oil and 202 barrels of formation water. So it appears that that last acid job brought water in on us to some extent.

We then drilled a bridge plug between the sets of perforations; we set a retainer in at 11,570 and squeezed all the Devonian perforations again. Then we drilled out cement and we jet perforated the Devonian this time 11,655 to 11,664, which is the upper set of Devonian perforations. We had it open immediately prior to this, ran the tubing, back spotted 250 gallons of mud acid, then apparently they thought they might not have gotten it perforated. They reperforated the same interval, 11,655 to 11,664 and spotted

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250 gallons of acid again; and then they used 250 more gallons of acid and then they swabbed and tested, on five barrels of new oil and 26 barrels of formation water in ten hours. Then they swabbed and flowed the Devonian perforations from 11,655 to 11,664 for three or four days; and, let me see if I can find the last test they had.

Here on March 26, 1964 they swabbed the Devonian three barrels of new oil and 55 barrels of formation water in three hours. They then pulled their tubing and packer, set a Model D at 11,550 and prepared to run dual strings of tubing. You will notice that out Number 4 is a dual well. We then went in and treated the Bone Springs, we got the Bone Springs back on production, and we then went back to Devonian and started running our pump in our lower set there.

Q As a result of your reworking operations, in your opinion will this well make its allowable?

A No, sir, it won't make an 80-acre allowable. It won't even make a 40-acre allowable.

Q Going to your Well Number 5, is it producing water at this time?

A Yes, it is.

Q Approximately how much?

A I refer you again to Exhibit 4., Our State Lea 403 Number 5 during February made 2,784 barrels of water and 3,943 barrels of

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oil. That is an approximate total fluid water cut of 40 percent.

Q On initial completion that did not produce water, did it?

A No, sir.

Q Is the same true for your Well Number 6?

A Yes, sir..

Q It is producing water at this time but not upon initial completion?

A Yes, sir, that's correct.

Q Have you, from your reworking operations been able to determine where the water was coming from, whether it's from below or from the sides in the perforations?

A It is my opinion that we have an edge water drive here as opposed to a bottom water drive, so I believe that the water is coming from the Devonian, and it is probably coming from the Devonian aquifer here into the well bores.

Q And you don't believe it is coming from the bottom?

A No, sir.

Q Now, in determining the economic feasibility of developing this area on either a 40 or on 80 acre spacing and allowable, was any consideration given as to the fact that some of these wells are dually completed?

A No, sir, we did not take into consideration any of the dual completion aspects when I prepared Exhibit 6 here.

Q But the fact that you could produce from a formation



above it as well as this information would affect the economic recovery because --

A It would.

Q But you only attribute the additional cost of going to the additional depth to get the additional oil, is that correct?

A Yes, sir. May I point out in that respect that the cost of drilling and equipping a well, that I used for both 40 and 80-acre contemplates a single Devonian completion. A single Devonian completion is significantly cheaper than a dual completion.

Q On, I believe it's your Exhibit Number 1, which is your contour map, did you prepare that yourself or did someone prepare it under your direction?

A No, it was prepared by the Geological Department, at my request.

Q And you interpreted the data on it?

A No, the interpretation is by our geological people.

Q When you refer to the interpretation you are talking about the location of the contour lines?

A The actual location of the contours were made by our Geological Department.

Q Of course --

A I will say that I agree with them from all I know about geology.

Q What is the basis for your agreeing with them?

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A I say on the basis of what I know about geology this is a reasonable interpretation of the Devonian in this area.

Q But any contour map made on top of any formation is a matter of opinion, is it not?

A To a certain extent it is. We have nine wells which furnished control. We know where these nine wells hit the top of the Devonian. We have based our contour map on the control afforded by these nine wells.

Q But are you saying that geologists will all agree?

A No, sir.

Q And if you had more controls than you have that it may change these contour lines, correct?

