BEFORE THE OIL AND GAS CONSERVATION COMMISSION

OF THE STATE OF COLORADO

IN THE MATTER OF THE)
ADENA FIELD.) CAUSE NO. 26

PURSUANT TO NOTICE TO ALL PARTIES IN INTEREST, the above-entitled matter came duly on for continued hearing at Room 243 State Capitol Building, Denver, Colorado, at the hour of 10:00 o'clock a.m., May 28, 1958.

BEFORE:

H. C. Bretschneider, Commissioner
W. A. Dillon, Commissioner
Harvey Houston, Commissioner
Joseph Conrado, Commissioner

APPEARANCES:

(As heretofore indicated.)

* * * * * * *

I N D E X

WITNESSES:	DIRECT	CROSS	REDIRECT	RECROSS
For Petroleum Inc.:				
John McLeland	200	268		
Herman Kavaler	233			
Paul B. Shivel	262	264	265	
For Lion Oil Co.:				
Richard Struble	320	329	336 & 340	337
For Pure Oil Co.:				
Jack Weyler	343	348	349	349

E X H I B I T S

	FOR IDENT.	IN EVID.
For Petroleum Inc.:		
1 thru 5	--	230
6	204	"
7	206	"
8	216	"
9	218	"
10	223	"
11	225	"
12	226	"
For Lion Oil Co.:		
1	320	341
For Robison:		
1	340	342

LAWYER'S NOTES

Page	Line	
297	11	Delaney #3 — McLeland

PROCEEDINGS

* * * * * * * * *

COMM. BRETSCHNEIDER: All right, gentlemen, if everyone is here we will resume the hearing and you may start in where you left off last night.

MR. KIRGIS: At the close of the session yesterday we had concluded our discussion of the exhibit identified as No. 4.

JOHN McLELAND

called as a witness on behalf of Petroleum, Inc., having been previously duly sworn, resumed the stand and testified further as follows:

DIRECT EXAMINATION
(Continued)

BY MR. KIRGIS:

Q Mr. McLeland, will you turn to Exhibit No. 5. Is that on the board now?

A Yes, sir, it is.

Q Who prepared this exhibit?

A It was prepared under my supervision.

Q Was it prepared by people in your immediate office?

A That is correct.

Q What generally is shown by this exhibit?

A This exhibit as entitled on this map and on the small maps that you have is the "Gross J Sand Interval" between the top of the "J" sand and the base of the "J" sand.

Q Now, is that the full "J" sand section, or only that which has been determined to be possibly productive in the Adena Field?

A That section which has been considered productive in the field.

Q What is the source of the information which is portrayed on this exhibit?

A The data used in determining and contouring this map was from electric logs in the field.

Q Will you explain why the area depicted on this Exhibit 5 is a lesser area than on prior maps of the field?

A That is primarily due to the time and effort needed to go into the construction of the entire map. We feel that the area of interest with which this Commission is concerned at the present time is the southwestern edge, and we therefore limited the construction of this map to the south half of the field.

Q Now, in this Exhibit 5 there are figures located by the wells. What do those figures locate?

A We will take this one, for instance, in the southwest of the northeast of 19, the No. 32. That means the total "J" sand interval from the electric log analysis.

Q Is that number of feet, is that right?

A This is the number of gross feet.

Q Now, there are also contour lines on this Exhibit 5

and there are figures written into those contour lines. What are the significance of those figures?

A These contour lines join equal points of thickness, gross thickness; and as you note here there are roughly thicknesses on the east side of the field, twenty, twenty-five, thirty as you progress into the field. As you go to the west we have the last line at this point being thirty feet, and the last line shown on this map is twenty-five feet in thickness, gross thickness.

Q Now, there is a blue area to the left on the large plat on the board and there is a red line in a similar area in the small plats in the folders. What is the significance of that blue and red line?

A That is the same line that was used on the structural top map. It is the westernmost extension of the sand that is productive in the Adena Field. This is merely just a tracing from the top map to show where that line falls on this map.

Q Again is the Delaney lease shown in pink or red?

A The Delaney lease, which is the east half of 26, is shown in pink in this area. It is also shown here that with respect to the water table, as in previous exhibits, or the waterbearing sand, it is some distance removed to the east.

Q Now, what does this Exhibit 5 indicate as to the thickness of the sand on the Delaney lease?

A It shows that throughout the Delaney lease there is at least twenty-five feet of gross sand thickness. Now, this possibly you would say is somewhat different from that, but we have eliminated the north portion of the field. It might go down to as much as twenty feet at that particular point.

Q Now, what is the actual significance of this Exhibit 5 as you see it and interpret it?

A The significance of the construction of this map, or as you view it, is that the sand has various points of build-up and various points of thinning. You will note in the center of the field that we have a gross thickness in this area of thirty-five feet; in this area we have thirty-five feet. You come to this point which is in the northeast quarter of 24; you may have a thickness of thirty feet, I believe that line is, and it shows the general trend of sand build-up, sand thinning, that is always in occurrence in a sandbar type deposition.

Q Now, does this exhibit indicate anything to you, and if it does tell why regarding possible connection between the Adena Field and what has been known as the South Adena Field?

A It shows the presence of the "J" sand section, and the continuity, the actual trend of the field being northeast-southwest, and the good chance that there is continuous structure from the main Adena Field proper to include the

Adena South.

Q Do you have anything you wish to add regarding this Exhibit 5?

A I believe not.

Q May we turn then please, Mr. McLeland to Exhibit No. 6.

(Petroleum Inc. Exhibit No. 6 was marked for identification.)

Q Mr. McLeland, I call your attention to what has been designated Exhibit No. 6, and I ask by whom that was prepared?

A This exhibit was prepared under my supervision.

Q Was it prepared by people in your immediate office and in your staff?

A That is correct.

Q Now, generally what is shown by this exhibit?

A This exhibit is a preparation of net pay sand thickness.

Q What is the difference then between this Exhibit 6 and the Exhibit 5 which we have just discussed?

A The "J" sand thickness shown on this map is net pay which we used or imposed the limits which were used in the Adena Field unitization or the Adena unit, of two and a half millidarcies, in excess of two and a half millidarcies, and measureable oil saturation for each foot that was cored.

Q Now, is this exhibit with the distinction you have just stated constructed similarly to No. 5?

A That is correct.

Q Now, do you have any correction that you wish to make on this exhibit?

A I do. My supervision must not have been too good. I note approximately a day and a half ago that while this line was drawn through and included the Bruce No. 2, that well did not have any permeability above the water table. This line should have been drawn, not the zero water-oil contact line, but the pay limit should have been drawn such that zero would have come around and omitted the No. 2 Bruce.

Q When you refer to the No. 2 Bruce and when you point, are you referring to a well which appears in what I believe would be the east half of the northwest quarter of Section 26?

A The No. 2 Bruce is located in the southeast of the southeast of the southwest of 23.

Q Have you drawn a pencil line on the exhibit on the blackboard to show the correction, and if not will you do so?

A All right (marking on chart).

Q Mr. McLeland, have you checked out the rest of this map and found that it is accurate?

A Yes.

Q What is the source of the data which is used for the preparation of this map, which is Exhibit 6?

A We utilized it for core analysis and electric logs

as well as completion information.

Q Now, what is the overall significance as you see it of this exhibit and what is portrayed thereon?

A The primary significance for the purpose of this hearing is to show the sand net pay thickness which exists within the area of interest which we consider to be the east half of 26, or the Petroleum Inc. Delaney lease. It once again shows the trend of the field from an actual position or an actual trend of the field from the northeast portion of the field proper trending to the southwest, which may be well included into South Adena.

Q Now, will you indicate what this exhibit shows as to the net pay thickness on the Delaney lease?

A The net pay thicknesses on the Delaney lease vary from zero, which would include the Goedert No. 1, which was drilled in the southeast of the northwest of the northeast of Section 26, to as much as twenty feet in net pay thickness surrounding the Delaney No. 2.

Q Do you have anything else to add regarding this Exhibit No. 6 or what it portrays?

A Only in reiteration to show that there is a definite trending of the sand typical of sandbar type deposition.

Q Will you turn now to Exhibit No. 7, please.

(Petroleum Inc. Exhibit No. 7 was marked for identification.)