A Indeed. After we had drilled our Number 4, or even before we drilled our Number 4, we had a different interpretation than we have now. If any other wells are drilled in this pool, and when Texas Pacific's Number 3 "AF" comes in in the Devonian, this may change our interpretation. This is our present interpretation based on the control in nine wells.

Q At the time of preparing this exhibit, did you have any of the drilling information available to you in connection with Texas Pacific's "AF" Well Number 3?

A No, sir. All we know is that it's somewhere in the Mississippian and has not topped the Devonian yet.

Q But you have no information to use as your control in



preparing --

A No, sir, this Number 3 did not provide any controls here.

MR. RUSSELL: That's all I have.

BY MR. NUTTER:

Q Did the Number 2 provide any control, Mr. Cunningham?

A When we originally started preparing this map, Mr. Examiner, the Number 2 had not topped the Devonian. Before the Number 2 topped the Devonian our contours were significantly extended in a northeast direction here on that 160-acre lease. We swung the contour in then, based on the top of the Devonian provided by the "AF" Number 2.

Q What control did you have to swing the contours, particularly the water-oil contact down to the southwest, around the southwest corner of your 403 Lease, in order to take in the entire north half of Section 17 within the water-oil contact?

A We don't have any control, that's just interpretation.

Q Since the reserves here that you have estimated depend a lot on the correlation of the core analysis of your Number 5, of the correlation of the core analysis with the sonic log, could you furnish us with a copy of that log and the core analysis?

A Yes, sir. I have a copy with me if you would like to see it at this time.

Q We would like to have a copy in the record, a copy of the log and the core analysis.



A I only have with me one copy of each. If there is any method that we could copy this thing I'll be glad to do that.

Q If you can do that, once you get home, make a copy and send it in --

A I will do that.

MR. KELLY: Could I make a tender of those as exhibits at this time then, so we can actually have them as an exhibit?

MR. NUTTER: If you would like to offer them at this time, then they could be withdrawn for reproduction.

MR. KELLY: You are asking for the --

MR. NUTTER: Sonic log and core analysis of Well Number 5.

A Mr. Examiner, would you also like to have the microlog and the induction electrolog on Number 5?

Q You used the sonic log?

A Well, I looked at all the logs. I looked at all the logs I had; now, in that relations I would say that this being a fractured and vugular Devonian, more than likely the microlog don't show very much. However, I did look at each microlog.

Q And you have an electrolog?

A I have an induction log on each of the wells.

Q We would like the induction and sonic log.

A On Number 5 --

MR. KELLY: Then I move -- I don't know how to make this



offer since I don't have them with me. I move the introduction of the sonic log, and the induction log and the core analysis on Well Number 5 and they will be made available as soon as copies are made.

MR. NUTTER: Would you like to see them, Mr. Russell?

MR. KELLY: We could furnish counsel --

MR. RUSSELL: Not necessarily, we don't need them.

MR. NUTTER: If you have the analysis and the sonic log with you --

MR. RUSSELL: We would like the core analysis, but that's all.

MR. NUTTER: We would like to identify those as Exhibits 7, 8, 9 and 10 in this case, then you can withdraw them and re-submit them.

MR. KELLY: Okay.

(Whereupon, Applicant's Exhibits 7, 8, 9 & 10 marked for identification.)

A The sonic log has some of my scribbling on it.

MR. KELLY: Just to get the record straight, I'll move the introduction of Sinclair's Exhibit 7, which is the core analysis and Exhibits 8, 9 and 10, which are the gamma ray, electro and micro survey logs.

MR. NUTTER: Sinclair's Exhibits 7, 8, 9 and 10 will be admitted in evidence. Did you want to leave any of these at this time, Mr. Cunningham?



A No, sir, I don't, these are the only copies I have.

MR. KELLY: We request that he furnish the Commission with duplicates.

MR. NUTTER: Let me see those.

A The log, as soon as we are furnished the film, are sent to the Tulsa Office. There may be a delay of two weeks before we can get back the copies, but we would definitely send them.