Q Mr. McLeland, will you state who prepared Exhibit No. 7?

A I prepared Exhibit No. 7.

Q Now, what is the base map which you used for this Exhibit No. 7?

A The base map from which this Exhibit 7 was prepared was the latest revision of the oil in place as determined and submitted by the Pure Oil Company, with the exception my revision once again commences at the Dewey No. 8, which would be in the northeast quarter of Section 23; and also to start in this particular area it would be in the neighborhood of the Robison No. 1, which would be located in the south half of Section 25.

Q Now, what is the purpose of a map isopach such as our Exhibit No. 7?

A The primary purpose of this exhibit is to show the oil in place underlying the Petroleum Inc. Delaney lease.

Q Now, will you explain what modifications you made and why you made them in the southwest area to which you have referred, modifications being from the Pure Oil Company isopach showing oil in place?

A The first modification of this map commences on the west side in the area of the Dewey No. 8, which is located in the north half of Section 23. The really first modification is the calculation of an oil in place for the Dewey No. 8,

which was an abandoned hole. The oil in place isopach that Pure has presented has previously considered the Dewey No. 8 within the confines of the Adena Field. They have, however, omitted the value of oil in place which would be assigned to that particular well. I calculated the oil in place similar to the calculations which were shown for our wells, finding that 4,362 barrels per acre underlie that particular well. It is a dry hole.

In addition in the south half of Section 25 the Robison No. 1 has now been assigned within the zero oil limits as prepared by the Engineering Committee. Once again they did not calculate the value and show it on the base map that they have. I calculated this well similarly as was done in other wells, using the same methods that they used, and find that a value of 1,957.9 barrels per acre exist for that dry hole. The other changes that have been made in this map are the inclusion of a zero oil in place area, which includes the area lying intermediately between the Dewey No. 7 and the Goedert No. 1. The Dewey No. 7 is located in the southwest quarter of Section 24. The Goedert No. 1 lies on the Delaney lease, which is located in the northeast quarter of Section 26.

From review of the core analysis data no permeability within the "J" sand exists, and no oil saturation was present. We must conclude that there is no recoverable oil in place within the limits of this contour line. Beyond that we

extended the lines to include calculations for the Bruce No. 1, which are in the Adena Engineering Committee report which gave that well 10,415.6 barrels per acre. We, therefore, drew our zero oil in place contour line outside of that limit and around to include that well within the field.

Beyond that these values are very much the same; in fact, I believe they are the same values for Delaney No. 1. We used the values that the Pure Engineering Department calculated for that particular well, those particular wells. It does show the revision that we have determined necessary for the Delaney No. 2, which is located in the southeast quarter of Section 26. In addition we also show a recoverable oil in place calculation for the Edith No. 1 which is located in the northeast quarter of Section 26. That is in our exhibits in the small maps. For that well we calculated 2,215.1 barrels per acre. It is a dry hole.

We also calculated the Doll No. 2, which is within the confines of what is now considered to be South Adena. For that particular well we calculated 2,727.6 barrels per acre. Immediately south of that we pick up the Doll No. 1 and from core analysis data and similar calculations we assign 20,639.0 barrels per acre. I believe that is all the calculations that were done in the preparation of that map. Beyond that we simply contoured using normal procedures and practices to arrive at the oil in place underlying the

Delaney tract.

Q Now, will you point out generally how this differs from the isopach of original oil in place which has been hretofore produced by Pure Oil Company?

A The zero oil in place which has previously been submitted by the Pure Oil Company, zero oil in place contour line, extends through the Dewey No. 8, swinging around to include Dewey No. 7, and then proceeding south southwesterly to include a very small portion of the Delaney tract northwest of the Delaney No. 3; proceeding generally straight south to include only the area in the immediate vicinity of the three Delaney wells, and then proceeding around to include the Robison No. 1, and from this point on this map is the same as their presentation.

Q Is it correct then, as I interpret your answer?

A I do not believe it is correct.

Q Let me ask another question then: Am I correct in interpreting your answer that the Pure Oil Company exhibits have shown the zero oil in place line as really just edging the three Delaney wells and taking in the minimum area served by those wells themselves?

A It certainly is a minimum area of inclusion into the Adena Field.

Q Now, to what extent is the Exhibit 7 a culmination or a conclusion drawn from the prior exhibits which you have

explained and presented?

A From previous exhibits and the preparation of those maps this is the conclusion that the trend is still here. The axial trend once again is repeated on the oil in place map as it should be from the northeast to the southwest. Beyond that point we imposed the limits for calculation for these three wells as was previously presented that were imposed upon the calculations of all wells within the Adena unit. This, therefore, allows us to calculate a recoverable oil in place underlying the Delaney tract.

Q Now, have you made an actual calculation from this of the oil in place under the Delaney tract?

A I have.

Q Will you state what that conclusion is?

A The oil in place assignable to the Delaney tract is 1,550,000 barrels.

Q How does that compare, if you know, with the oil in place assigned to the Delaney tract by the testimony of the Pure Oil Company?

A It is approximately five times what the Pure Oil Company has assigned to this tract.

Q Now, just in your own judgment do you consider your 1,550,000 barrel figure a minimum or maximum figure?

A I consider this a reasonable figure for the oil in place underlying the Delaney tract.

Q Perhaps this is repetitious: Has this been arrived at by using the 2.5 millidarcy limitation?

A It has been arrived at by using the 2.5 millidary limitation and imposing on core data that was available the same limitation of measureable oil saturation for each foot cored.

Q Now, may we turn to Exhibit 7. As I understood you during your testimony regarding Exhibit 7, you made mention of the fact that as to the Delaney No. 2 you assigned values for oil in place in excess of those which had been used by Pure Oil Company, is that correct?

A That is correct.

Q Now, does Exhibit 7-A give explanation and justification for your action in that regard?

A Yes, it does.

Q Who prepared Exhibit 7-A?

A I did.

Q From what data was it prepared?

A The data from which this exhibit was prepared were the two electric logs available, the one for the Petroleum, Inc. Delaney No. 2, and on the other hand, on the right side from the Lion Oil Company Albert No. 1. This particular well is located in the southwest area, which would be this particular location, which would be in the northwest quarter of Section 19 (indicating).

Q The Albert No. 1 which you indicated?

A The Albert No. 1.

Q Now, what is the purpose of this comparison?

A The purpose of this comparison is to show the relationship existing between the Delaney No. 2 and the Albert No. 1 with respect to development of the 16-inch curve on the log. It also relates the fact that a core was available throughout the entire section of the Albert No. 1. A core was not available on the Delaney No. 2 bel the depth of 5852. The comparison or drop off or decreas in the 16-inch resistivity curve is quite similar. If yo will note where we stopped our calculations on this parti lar log was very close to the base of the sand section at depth of 5866. This compares to a resistivity reading at that particular point of 16 ohms.

Similarly, the core analysis of the Albert No. 1 sho the existence of permeability and porosity throughout the sand section to a depth of 5648. The resistivity reading the 16-inch curve at that depth was exactly 17 ohms; I th it shows a very similar circumstance.

Q Now, in the work of the Engineering Committee a in the testimony of Pure Oil Company, has there been any inconsistency between the treatment of these two wells in far as calculations of oil in place are concerned?

A Yes, sir, on the Albert No. 1 the core data we

available to the base of that section, which we consider to be at 5648. That was the base of the sand that was used in arriving at the oil in place calculations for that well. The point at which the Delaney No. 2 was discontinued as far as calculating oil in place by the Pure Engineering Committee at a depth of 5852, which would be the base of the core.

Q In your opinion as an expert and an engineer is there justification for cutting off the Delaney No. 2 at 5852 feet?

A No, sir.

Q Is that for any reason beyond what you have already stated?

A There are other details available on this well. The caliper survey throughout the entire sand section showed a mudcake build-up. You cannot have mudcake build-up without permeability. This mudcake build-up extended from the top of the sand section to the base. We therefore must conclude that permeability does exist throughout the sand section, and beyond that I believe this exhibit does show our reason for determination of oil in place below the coring depth.

Q That's in relationship to the Delaney No. 2, I take it?

A That is correct.

Q Now, what if any part does this matter which is portrayed and now explained by you in connection with Y.A.

what part does that play in the difference between you and Mr. Weyler in your calculations of oil in place under the Delaney tract?

A The only difference between our calculations is that I have taken the sand section existing below the core depth and summed that total of oil in place calculation to those which would be calculated by the Pure Oil for the cored section.

Q Now, this Exhibit 7-A as you have pointed out, Delaney No. 2 and the Lion Oil Company Albert No. 1, are there other instances in the field where you could get a similar comparison, or is the Albert No. 1 the only one to which you could look in this regard?

A There are several other examples very similar to this preparation of the relationship existing between these two wells. I have the logs here available if anyone wishes to look at the other instances. I chose only to look at the logs in this immediate area. I did scan some of the logs in the northern portion of the field, and similar circumstances do prevail in the other areas. There was a discrepancy between where the picks were taken based upon core analysis, and with respect to the development of the 16-inch curve.

Q Now, there is on Exhibit No. 7 a small area in red pertaining to the Delaney No. 2 and the Albert No. 1. Will you explain what the significance of that is?

A On Exhibit 7?

Q 7-A.

A The area colored in red on this exhibit shows the relationship existing between the two wells. The Albert No. 1 area colored in red was given an oil in place value for that interval. The Delaney No. 2 was not granted the oil in place calculation or value for the interval colored in red on that portion of the log.

Q Do you have anything further you wish to add regarding Exhibit 7-A?

A No, sir.

(Petroleum Inc. Exhibit No. 8 was marked for identification.)

Q Will you turn now, please, to Exhibit No. 8. Mr. McLeland, who prepared this exhibit?

A I did.

Q What does it purport to show?

A It shows the monthly oil production for the Adena unit-operated wells in the immediate vicinity of the Delaney lease. This includes all of the unit-operated wells south of the line which would be drawn through Section 24 and Section 19. All of these wells lying south of that line within the unit are shown here as far as their monthly oil production.

Q Where did you get the data that you used in preparing this exhibit?

A I obtained this data from the Conservation offices of the State of Colorado here in Denver.

Q Now, what in your judgment is the significance of what is shown here on Exhibit No. 8?

A Exhibit No. 8 shows some variations in the volume of oil produced from this immediate area. I call your attention particularly to the production within the limits of time referred on this graph from May of 1957 through November of 1957. This portion of the exhibit shows that during that period that in the order of 10,000 barrels were produced from all of the wells south of this line. Now, those are unit-operated wells. Furthermore, in the month of November, the immediate offset to the Delaney lease the Scanlon No. 5, produced at the rate of 197 barrels of stock-tank oil per day, which would allow that well around 5,800 barrels of oil monthly produced for the month of November. The well was also producing and had been tested in October as having a gas-oil ratio of 3,280 cubic feet per barrel, with 5,000 or approximately 6,000 barrels of oil produced during the month, and a gas-oil ratio, assuming at 3,000, this then would allow for approximately 18,000,000 cubic feet of gas produced from that well in the month of November for 1957. This is approximately the daily plant capacity of the gasoline plant in the Adena Field. I believe the plant capacity is in the order of 25,000,000 feet. It is

approaching one day's capacity of the plant.

(Petroleum Inc. Exhibit No. 9 was marked for identification.)

Q Turn now, if you will, to Exhibit No. 9. Who prepared that exhibit?

A I did.

Q And what does it purport to show?

A It is a calculation showing the relationship of the actual stocktank oil production from the east offset to the Delaney No. 1, the Scanlon No. 5, which is located in the southwest or the northwest of Section 25. The upper line shows the actual stocktank oil production. The lower line, which is shaded in areawise, shows the equal voidage of stocktank oil production. Now, equivalent voidage in my terms are the production of equal volumes of reservoir barrels of oil.

The volumes that were produced from this well were related to reservoir barrels. In order to arrive at an equivalent voidage I contoured the oil in place underlying the forty-acre tract of the Scanlon No. 5. This value was then related to the oil in place within the Adena unit to arrive at a factor or a relationship existing between the oil in place underlying this forty-acre tract and the Adena unit. This then gave me a factor which would be a means of comparison to the unit voidage which was occurring at that

time. The unit voidage was then compared and we arrived at a reservoir voidage in barrels which would be allowed for this Scanlon No. 5, which we call equivalent voidage. It shows that for the various months the Scanlon No. 5 was voiding more space from the reservoir than its proportionate share based on oil in place underlying that forty-acre tract.

Q Have you indicated what the amounts are as shown by the scales on Exhibit No. 9?

A I have; for the month of May the equivalent voidage or the stocktank oil voidage with respect to equivalent voidage in stocktank oil is 4.1 to 1. It proceeds showing an increase in production with respect to equivalent voidage to as much as ten and a half times what its equivalent voidage would have been calculated in the month of November in 1957.

Q Does that indicate anything to you as to the rate of production in terms of its oil in place?

A Yes, it does; it shows that this well was voiding more than its prorated share with respect to unit voidage at that time.

Q Can you make any estimate as to how much more?

A The total amount throughout?

Q Ratiowise.

A For any one month?

Q Any month, yes, that you wish.

A Ten and a half times what it should have been allowed on an equivalent voidage basis.

Q Which month were you picking then?

A November of 1957.

Q Now, why is nothing shown on this Exhibit 9 beyond the end of November, 1957?

A In December of 1957 there was a small volume of production from the Scanlon No. 5. This, incidentally, is coincident with the preparation of a isobaric map for the entire area. The isobaric map was prepared by the Pure Engineering Department for December of 1957. From that point on the well was shut down as far as my operations or my checking into the records of the Conservation offices. The well was shut down and no production occurred, my data shows, through February of 1958.

Q Now, looking at Exhibits 8 and 9 together, what do they indicate to you in terms of the effect of unit operations on the Delaney lease?

A The effect would be during this high rate of withdrawal, May of 1957 to November of 1957, a drastic reduction in bottomhole pressure through that production period. The reduction in bottomhole pressure would allow the increase of gas breaking out of solution increasing GOR in the immediate area. Then the effect of shut-in from December to and including February would result in a

rise in reservoir pressure in the immediate area.

Q Now, has this had any noticeable effect that you have observed in connection with pressures and gas-oil ratios on the Delaney lease?

A I cannot confirm the effect on bottomhole pressure for the Delaney lease. I do know that GOR tests were conducted on our wells in May, the early part of May of this year. We have noticed a doubling of our GOR's for the Delaney No. 1 and the Delaney No. 2 by GOR test conducted in May of 1958.

Q By "GOR" do you mean gas-oil ratio?

A Gas-oil ratio, excuse me.

Q Now, how, if at all, do you relate that to the method of operation of these unit wells to which you have referred?

A This increase in pressure as was noted on the Pure exhibit showing the isobaric map for April of 1958, this increase in pressure which would not only be from possibly the injection of water but also from higher pressures existing within the Adena Field proper, would allow for migration of fluid, the supplement of reservoir pressure, the build-up of reservoir pressure in this area, and possibly the migration of gas that was broken out of solution onto the Delaney lease.

Q Now, is there anything intrinsic in the operation

of the Delaney lease itself which would have contributed to these factors?

A No.

Q Has the production of those leases remained constant or substantially so through all of this period?

A They have remained within the limits of the allowable imposed by the Corporation Commission orders.

Q You mean the Conservation Commission?

A That's right, excuse me.

Q And by that you mean forty barrels per well per day?

A Forty barrels per well per day. They may have been slightly overproduced for one month, but the next month they were shut in and produced at a lower volume than that, so that the overall average is in the order of forty barrels per day per well.

Q Do you have any opinion as to what the result of the type of practice, production practice which is shown for the unit wells on Exhibits 8 and 9, what that means in terms of waste?

A Certainly the rapid withdrawal rates that have occurred allows for an increase in gas-oil ratio. This means that the gas is breaking out of solution, and by that high withdrawal rate the efficient method of operation is not as good as it would be if it had been produced at a

controlled rate of production. It would cause a lowering of efficiency of the type of mechanism operating upon the reservoir.

Q Do you have anything further now that you wish to add as to Exhibits 8 or 9 or the results or opinions which follow from them?

A No, sir.

Q Will you turn now to Exhibit 10?

(Petroleum Inc. Exhibit No. 10 was marked for identification.)

Q Who prepared this exhibit?

A I did.

Q What does it purport to show?