MR. NUTTER: We will wait until we have the complete set of exhibits before an order could be entered in this case.

Sinclair's Exhibits 7 through 10 will be admitted into evidence, subject to withdrawal and resubmission at a later date. Did you care to examine them?

MR. RUSSELL: Not at this time.

MR. NUTTER: Are there any other questions of Mr. Cunningham?

MR. DURRETT: Yes, I have a question.

By MR. DURRETT:

Q Referring to your Exhibit Number 6, which is the economic analysis --

A Yes, sir.

Q -- look at Number 3 under roman numeral Number I, where you are talking about formation volume factor.

A Yes.

Q That's your well Number 4?



A Yes.

Q What I'm wondering, why don't you use Number 5 for this analysis, since you used Number 5 on all the others?

A Well, it's strictly a mechanical thing. We caught the core analysis on Number 5, but we caught our fluid sample from Number 4. This was the first well in the field, and in general you try to catch a fluid sample as quickly as you can after you drill a new reservoir. I'm not certain of the date that we caught the sample. I've got the dope here in my files, but that is the reason that the fluid sample was caught on Number 4. Now, the fluid sample should be valid for the reservoir oil wherever caught in the reservoir here.

Q Then you don't think it would make any substantial difference whether you used 4 or 5?

A No, but we didn't catch a fluid sample on 5. You only need a fluid sample usually from any one reservoir.

Q Proceeding on down the exhibit where you speak of forty cents per barrel operating costs, that would be down in the Number 3 under your roman numeral Number III.

A Yes, sir.

Q How did you compute that?

A Well, I just estimated forty cents per barrel, based on the fact that these wells probably will be pumping and that they will be lifting large volumes of water. This, I would say, would



be an experience factor, and forty cents per barrel, I think, is reasonable for a lifting cost. It could be more or it could be less.

Q The same question as to your cost of drilling and equipping a well, what did you use as a basis for that?

A I used the cost of Well Number 5, which is a single Devonian completion. That well encountered no particular drilling difficulties and we ran five and a half inch casing, which I would say would be a normal completion practice. We can make it a little bit cheaper possibly with four and a half inch casing, but I believe the drilling costs and the equipment costs of Well Number 403 Number 5 was representative of what we would expect a single Devonian well to cost; so that's why I used the \$242,000.

Q That Well Number 5 is the well that you have been using in the majority of your analyses here?

A That's the well we have the core on, yes, sir.

Q Just one additional question. I believe you stated that it was your opinion that a prudent operator would not drill on 40-acre spacing in this pool?

A Yes, sir.

Q There are 17 wells drilled in there now, isn't that correct by three different oil companies?

A Yes, sir.

Q On 40-acre spacing?



A We are on 80-acre spacing, Mr. Durrett.

Q You are getting a 40-acre allowable?

A We are getting a 40-acre allowable. We had drilled it hoping to have 80-acre spacing.

MR. DURRETT: Thank you.

BY MR. NUTTER:

Q On your Number 4 Well, prior to this torturous series of perforations and squeezing that you went through before deciding to put it on the pump, the well made 7,180 barrels of oil in December and it shows no oil in January. Did it just quit making oil all of a sudden?

A We just took it off production.

Q Did it cease to flow when you took it off production, or was it commencing to make water, or what?

A It had already started to make water. You notice in December as well as November it made 2,000 barrels of water.

Q Yes.

A It was getting increasingly hard for the well to flow. We could see, if we let it continue it was going to be water-logged and die and we would have to do this work; so they just took it off of production in January and submitted the proper forms to the Commission for removing it from the schedule.

Q Did it produce all through the month of December?

A As far as I know.



Q And then it was just taken off production the first of January?

A The first of January.

Q And didn't produce until the rework and the testing?

A We still haven't potentialled the well yet.

Q It was making top allowable in the month of December, however, wasn't it?

A Yes, sir.

MR. NUTTER: I believe that's all. Are there any further questions? Mr. Irby?