A It shows the monthly oil production and monthly water production from the Lion Oil Company Bruce No. 1, which is located in the northwest quarter of Section 26.

Q From what source did you get the data which is portrayed on Exhibit 10?

A This data came from the Conservation offices of the State of Colorado.

Q What in your judgment is the significance of what is shown on Exhibit 10?

A The significance of this exhibit is to show the production of water to show that there is evidence of increasing water production in the immediate area. This can be

concluded as coming from the waterbearing portion of the "J" sand existing to the west.

Q Now, do you mean by increase in water production in the actual barrels produced or in the ratio of water to oil?

A The overall mean average shows an increasing water-oil ratio. It is not substantial to the amount yet to indicate a very effective edgewater encroachment at this time.

Q Now, is there any relationship between what is shown here on Exhibit 10 as to the Bruce No. 1 and the Delaney wells?

A I believe there is; we notice from our cross-sections the continuity of structure existing. We also by cross-sections and by our oil in place calculations show the existence of oil in place in continuity to the west. We can, therefore, presume that if the edgewater encroachment becomes a dominant mechanism in the recovery of the oil, this then sometime in the future will play an important part upon the recovery of oil from the Delaney tract.

Q Are there any areas in the Adena Field generally where water encroachment has occurred in significant amounts?

A Yes, I believe there are. From Pure's exhibits that were on the board yesterday they have these isobaric map presentations. On that they show a line of edgewater encroachment which I believe takes into consideration the westernmost line of producing wells within the Adena Field. They have marked that line as the front line or the first

evidence of encroaching water upon the Adena Field.

Q Do you have anything further to add in relationship to Exhibit 10?

A No, sir.

(Petroleum Inc. Exhibit No. 11 was marked for identification.)

Q Will you turn now to Exhibit No. 11?

A Yes, sir.

Q Will you state what that is?

A Exhibit No. 11 is a structural top of "J" sand map that was taken from the Core Laboratories report on the Adena Field.

Q Do you know whether that report to which you refer has been identified as Pure Exhibit No. 1 in prior hearings in this matter?

A It is the same.

Q What is the purpose of including that in your exhibits today?

A The purpose of including this in our exhibits is to show the very good similarity between this exhibit and our presentation on Exhibit No. 4, I believe, which was our structural top interpretation. The only difference between the two maps as we see it generally is that they have included a postulated permeability barrier or limit in the southern portion of the field. This was prior to the

development, additional development that occurred on the Delaney tract and the additional development that occurred on the Robison tract.

Q Is there a similarity of contours on Exhibit 11 with those on your Exhibit 4?

A Yes, there is a marked similarity.

Q Do you then find support for your work in this Exhibit 11?

A Yes.

Q Do you have anything further to add on Exhibit 11?

A No, sir.

(Petroleum Inc. Exhibit No. 12 was marked for identification.)

Q Will you turn now to Exhibit 12. Will you state, please, what that is?

A Exhibit 12 is a cross-section which was also taken from the Pure Oil No. 1, the Core Laboratory report. This is a cross-section extending from northeast to southwest. It commences on the S. D. Johnson H. Glen No. 1, which is within the Adena Field, extends through the Falcon-Seaboard Snodgrass No. 1, and on down into the Albert tract within the Adena Field to include the Nichols No. 7 located in Section 24, to include the Scanlon wells 1 and 2, to include the dry hole Robison No. 1, and a projection into the G. A. Doll No. 1 and 2 within South Adena.

Q Now, does this bear any relationship to our Exhibit No. 3?

A It shows the general continuity and development of the "J" sand in the same general direction as our Exhibit No. 3.

Q Now, what do you find as the comparison between what is shown in Exhibit 12 and what is shown in Exhibit 3?

A It shows that by Core Laboratory analysis of the area there is continuity of structure, a continuousness of the "J" sand from the Adena Field into the Adena South.

Q Do you find any support for your conclusions in this Exhibit 12?

A I believe there is direct support.

Q Now, we have concluded the exhibits, and I have a few general questions. You stated a short time ago that on your calculations of oil in place you found 1,550,000 barrels under the Delaney tract, is that correct?

A That is correct.

Q How would you correlate that to, let us call it an allowable in barrels per day for the tract?

A The direct correlation with respect to allowables would be by Order 26-30. That order permits the establishment of a tract allowable for those tracts lying outside of the Adena Field. I think the formula states simply "B", which is the daily rate of production allowed for the Adena

Field, being at the present time 14,000 barrels of oil per day, divided by the oil in place underlying the entirety of the Adena Field, times the tract oil in place, which would therefore give you the amount of oil production allowed for any one tract lying outside of the Adena Field.

Q Now, have you applied that formula and come to the conclusion then as to barrels per day for the tract?

A This formula permits 113 barrels of oil per day from the Delaney tract.

Q Turning now to another brief subject matter, would you state the date of the completion of the Delaney No. 1?

A The Delaney No. 1 was completed in April of '56.

Q Will you state the production of the Delaney No. 2 at and shortly after its completion?

A The initial production test on the well after completion was--the well was swabbed at a rate of fifteen barrels of total fluid per hour with ten percent water. A later test in January of 1957 shows this well capable of producing 136 barrels of oil per day and nine barrels of water. This also shows a production of 84 MCF of gas at that particular time, resulting in a gas-oil ratio of 619 cubic feet per barrel.

Q Now, do you know what in fact the well was producing on production during that period as distinguished from tests?

A In January of 1957 the well was producing in the order of the allowable of 40 barrels of oil per day.

Q Of 1957?

A I cannot state directly what the allowable was for that well at that time.

Q As to the Delaney No. 2, when was it completed?

A The Delaney No. 2 was completed in March of 1957.

Q What was its production on completion?

A On completion this well was tested at 8 barrels of fluid per hour producing 55 percent water. In May of 1957 this well was tested to be producing 89 barrels of oil per day, 96 barrels of water, and 50 MCF of gas. This results in a gas-oil ratio of 620 cubic feet per barrel.

Q Now, when, if you know, was the water injection program on the unit undertaken as an effective program?

A The water injection was commenced as an effective program within the Adena Field in July of 1957.

Q Was that then after the completion of both the Delaney No. 1 and Delaney No. 2?

A That is correct.

Q And after the production figures which you have given had been established, is that right?

A That is correct.

BY COMM. HOUSTON:

Q Mr. McLeland, were these wells flowing or pumping?

A Pumping.

Q Pumping now?

A Yes, sir.

Q And at the time when you gave the figures on the production?

A They were pumping.

MR. KIRGIS: The witness is available for examination. May I at this time offer all of our exhibits which have been identified from 1 through 12 and including the various other exhibits?

COMM. BRETSCHNEIDER: Yes, sir, they will be accepted as exhibits in evidence, unless there is an objection to any of the exhibits.

(Petroleum Inc. Exhibits 1 through 12, inclusive, were received in evidence.)

COMM. BRETSCHNEIDER: Would you like to take a little recess before your cross examination?

MR. STOCKMAR: As a matter of fact, Mr. Bretschneider, I would like to suggest that we defer the cross examination of this witness until we have seen the entire case, if we may. At the present time, not being precisely sure what their proposal is, what it is they are suggesting be done, we could spend quite a few hours picking away at this information. Were we to see their whole case we might be able to eliminate a substantial part of that.

COMM. DILLON: Is there any objection to that?

MR. KIRGIS: We have another witness; I have no particular objection, however I think I can meet Mr. Stockmar's problem immediately, if you wish to proceed in a more orderly manner. The ultimate conclusion, as we see it, as brought out near the end of this testimony, is that the actual oil in place under the Delaney tract justifies on the formula and the theory which has been heretofore presented an allowable of 113 barrels per day for the Delaney tract. It is just that simple; all of this has been building to that one thing.

COMM. BRETSCHNEIDER: What do you expect to show by your other witness?

MR. KIRGIS: Largely supporting testimony.

COMM. BRETSCHNEIDER: Will it be as lengthy as this?

MR. KIRGIS: No, it will not and it will not involve additional exhibits or anything of that type. All the exhibits are in which are the basis for our entire presentation on this phase of the matter.

COMM. BRETSCHNEIDER: Mr. Kavaler is going to be your next witness?

MR. KIRGIS: That's correct.

COMM. BRETSCHNEIDER: Is he just going to make a statement concerning the evidence that has been produced now?

MR. KIRGIS: It would go into some detail, but it will all be based on the exhibits in evidence which are in. All of the basic evidence from which any opinion or conclusion is reached is now in.

MR. STOCKMAR: Gentlemen, that may serve to focus our attention onto particular parts of this, and I think we can shorten the cross examination of this witness.

COMM. BRETSCHNEIDER: I think that would probably be all right, unless you object to it strenuously.

MR. KIRGIS: No.

COMM. BRETSCHNEIDER: If you wish to present your next witness you may do so now, unless you want to take five or ten minutes recess.

MR. KIRGIS: May we take five minutes?

COMM. BRETSCHNEIDER: I think maybe that would be advisable.

(Recess taken.)

COMM. BRETSCHNEIDER: I think we may go ahead.

MR. KIRGIS: Mr. Bretschneider, I wonder if we might do one thing? It appears that a wrong year was given on one of the tests for the Delaney No. 1. Would you want to correct the year?

THE WITNESS: The test reported for the Delaney No. 1 of 136 barrels of oil per day and 9 barrels of water should have been for January, 1956 rather than as reported

being January, 1957. The allowable at that time was 125 barrels of oil per day.

(Witness excused.)

MR. KIRGIS: Call Mr. Herman Kavaler, please.

HERMAN KAVALER

a witness called on behalf of Petroleum Inc., was duly sworn and testified as follows:

DIRECT EXAMINATION

BY MR. KIRGIS:

Q Will you state your full name?

A My name is Herman Kavaler.

Q Have you appeared in this hearing before, Mr. Kavaler?

A I have.

MR. STOCKMAR: We will accept the witness's qualifications.

COMM. BRETSCHNEIDER: We will accept him also because we know him very well and we like to hear him testify.

Q Mr. Kavaler, have you heard all the testimony as given by Mr. McLeland?

A I have.

Q Have you examined the exhibits which he has prepared and presented?

A I have.

Q Have you done that only in this hearing or have you had occasion, an opportunity to sit down and study them yourself?

A I have had occasion to study them from time to time in the course of their preparation.

Q You have heard also Mr. McLeland's conclusions, have you?

A I have.

Q Do you agree with his conclusions as to oil in place?

A I do.

Q Now, will you state generally why you have that opinion?

A I have that opinion by reason of the fact that Mr. McLeland has made a competent interpretation of the information available in respect to the Adena Field, particularly in respect to those wells that have recently been drilled adding new information to the information available at the time that the unit was formed. I don't entirely agree with his conclusion in respect to the fact that I think he has reached a minimum estimate of 1,500,000 reservoir barrels on the Delaney lease. The reason I think he has reached a minimum figure is that he for the purposes of his calculation adopted all of the premises that the Pure Oil Company adopted in the course of their negotiations to

create what is now the Adena Field unit.

The Commission knows by this time the magic number 2.5 millidarcies as a cut-off point below which the Pure and their associates considered for purposes of forming the unit that there was no recoverable oil. Now, in that Mr. McLeland took that postulate, I think he has reached a minimum recoverable oil figure. Furthermore, Mr. McLeland in adopting all of the ramifications of the Pure calculations assumed certain matters in respect to connate water, distance above the water table, and all that sort of thing, which would tend to reduce an estimate of recoverable oil in place; so while I say he has reached an equally competent estimate expressed as a million and a half barrels, I think that is a minimum estimate.

COMM. BRETSCHNEIDER: You used the phrase "recoverable oil in place"?

THE WITNESS: I do.

COMM. BRETSCHNEIDER: Should it not be oil in place?

THE WITNESS: Yes, Mr. Commissioner, I should say oil in place and not recoverable oil, and I thank you for correcting me. My criticism of the minimum value as obtained by the Delaney lease goes also in my opinion to the entire Adena Field. I think there is more oil in place in the Adena Field than was calculated by Pure for the purposes of their negotiations to form the unit, so that all estimates

that the Commission has heard of oil in place in the Adena Field in my opinion are minimum figures.

Also for the same reason I think Mr. McLeland has made an equally valid competent calculation to any calculation heretofore presented to this Commission as shown by his exhibits, beginning with his Exhibit 1, which was simply a base map on which were drawn the outlines of oil in place as Pure drew them down to the center of Section 23 on the west, and as he extended that outline of the oil in place by the dashed line based upon the additional drilling that has taken place since Pure drew the original limits, suggesting a factual situation, and that is that the Adena Field extends southwestward to an unknown distance, including possibly the so-called south Adena Field, including also the Bruce No. 1, which the Commission has heretofore set aside as a separate pool.

Now, Exhibit No. 2 and No. 3 which are substantially the same picture that the Core Lab drew of the continuity of the "J" sand running across the Delaney lease eastward and north and southward shows that the Delaney lease and the tracts lying southward and westward all appear to be a part of the same common source of supply in the "J" sand. His exhibit, I think No. 4, which is the structure map, is a rather convincing picture that there is continuity of structure, even taking into account the

wells in South Adena. You have no difficulty on the basis of structure of saying that South Adena is a part of what we call the Adena Field. It shows also on Exhibit 4 that the Delaney lease is not an orphan boy in this situation; it is not a nuisance, a useless appendage, but structurally is a part of the Adena Field just as important as any other tract in it. Showing also on Exhibit 4 that the Delaney tract lies up on structure away from the 100 percent water level, and therefore is not to be regarded as something that is more of a nuisance than something of value.

COMM. BRETSCHNEIDER: From what you say there you would think that another well west of the three wells on that tract would be justified.

THE WITNESS: Yes, might be drilled.

COMM. BRETSCHNEIDER: Would be a good prospect.

THE WITNESS: Might be drilled, yes, sir. And then showing on Exhibit 5 that the gross sand thicknesses as reflected by the cross-sections from the electric logs, that here is a typical sandbar laid down in the old sea that covered this country. You have built-up sand dunes on this sandbar; you have nosing, and the Delaney lease has a thickness comparable in many respects to any other tract in that field, and that there is no indication that South Adena is a separate pool from this, and that the Adena Field probably will extend on southward. Then coming on translating

oil in place calculations, a net pay thickness using the Pure's own measures, there is nothing bastard about the Delaney lease on the basis of sand thickness, and then going on to Exhibit No. 7, which is his final conclusion, we have the matter of a mudhole on the north end of the Delaney lease where using Pure's measures you would have to assign zero oil in place; but, that is no different than depressions like this (indicating) which occur in the east half of Section 7. That's a little mudhole in there, too, and there are probably other spots on the map. Here is a depression in the east half of Section 27 which is related to this mudhole here (indicating), so that there is nothing unusual about this lease in any of the ordinary aspects that one uses to consider the value of an oil and gas property.

Coming down then, taking Exhibit 7 as a final result and reaching the conclusion that using Pure's own measures there is a million five hundred thousand barrels, reservoir barrels of oil in place on that tract, and then using the formula that Pure has heretofore recommended and the Commission has adopted, 1,500,000 barrels of oil in place, reservoir barrels, out of the 189,000,000 which Pure says is in the field, 1.5 over 189 multiplied by 14,000 would lead to the conclusion that that least is entitled to 113 barrels per day of daily allowable.

COMM. BRETSCHNEIDER: Speaking of oil in place, I would like to have you make an observation concerning something about which I have given a little thought, but not very detailed or carefully. I think it is a fact that every forty-acre tract in a known productive area has been drilled in the southeast corner, isn't that correct?

THE WITNESS: Yes, sir.

COMM. BRETSCHNEIDER: What would you say as a guess or an observation would be the result if all the wells had been drilled on the northwest corner of the 40 tract?

THE WITNESS: Mr. Commissioner, in view of the fact that some 180 wells have been drilled in this field, in view of the fact that that large number has been drilled, the average result would have been substantially the same as the result now. The best analogy, Mr. Commissioner, that I can cite to you to substantiate that is associated with, say, sampling the wheat in a carload of wheat. If you wanted to know precisely about that wheat you would have to take every grain and look at it, but people buy and sell wheat on the basis of the number of samples that the boy scoops out of the trough as the car is filled. Now, if we took just one sample there would be some uncertainty about the average quality of that wheat; but, if we took two or three or four or five or, say, ten

samples, then the ten would be a fairly reliable measure of the average quality.