BY MR. IRBY:

Q I would like to ask the witness if his proposed special rules request an exception to the printed rules and regulations of the Commission with regard to the drilling and completion of the wells.

A Casing program, Mr. Irby?

Q Yes.

A No, sir.

MR. IRBY: Thank you.

MR. NUTTER: Are there any other questions?

MR. KELLY: I have a couple of questions.

REDIRECT EXAMINATION

BY MR. KELLY:

Q Would Sinclair object to Texas Pacific being given a 40-acre allowable on 80-acre spacing, for their Well Number 3?



A Well, we have asked for 80-acre spacing and 80-acre allowables to be assigned to our wells. However, since Texas Pacific spudded their Well "AF" Number 3 prior to being advised that we were going to ask for 80-acre spacing and 80-acre allowable rules, Sinclair would be agreeable if the Commission saw fit to assign the Texas Pacific Wells "AF" Number 1 and "AF" Number 3 40-acre allowables, even though the pool is on 80-acre spacing and 80-acre allowables. Now, a similar problem was encountered, as best I can determine, in the South Vacuum Pool and this was done.

Q 40-acre allowable was given?

A To two wells which were drilled on 40-acre spacing before the hearing came up.

Q Now, we've had some question about your control; as far as the geological information, the control is as good as you can get, as far as your oil-water contact line being brought in next to Texas Pacific's State Number 2, when they have a dry hole there?

A Well, the contour line is there because of their Well Number 2. It swabbed the water into the Devonian.

Q So, at least as to the northwest section of -- No, it would be the southeast section of Section 8, it indicates that the outer limits of the pool are where your line, oil-water contact line is?

A That's our interpretation of it.

MR. KELLY: That's all I have.



RE-CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Cunningham, do I understand it correctly that it would be Sinclair's proposal that any well that's presently completed in, or drilling to this pool-- I presume the Texas Pacific Number 3 is the only one that will come under this category -- to which can not be dedicated a full 80-acres on that lease in that quarter section, should continue to receive a full 40-acre allowable in the event that the Commission would grant the application?

A That is not Sinclair's recommendation. I say, Sinclair would be willing to accept such determination from the Commission.

Q And then any future well which would be drilled on less than 80 acres would receive an allowable in proportion to an 80-acre allowable that the acreage dedicated to the well bears to the 80?

A Yes, this 40-acre allowable would only apply to the two wells of Texas Pacific.

Q Now, we do have a telegram here in which Tidewater Oil has expressed concurrence with Sinclair's application in this case. Did you discuss this willingness--

A Yes, sir.

Q --willingness to go along with the full 40-acre allowable to each of the Texas Pacific wells with Tidewater?

A Yes, sir, I did.



Q In concurring with your application they concur with this expression of your willingness in this regard?

A I am not entirely sure that they do.

Q They were aware of it?

A They were aware that we would express our willingness to do this if the Commission saw fit.

MR. NUTTER: I see.

MR. DURRETT: One additional question, please.

BY MR. DURRETT:

Q Mr. Cunningham, would Sinclair have any objections to this proposition if the Commission should determine that they thought that there might be a possibility of correlative rights being violated, as far as the Texas Pacific Well Number 1 was concerned, to limiting the three Sinclair wells, the two Sinclair Wells, it would be the Sinclair 4011 Number 1 and the Sinclair 403 Number 4 Wells, to a 40-acre allowable along with the Tidewater Wells Number 8 and 9 that we have discussed here, a full 40-for those to offset this Texas Pacific Well; would you have any objection to that proposition, and then 80's for the rest of the pool with 80-acre allowable?