Now, if this field had comprised only four wells then there would be some concern about whether you drilled in the southeast or the northwest, but when you expand your sampling to the extent that it has been here I think you would get about the same result. But, of course, every oil field has an edge, and if you drilled in the northwest consistently you would know more about this edge than what you do now.

COMM. BRETSCHNEIDER: And not so much about the east edge?

THE WITNESS: And not so much about the east edge, so it is the fringe that is important. I might observe in that connection, Mr. Commissioner, that there has been an awful lot of ruckus raised about less than half a percent of the whole field. Here is 1.5 million; that's a big number, but 189,000,000 is a big number. 1.5 is about six-tenths of a percent, so we are getting down with the microscope and looking at this thing, I think.

COMM. BRETSCHNEIDER: Yes, we ought to know it is a very important problem in a way for the small percentage, and yet an important point from the standpoint of Pure Oil Company as to when they say that one barrel of oil per day more or less equals $1,000,000 over the life

of the field, as I remember what you said---

MR. STOCKMAR: I think we said 13,000.

THE WITNESS: The present value of that is not going to wreck the Pure Oil Company.

MR. STOCKMAR: I don't need a microscope to see a million dollars.

THE WITNESS: I don't want to offend the royalty owners, Mr. Commissioner, by my answer. It is a pretty valuable piece of land to them, but to the field as a whole it is a small thing that we are talking about.

Q (By Mr. Kirgis) Mr. Kavaler, along the line of this last statement of yours, do you have any opinion or have you made any estimates of the barrels and also of the dollar value of the increase in values to the unit by reason of the waterflood?

A Well, I just made a shirttail estimate since the question of dollars came up yesterday. The Pure has heretofore represented to the Commission that the waterflooding operation which they are engaging in will produce about 30,000,000 additional barrels of oil, and produce along with it 41,000,000 that was regarded as primary, an ultimate recovery of 71,000,000. Now, I think that more than 71,000,000 barrels of oil will be recovered out of the Adena Field, due to the fact that we are talking about minimum oil in place figures to start with, and due to

the fact that Pure with the assistance of all their unit operators will do a better job than they now think. Take their figures; they are going to get 30,000,000 barrels of oil out of the water flooding, and oil is selling now for $3.08, and we hope for more in the future. Take, say, a fifty-cent per barrel operating expense off of that. Their gross income before taxes then for the unit then is going to be about $2.50 a barrel, so there is--gosh, I didn't know, about $75,000,000, and probably nearly 200,000,000 when you take into account the possibility that there will be more than 30,000,000 recoverable by water-flooding, so they are shooting with big dice, too.

Q Now, Mr. Stockmar said, if I understood him correctly--correct me if I am wrong, Ted--that as they looked at this thing the Delaney lease might get a benefit of some $700,000 in ultimate recovery by reason of this waterflood or secondary recovery program, am I right?

MR. STOCKMAR: I think our testimony was more in the neighborhood of $180,000.

MR. KIRGIS: $180,000?

MR. STOCKMAR: The rest of the $700,000 was general migration.

Q Let's take that figure of $180,000, Mr. Kavaler, and compare that with the figure you just gave of the dollar values. Is the ratio between those anywhere close

to permissible error in engineering calculations?

A That would be .18 divided by 75. That's three-tenths of a percent. We have got an awful sharp microscope; you see, the uncertainty in these estimates, a man would be a genius if he knew within 25 percent more or less either the ultimate recovery or the profit or anything else. He would be a genius, and anybody that come down and say he is within .3 of a percent as to what is going to happen, why, I can only kneel at his feet and adore him.

COMM. BRETSCHNEIDER: In that case you have to wait until all the oil is produced.

THE WITNESS: You know a lot more when you have hindsight, yes, sir, but the foresight--I think if I were to criticize the whole presentation of the Adena problem, the engineering has been raised to a pedestal of precision and accuracy which is way beyond fact, and it would be nice if we could come into the Commission and say we know within ten percent what is going to happen. I would be a much richer man if I could do that myself, and I think I am lucky if I can get within fifty percent at this stage of development. There is too much future life to this field to know what way the horse is going to run, so I think that in order to get what we want we are straining precision beyond the realm of reason.

Q (By Mr. Kirgis) Mr. Kavaler, have you finished

what you wished to say on that point?

A Yes, sir.

Q Will you look at Exhibits 8 and 9 as they have been produced here; they are in the small book there.

A Counsel, if I may, may I comment briefly on 7-A since it bears on this?

Q Yes.

A I am attracted very much by Exhibit 7-A because it shows the limitation that is placed upon all of us in trying to evaluate an oil field. We have the same problems if we were trying to evaluate a herd of cattle. There are a few things that you don't know about the cattle which you would like to know if you wanted to horsetrade your herd for somebody else's herd. The same problem goes here to these electric logs. If these electric logs told the whole story, why, the oil business would be a lot simpler; but, nevertheless we run them because for absence of something better we use them as a guide for the exercise of judgment.

Now, in my way of looking at it, in respect to the Lion Albert No. 1 well on Exhibit 7-A, I can't see much difference between that electric log and the electric log on the Delaney No. 2. They both got kicks on the right and left side and kicks of about the same configuration, yet Pure and their associates when they sat down

around the table and formed the unit decided that the Lion Albert No. 1 should have credit for all of the thickness shown on the electric log as confirmed by core analysis, and they decided with respect to the Delaney that that horse, well, it had about the same electric log characteristics. It didn't core all the way through; it should be penalized.

Now, the moment that some decision is made in respect to the fact as to whether or not the Delaney No. 2 did in fact have productive sand below the point of coring, the moment that a decision is made in respect to that point then this whole case is decided in respect to Petroleum Inc.'s position and my own opinion. It is my own opinion the lower part, the uncored part of the Delaney No. 2, has oil in place, has permeability, and the oil is recoverable, and I think Mr. McLeland has reached an equally competent conclusion in respect to what is the oil in place on the Delaney lease.

Now, with respect to Exhibit 8, I don't have to be much of an expert to say to the Commission that producing the south end of the Adena Field in the matter in which Pure and their associates did during the years 1955, 1956, 1957 is poor practice. Take the production of those tracts that were shown on the upper right-hand corner of Exhibit 8, six tracts, ten wells, and produce 10,000 barrels a month

from ten wells. Let the rest of the field shut-in. That is not following what is considered in the oil business to be good practice, and I think when a unit is formed and all of the glorious things that were said about this unit you would expect Pure to operate this field, take oil and gas uniformly over it, prevent the occurrence of pressure sinks which their maps show exist, and not crowd, run the south end of the field a fast race and then suddenly in December shut the place down. Now, what happened as a result of that program was this, that the south end of the field was pulled down in pressure, including the Delaney lease, and then when they shut the south end in they came along in April and they caused migration to occur in that depressured area, and then come into the Commission in April and say, "Look, look how the pressure has been built up down here. That's not good for us," and it causes migration that they complain of.

I think they are subject to two criticisms: first, that the operating practice was not good, and second it just so happened that they were in a good position for this hearing to scream that they were repressuring the south end. Well, they should have repressured it because they pressure-depleted it in the first instance, so I am not very much impressed personally with their plea that something is going on out there that is highly detrimental

to them.

Exhibit No. 9 I think speaks for itself without further comment from me, that if you produce at the rate of ten times of the recoverable oil in place that you are abusing a well, and to say, "Well, that end is low permeability, is no good, it has high gas-oil ratios and so forth," I think they made it that way; so I don't think that the south end of the field is such a horrible lousy place as Pure would lead you to believe, because I think if the gas-oil ratios are high down there it is their making.

Q (By Mr. Kirgis) Mr. Kavaler, if I may interrupt you, I think I understood you to say when you were talking about Exhibit 8 that the south end was producing at this certain rate and the rest of the field was substantially shut-in. Did I understand you rightly in that?

A I probably would have to check. Exhibit 8 from the south end in 1957, in the neighborhood of nine to ten thousand barrels per day production.

Q That's monthly production, is it not?

A Oh, yes, thank you very much; I am reading a little too fast. That's ten thousand barrels per month, so it would be a thousand--well, it was a thousand barrels per day per well. Let me start over again, ten thousand barrels per month from this south area and divide that by thirty;

it would be 300 barrels per day, and the field was producing about 14,000 barrels, so the north end of the field was not substantially shut-in.