A Well, maybe I can express it this way. We are willing to grant Texas Pacific their Well Number 1 and their Well Number 3 40-acre allowables. Now, two 40-acre allowables with the present unit allowable in New Mexico at this depth is equivalent to approxi-



mately 220 barrels per day; so two 40-acre allowables is equivalent to 440 barrels here today of allowable for this 80 acres. The current 80-acre allowable would be 260 barrels for an 80-acre allowable; so if they have 40-acre allowables on their "AF" Number 1 and their "AF" Number 3, and we have 80-acre allowables on our 4011 Number 1 and 403 Number 4, or Tidewater's 80-acre allowable on 8 or 9, and if Texas Pacific Wells will produce the 40-acre allowable, there would be no way for our leases to drain their lease; their leases would drain our leases.

Q They actually would be getting more oil?

A They would get more allowable for 80 than we got for 80 acres, whether they would get more oil I don't know yet.

Q Well allowables they would?

A Allowables they would. It is our recommendation that we get 80-acre spacing and allowables for every well in the field. That is the case that we tried to present here today. That will continue to be our recommendation.

Q What I'm thinking is this, Mr. Cunningham, if the Commission did decide to do what I propose, as far as your Wells Number 1 and 4, and Tidewater's Wells Number 8 and 9 are concerned, it couldn't hurt you if it gave you more allowable than you would get under 80's, could it?

A No, sir.

MR. DURRETT: Thank you.



MR. NUTTER: Any further questions of Mr. Cunningham?

MR. PORTER: I have one.

BY MR. PORTER:

Q Mr. Cunningham, I missed a part of the testimony here. It seems that your water encroachment starts rather suddenly and in considerable volume.

A Yes.

Q Would you think that even a 40-acre allowable is possibly too high in here?

A Well, if you are asking me, do I think that a high rate of oil production would bring the water in --

Q That's what I mean.

A -- I don't know the answer to this question, but I think that if that is what is happening that a 40-acre allowable is too high, as well as an 80-acre allowable, yes, sir.

MR. PORTER: Yes, sir, thank you.

MR. NUTTER: Any further questions of the witness? He may be excused.

(Witness excused.)

MR. NUTTER: Do you have anything further, Mr. Kelly?

MR. KELLY: Nothing except possible rebuttal.

MR. NUTTER: We will take a ten minute recess before we continue with the hearing.

(Whereupon, a ten minute recess was taken.)



MR. NUTTER: The hearing will come to order, please.

Will you proceed, Mr. Russell?

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

DIRECT EXAMINATION

BY MR. RUSSELL:

Q Would you please state your name, address and by whom you are employed?

A Nolan Hirsch, in Fort Worth, Texas and employed by Texas Pacific Oil Company.

Q In what capacity and for how long?

A I have been with Texas Pacific Oil Company for approximately ten years. My present job, Division Exploitation Geologist in the Fort Worth Office.

Q Have you previously qualified to testify before the Commission or one of its examiners?

A No, sir.

Q Would you give me a brief resume of your educational background, and the work that you have been engaged in since graduation?

A Graduated from the University of Texas with a Bachelor of Science Degree in Geology in 1944. Was employed by Stanolind after returning from the Service, from 1946 to 1950, in Midland, which at that time included Southeast New Mexico and West Texas.



In 1950 I went to work for Deep Rock as District Geologist, and also covered this area, through 1954, at which time I was employed by Texas Pacific Coal and Oil Company as Division Geologist and was transferred from Midland into Fort Worth in 1956, and have been there the remainder of that time, and have continued to work in this area.

MR. RUSSELL: Are the witness' qualifications acceptable?

MR. NUTTER: Yes, sir, they are.

Q Mr. Hirsch, have you prepared a contour map on the top of the Devonian in the North Vacuum-Devonian Field?

A Yes, sir, I have.

(Whereupon, Texas Pacific Oil Company's Exhibit No. 1 marked for identification.)

Q And that is what has been marked as Exhibit 1?

A Yes, sir.

Q Will you please explain to the Examiner the information upon which you base this map; these contour lines?

A Prior to constructing this map I examined the logs of all the wells in the field and also made an isopac of the Mississippian, thickness of the Mississippian and the Woodford to help clarify the position and to give additional information, in so doing I prepared this structure map.

I might go into a little detail here which I think we agree with Sinclair in examining the log we came to the water table of plus, or minus 7,900. On the Number 2 "AF", which we completed as



a dry hole, I have shown a fault passing through that well. We had 280 feet of additional thickening in the Mississippian and Woodford over the west offset, the Sinclair 4011. We had an additional thickening of 100 feet over the south offset, which is the Sinclair Number 6 403, and in examining these logs it is my opinion that this well had an additional section, additional deposition and it cut a fault which I have indicated here on the structure map.

I have trending in a northwest-southeast direction, which is very similar to the fault that is on the Sinclair Exhibit in the South Vacuum field; also in preparing this map, our present drilling well, the Texas Pacific Number 3 "AF" topped the Mississippian at 10,970 minus 7,007 and by using the information that I prepared on the isopac maps, it is expected that we will encounter approximately 500 feet of Mississippian and 175 feet of Woodford. Using this information, it appears that the Devonian will be encountered at our well at approximately minus 7,685. I've used this information in drawing the structural contour passing through our Number 3 Well and on this basis it is shown a little steeper dip on the eastern rim of this feature than is indicated on the Sinclair Well. On that basis is how this map was prepared.

MR. RUSSELL: I have no further questions of this witness.

MR. NUTTER: Any questions of this witness?

MR. KELLY: Could we have just a moment to examine this exhibit?

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DIRECT EXAMINATION

BY MR. RUSSELL:

Q Mr. Yuronka, will you please state your name, address, by whom employed and in what capacity?

A My name is John Yuronka, I am employed by Texas Pacific Oil Company in Dallas, as an engineer in charge of primary production.

Q You have previously been qualified to testify before the Commission?

A Yes, sir.

Q Mr. Yuronka, drawing your attention to Exhibit Number 1 which has been prepared by Mr. Hirsch, is it correct that the blue line shows the outer productive limits of the pool, based upon his opinion on contour here?

A Yes, sir.

Q On the basis of this contour map, will you explain, or point out to the Examiner, those wells which could have, on the basis of this map, 80 productive acres assigned to it?

A Essentially there is only one well that could be called, or would have 80 productive acres, and that would be Tidewater's "AN" Number 9. Possibly, as shown on this interpretation, there's a little nick right in the corner of our State "AF" right there in the northwest of the southwest of the section, but those would be the closest to supporting, or being 80 productive acres, those



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two tracts right in there. Let me clarify this a little further. The 80-acre tract for Number 9 would have to run, or would include the northeast of the southwest, and the southeast of the northeast. It could not be a long 80.

Q That Tidewater "AN" Number 9 could not make an 80-acre allowable anyway?

A No, sir.

Q Direct your attention to Tidewater's "AN" Wells Number 8 and 9, and Sinclair's Well 4011, they are all drilled on a 40-acre pattern, are they not?

A Yes, sir.

Q And your "AF" Number 1 is also on a 40-acre pattern?

A Yes, sir.

Q In your opinion, will the granting of 80-acre allowables to the three offsetting wells impair your correlative rights?

A Yes, sir, we feel it will. If I may elaborate a little further --

Q Yes.

A --four of the eight wells, four of the seven presently producing wells fall within the tolerance allocated by Sinclair's application, of 660, with a tolerance of 150. The three wells that do not fall in this category that are 330, all three of them offset our lease. We have our Number 1, it is 510 from the south and 660 from the west. Now, if this well is granted a 40-acre allowable of



222 barrels, we have two wells that are within 330 feet of your lease line that will be producing 260 barrels. The way it stands now it is very possible that under the present locations they would get some of our oil; but by being granted an 80-acre allowable it is more likely that they would get more of our oil.

Q In the event the Commission should grant to all of the three wells, two of Tidewater and one of Sinclair, a 40-acre allowable, would you have any further objection to the granting of the application as to their wells in there?