Q Does that make any difference in the conclusions that you have stated, Mr. Kavaler?

A No, I think that going into Exhibit 9 the conclusion is that there was an excessive rate of withdrawal from wells offsetting the Delaney lease, and the number of the tracts from which the 300 barrels per day were taken are shown in the upper right-hand corner of Exhibit 8.

Q Now, Mr. Kavaler, have you finished your analysis of this particular problem?

A I believe so. I might add just this one observation, and that is the difference between Exhibit No. 7 as presented by Petroleum Inc. and a comparable oil in place exhibit presented by Pure shows that Pure's figure is that the Delaney lease is just a little bobtailed attachment to this field, and they saw it off pretty quick, whereas I think Exhibit 7 as presented by Mr. McLeland takes a much more reasonable view, and that is that the Delaney tract is underlaid by oil in place, and that the Delaney tract is not at the tag end of the Adena Field, but it is a part of that whole productive trend.

Q Now, Mr. Kavaler, in your opinion based on the information which is available here, is there any evidence

that there is a need for limitation upon the production of wells within the unit offsetting or near the Delaney lease?

A Yes, I would think that the Commission's rules ought to include some limitation with respect to how much oil can be taken in any day or any forty-eight hour period from wells offsetting another lease. I think it is almost universal policy of all conversation commissions to put some limitation on the offsets on large leases.

Q Why do you think that necessary?

A Well, competition being what it is people sometimes like to abuse their neighbors. Pet. Inc. should be limited in that respect just like the Pure should be, and I think the Commission's order ought to apply to both parties with respect to line wells, "You boys behave yourselves and only produce a certain amount." I would suggest that each party be limited to producing the average well allowable from any offset well, which is the ordinary rule.

Q Do you mean by that they should be limited to the same amount as the Delaney, or was that not the implication of your statement?

A I don't know that I would--that's another element in this whole thing. The hearing goes forward on the theory that these Delaney wells are no good in one instance, and in the other instance that they will produce at their

present rate forever. Now, the Delaney wells are not as good as other wells in the field; they will decline in oil production, so I wouldn't limit Pure in the unit to just what the Delaney could produce. I think that Pure probably should be limited to, say, the allowable, the normal allowable for a forty-acre tract and no more than that, and the Petroleum Inc. or any other, the Lion over here on the Robison should be limited to what we might call the basic allowable for wells in this field. I think that figure now would be about five barrels per day. That's the average production per well at 14,000 field output per day, so just to have a number I would say that wells offsetting a lease should be limited to not more than 85 or 90 barrels a day.

Q Now, as has been brought out often, the Delaney lease is a tract near the edge of the field. In your general experience in reservoir operations do you think that any special treatment is needed or special consideration need be given to edge tracts or near-edge tracts?

A Well, my answer is yes. Every oil field has an edge; you get to the point finally where you wonder whether or not it is prudent to invest your money in an edge well. Now, that's the industry's point of view and they are entitled to that. At the same time a body like this Commission has the problem of insuring that all of the recoverable oil in the state will be found, and you

can't find recoverable oil except by boring a hole in the ground; there is no magic way of doing it. In other that this Commission may fully promote the conservation of oil it has the burden of encouraging development, and you have to encourage development to the point where you are satisfied that every oil field in the state has been fully defined. For example, all of the reliable evidence indicates the fact that the southwest end of the Adena Field has not yet been fully defined, and for all that we know there may be a substantial body of sand in the southwest corner of the Delaney tract, and you will never know it until a hole is bored down there. Nobody is going to bore a hole down there unless they have got some reasonable assurance that they have a chance of getting their money back with a profit.

Now, this isn't a problem just applying to Adena; the Commission has this problem before it in every oil field in the state. Now, other Commissions have had this problem and it is a matter of general knowledge, it doesn't take an expert to tell you that other jurisdictions, they have various devices, in Texas a minimum or marginal well, you can't cut a guy's shirttail off any shorter than twenty barrels a day, and in Oklahoma they have an unofficial marginal well allowable, and all the other jurisdictions. Now, you say that is inequitable and all that sort of thing.

Well, it may be, but the people of Colorado have to be assured that there is every reasonable opportunity to explore for and discover and produce oil at a profit in this state. I would say that one of the burdens that the Commission would place on the industry in this state would be by two ultra-scientific and imaginary conclusions about oil in place, leading them to a ridiculously low allowable; that nobody is going to drill the edge of these fields for eight, nine, ten barrels a day at 6,500 feet, so that edge wells do offer a problem, and it is a problem whereby the Commission needs to weigh the equities involved and weigh the concentration aspect and reach a reasonable conclusion, so that while we are talking here just about Adena I think it is evident statewide that the edge well, the poor horse, must be given some special consideration.

Now, these edge wells capable of producing 100 barrels a day now are not going to have that capacity throughout the life of this great field. They are going to decline so if you set an allowable of 113 barrels for this tract today that doesn't mean that those wells are going to produce 113 barrels a day for the next nine years or eighteen years. They are going to be producing less than that a few years from now, because there is going to be some water come in from the west, and the pressure is going to decline as the wells are produced. That is normal in oil wells; they

will go down in production capacity, so I think there is every reason in this instance why the Commission would have to give consideration to the fact that this is an edge property and needs special treatment.

COMM. BRETSCHNEIDER: At this point would you care to make some observations concerning Exhibit 6, net pay, isopach map?

THE WITNESS: Mr. Commissioner, is that Exhibit 7?

COMM. BRETSCHNEIDER: Exhibit 6.

THE WITNESS: Well, Mr. Commissioner, the net pay on Exhibit 6 shows the Delaney tract to have, except for the north part, in the range of twenty feet of thickness, twenty feet of thickness in the south half, let's say. Now, there is no reason to conclude that because the No. 1 well and the No. 3 well had only nine feet that the rest of the least has only nine feet or none at all, as the Pure suggests to you. The No. 3 well has twenty-three feet. Now, the Pure is persuaded that beyond just the bare site on which these wells are located there is no recoverable oil at all. Furthermore, it is no abortion of good conclusion to see that based upon this sand thickness tied into south Adena, which has a sand thickness of about fifteen feet based upon Pure's own conception of sand thickness, that fifteen feet in the center section of 35, and twenty feet in the south half of the east half of Section 26

that in all probability that pay zone extends on southward into Section 35.

Now, I haven't investigated fully the dry hole history that is shown on that map, but I think the Commission is well aware of the fact that people don't complete wells for a lot of different reasons, but the dry holes that are shown on there would not establish the absolute absence of oil in place on those drill sites. I hope I have answered the Commissioner's question.

COMM. BRETSCHNEIDER: Yes, I think you have. I wanted to hear what you had to say concerning that because most of the wells to the east of this tract have thicker pay sand.

THE WITNESS: East of the Delaney tract, Mr. Bretschneider?

COMM. BRETSCHNEIDER: The pay section east is anywhere from seventeen feet upwards.

THE WITNESS: Yes, for example on what the unit calls Tract 82 there is a pay thickness in the wells of 19, 24, 21 and 24, and those four wells on Tract 82 don't differ substantially from the Delaney 2 in thickness, and as far as the Tract 83 on the Robison, eight feet in the Robison No. 1 doesn't differ much from the Delaney 1 and 3. Then you have Tract 81-A, 17 and 18 feet. On the Goedert tract 17 and 18 feet. Pure doesn't quarrel with those

figures; Pure doesn't quarrel with the thicknesses on Tract 82. I don't believe Pure quarrels--well, they would quarrel with the Delaney No. 2, but not with No. 1 and 3, so there is not a big disparity between productive thickness in the southwest corner of the tracts inside the unit and the tract outside the unit.

BY COMM. HOUSTON:

Q You said some special consideration should be given edge wells. What consideration would you think would be fair and equitable to those edge wells compared with the others?

A Mr. Commissioner, I would sure like to answer your question. I may be guilty of a prejudiced view in my present position, but I would say this to the Commission, that if the Pure's theory of this oil in place is right and if Mr. McLeland's calculations are regarded as competent, as I do, then I think the Commission would be fair in setting 113 barrels for the Delaney tract. That is just taking this doctrine that we have adopted and applying it. I don't know whether the Commission would do that or not.