A If the offset wells would be granted a 40-acre allowable we would have no objection to the remainder of the field being on 80 acres.

Q Mr. Yuronka, you are familiar with the history of the water encroachment in these various wells of Tidewater and Sinclair, are you not?

A Yes, sir.

Q Do you have an opinion as to what would be the effect upon the water encroachment of the granting of an 80-acre allowable for these wells?

A Well, as we know, water encroachment can occur in one of two ways. It can occur either through comingling of bottom hole water or the encroachment of water through a porous zone, and consequently water out of a porous zone is probably contributing more heavily to production than any other zone. Sinclair's exhibit shows, for instance --



Q What number?

A Exhibit Number 4. Well Number 6, the only time that well has not produced any water, or State Lea 403 Number 6, is in the first month. There are only two wells in the field at the present time that do not have any water production history, and that is 4011 Number 1, and our "AF" Number 1. With the history that is shown by the, for instance, the discovery well, it would appear apparent that water encroachment is already occurring under a 40-acre allowable; if larger allowables are granted this water encroachment could possibly occur a lot sooner than it would under 40, and possibly cause abandonment of the reservoir before the ultimate amount of oil could be obtained in 40-acre spacing.

Q It would result in the premature abandonment of the well, of the reservoir, and result in recoverable oil left in place, which would constitute waste?

A Yes, sir.

Q Mr. Yuronka, have you come up with a formula or compiled some figures as to the economic feasibility of developing this pool on a 40-acre spacing and 40-acre allowable?

A Yes, sir.

Q Will you briefly give that to the Examiner?

A We, of course, have come up with slightly different figures than Sinclair has. We have picked, or are using 45 feet of net pay for a well in the field. This is based-- We did not



have the benefit of a core analysis; this was based on taking the sonic log and using a cutoff of three percent and we are using four percent as average porosity in our "AF" Number 1. We have one zone that has ten to twelve percent porosity, and consequently we are using 45 feet of pay. Actually by using this method we come up with an average feet of pay of 48 feet per well, and we are using 45. We use four percent porosity; we are using a 25 percent water saturation; we are using a formation volume factor of 1.25, and we come up with 200 barrels per acre foot for a 40-acre tract; this is 360,000 barrels of oil.

We have used, based on our "AF" 1, drilling and equipping a well, a single Devonian producer with a tank battery and a hydraulic unit, we come up with a figure of 277,000 dollars per well. Using \$2.29 a barrel, taking away your royalty and using fifty cents a barrel for lifting costs, we come in with a net income of \$2.05 a barrel of oil, which for 360,000 barrels, as you can see, will give you about \$720,000. The payout for a well on 40 acres, as it exists right now is 20 months. Your ratio of income to investment would be approximately two and a half dollars for every dollar invested.

Q And it's your opinion that this pool can be economically developed on the bases of 40 acres?

A Well, we feel it can by evidence of our drilling "AF" Number 3.

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Q Is there anything further in this case that we have not brought out that you would like to bring out at this time?

A No, sir.

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

MR. NUTTER: Are there any questions of Mr. Yuronka?

MR. PORTER: I have one.

CROSS EXAMINATION

BY MR. PORTER:

Q Mr. Yuronka, I don't think you testified on this, but do you think that one well will drain 80 acres here?

A Sir, in all probability it would, however, we are faced with the situation where we now have seven wells in the field already drilled, and we are faced with a problem of correlative rights and inequities being disturbed at this stage of the game. Consequently, under the circumstances we feel that the 40 acres would be a more economical way to go, and prevent any encroachment of correlative rights.

Q But you think there is a possibility that one well would drain 80 acres?

A It's very possible.

Q Given long enough time?

A Yes, sir. I could not testify, we don't have any specific evidence one way or the other.

MR. PORTER: I see. That's all I have.



BY MR. NUTTER:

Q You used 200 barrels per acre foot as your recovery and 45 feet of net pay, for a total of 360,000 barrels per 40; are you assuming 100 percent recovery of the oil?

A Sixty percent.

Q You figure that 200 barrels per acre foot is the 60 percent of the original oil?

A Yes.

Q What then is the original oil in place per acre foot?

A It would be in the neighborhood of 300 barrels per acre foot.

Q Per acre foot of original oil?

A Yes. This 200 barrels per acre foot, I might add, is a figure that is comparable to their barrels per acre foot figures we have for their Devonian fields in New Mexico; of course, taking into account variances in porosity and permeability and what have you, but that is about an average figure that we use for a barrel per acre foot recovery in a Devonian Pool in New Mexico.

Q Your cost, \$277,000 per well in the pool includes the cost of a tank battery and the hydraulic pumping unit?

A Yes, the cost of a single Devonian we estimate to be \$242,000.00.

Q For the well itself?

A Just for the drilling of the well. The cost of a tank



battery would be approximately \$10,000.00 and the cost of a hydraulic unit would be approximately \$25,000.00.

MR. NUTTER: Mr. Cunningham, did your cost of \$242,000.00 include any battery costs or pumping units?

MR. CUNNINGHAM: Yes, the usual additional costs for tankage. We have a lact on our lease.

MR. NUTTER: Does that include pumping equipment?

MR. CUNNINGHAM: No, sir.

MR. NUTTER: That's the cost of a flowing well?

MR. CUNNINGHAM: Yes.

MR. NUTTER: Are there any questions of Mr. Yuronka?

MR. RUSSELL: I have some questions.

REDIRECT EXAMINATION

BY MR. RUSSELL:

Q You did not have a core analysis to establish your figure for porosity or water saturation?

A No, sir.

Q In figuring, the figures that you have just given, you did not take into consideration the testimony that you heard concerning Sinclair's core analysis, is that correct?

A That's right.

Q These optimistic figures that you have given, would you say that Tidewater's Well Number 9 would be capable of this type of production?

A When I talk about 200 barrels per acre foot, that is an



average for a well in the field. That is not, we are not talking about specific wells.

Q I see. We are not talking about quite a number of wells in this field, is that correct?

A Well, that again is purely a matter of opinion.

Q How many logs did you have to make this analysis?

A We used the logs of producing wells in the field.

Q Did you have Number 5?

A Yes, sir.

Q What was your porosity figure for Number 5?

A What do you mean by porosity figure?

Q Did you also use your five percent porosity for Well Number 5?

A No. Let me go over what we did again. We used the sonic log and used the cut off point of three percent. Anything less than three percent we felt would not contribute to production. That is how we got our net feet of pay in each well. In calculating we have used an average of four percent.

Q You've used an average of four percent, but in arriving at this average you did not have available to you the fact that the porosity on Well Number 5 was 3.07 percent?

A No, sir, we did not have it.

Q You were speaking of possible encroachment of correlative rights. What you mean here is the correlative rights would not



be affected, the only possible affect would be to Texas Pacific's Well Number 1, isn't that correct?

A That is right.

MR. RUSSELL: I have no further questions.

MR. NUTTER: Any further questions of Mr. Yuronka? He may be excused.

A May I say one thing? We talk about porosity and a core analysis, but I think Sinclair would recognize this fact, that when you talk about a porosity and a core analysis you cannot say that the porosity in that core analysis is the same throughout the field, it is purely what you core in the wellbore. It can change within ten feet of the wellbore.

MR. RUSSELL: Isn't it true, Mr. Yuronka, that it is the best evidence available?

A It is the best evidence available of what is in the wellbore.

MR. NUTTER: If no further questions Mr. Yuronka may be excused.

(Witness excused.)

MR. RUSSELL: At this time I would like to offer into evidence our Exhibit Number 1.

MR. NUTTER: Texas Pacific's Exhibit Number 1 will be admitted in evidence.

(Whereupon, Texas Pacific's Exhibit 1 was admitted in evidence.)

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