COMM. BRETSCHNEIDER: That's a problem we have to consider.

THE WITNESS: I would say this to the Commission: I don't know whether I am about to lose a client or not, Mr. Commissioners, but you probably are not going to give--

well, I don't know, I think I might need counsel; I won't answer it.

MR. KIRGIS: Go ahead, state what you have in mind.

THE WITNESS: Well, I have in mind this, that you have got to weigh these things. One party wants 113, and I think they are entitled to it. The other party wants to dribble out 20, which I think is pretty cinchy, and when I worked for the Oil and Gas Board in Saskatchewan I usually added it up and divided by two on the theory that if both parties go away from the courthouse dissatisfied justice has been done. I didn't intend to testify on that point, Mr. Houston.

BY COMM. CONRADO:

Q Mr. Kavaler, don't you feel that one of the basic problems is that these wells were omitted out of the unit and that for continued operation during the field that strong consideration should be given toward extending the unit?

A Yes, sir, that involves the second point that I had intended to comment on in respect to the problems before this Commission. The problem before this Commission, if you don't mind my answering you a little bit more fully, is the problem that is common whenever a part of the field has been unitized. Now, I would like to see personally every field in the State of Colorado unitized; I would like

to see this Commission have the power and authority to bring that about, and I would be willing to contribute whatever service I might contribute to causing that to be done; but, the fact is as we sit here today that the Commission has no way in a forthright manner to deal with the fact that here a part of the field is in the unit and a part isn't, and whenever that situation exists the problem of equity is greatly multiplied.

Now, the problem is further made complicated by the fact that the Pure and their associates going off on what is now a big lease have elected to put water in the ground. The Commission didn't force them to do it; the Commission is pleased that they are doing it, and will properly encourage them to the extent that they can, but when the Pure put water in the ground and decided to over-inject, as they say, they knew then that they were going to cause migration to the Delaney lease. Now they come in here and agree that is happening. Who can help it? They brought it on themselves, and that happens in every instance like this, so that I don't see how the Delaney tract, both the working interest and the royalty owners, should be penalized by something that the Pure and their gang voluntarily did themselves; so I don't see that the fact that the Delaney tract may--I don't say that it will--it may--again, oil by migration is a very pertinent thing

in this proceeding. The issue before the Commission, as I see it, is how much oil in place is there on the Delaney tract as compared to the rest of the field, and how much is the Delaney tract entitled to take out of the field under the normal operations over which the Commission has no control?

That leads to the 113 barrel per day figure. Now, what would have happened, I wonder, if Petroleum Inc. and their royalty owners had decided that they wanted to waterflood this lease, the Delaney lease, and the Pure and their gang decided they didn't want to waterflood them. Was this little tail down here wagging the big dog in that circumstance? But now the dog is wagging the tail, or at least presenting their case on that basis, so that until a system is brought about whereby the Commission can bring about the unitization of the entire field--you see, that's what caused the delay of the Rangely unitization; nobody would dare step. They were a little more prudent, they wouldn't dare step until every horse was in the stable, and that's the thing that delayed the formation of units everywhere; where you can't get the entire field unitized.

Q My only concept is, even if relief is granted to either party at this stage could the latter part of the development of this field, because both parties work independently of one another someone is going to get hurt

and some oil will be wasted. Now, whether it be the Delaney property or---

A I don't know about the waste, Mr. Commissioner. I think the Commission can still hold its hand over the conduct of the parties; just don't let them cut each other's throat. You have the means to prevent that; you have limitations on gas flared and gas-oil ratio and water production and daily output and so forth, how much can be produced from each well; you can do all that. I don't think that waste will be caused simply because only a part of the field is unitized; I don't think that would necessarily follow. There may be a little disturbance of the equities.

Q Maybe that's what I meant to say.

A Yes.

Q I mean, either party because the production is flexible and prorated over a month, as you get down toward the blow-off period after the waterflooding, the Delaney lease will participate either beneficially or to a harmful nature, depending on how the gas comes through.

A Yes, Mr. Commissioner, I would say this to you, that the blow-off period, if it comes, is eighteen years away, and I don't think that you can be too much concerned now about what is going to happen at that remote time. The Commission will have to meet month to month and deal

with whatever problems that exist, so that as I see it you can look forward in a reasonable manner now. The fact that you have three separate leases out there is not going to create any wasteful condition, because you could control the conduct of the parties sufficiently, and then five years from now if there is a new circumstance, the Commission will have to re-examine the situation at that time.

BY COMM. HOUSTON:

Q Mr. Kavaler, you stated about the water drive as long as there was migration, why, the Delaney lease would still be producing. Would you term the Delaney lease an edge lease as long as the water drive is on edge wells?

A Mr. Houston, are you speaking of the water drive from the---

Q No, the water drive, the secondary recovery.

A The secondary recovery?

Q Yes.

A Well, I would like to answer you this way, Mr. Commissioner, from the standpoint of structure and location in the field the Delaney lease is an edge lease.

Q Even with the water drive on?

A No, just look at it from its position on the structure.

Q Yes, I understand from the watertable; you refer to the watertable?

A Yes, it is an edge lease in the common parlance of the oil industry. Now, in respect to the fact that Pure is injecting water and will maintain that program and the Delaney lease is not injecting water, then I would say that inescapably there is going to be some movement, some movement from the unitized lease onto the Delaney lease. It is inescapable, but what can the Delaney's do about it? They can't build a concrete wall around their lease 6,500 feet in the ground. They are sitting there; the other fellow is guilty. You know, you can carry this thing to a rather ridiculous point. Pure testified that they are causing migration on the Delaney lease, and migration, avoidable migration is wasteful in Colorado, so they are creating waste.

Q That was my point; as long as they are getting the benefit from the migration they would be entitled to any special consideration in your judgment?

A Well, Mr. Houston, I have difficulty in this respect in answering your question: It is this matter of special consideration. I don't think that the Delaney tract should get any more than it is entitled to under any circumstance. Now, the Pure is putting water in the ground, and because Pure is doing that I don't think that the Delaney lease is entitled to more; but, what I have said to the Commission is this, that because of the oil in place,

adopting Pure's theory, the Delaney lease is entitled to 113 barrels a day, just based upon the oil in place.

Now, when Pure elects to put water in the ground and induce migration, if the Delaney lease profits thereby it is not something that the Delaney lease is entitled to, but it is something they are going to get without any effort on their part. It is inescapable that Pure is causing that, the Delaney's aren't.

COMM. BRETSCHNEIDER: We are sorry to interrupt you, Mr. Kirgis, go ahead.

Q (By Mr. Kirgis) Mr. Kavaler, do you have anything further that you wish to testify to here?

A No, sir, I don't think so.

MR. KIRGIS: That is all then from Mr. Kavaler. In view of the interest of the Commission in the matter why this lease isn't in the unit I would like permission to call one more witness who will be very, very brief.

COMM. BRETSCHNEIDER: All right.

(Witness excused.)

PAUL B. SHIVEL

called as a witness on behalf of Petroleum Inc., was duly sworn and testified as follows:

DIRECT EXAMINATION

BY MR. KIRGIS:

Q What is your name, please?

A Paul Shivel.

Q What is your position or occupation?

A I am vice-president of production of Petroleum, Inc.

Q Are you familiar with any efforts which may have been made to secure an agreement whereby the Delaney lease would be included in the Adena unit "J" sand?

A I am.

Q Will you state briefly what has been done?

A We recently in March, I believe, made application to the unit operator for inclusion of the Delaney tract into the unit, on some acceptable basis, and we met with the unit operator and the operators for a discussion of the tract and a proposal to join the Delaney tract in the unit. The amount offered by the unit operator and the operators was much too small for consideration for inclusion. As I recall, it represented about 13 barrels per day. At that time---

Q Of the entire tract?

A That was for the entire tract. At the time we were undergoing this full study of our conception of the reservoir barrels in place we did not have full conclusion on it and that has only been reached recently; but, the effort to join the unit--and by the way, we believe in the interests of the unit, ourselves, the royalty owners,

obviously this tract should be in the unit.

Q Did you make a proposal to the unit in terms of barrels per day?

A We made a proposal at the time in the negotiating effort.

Q Was there any meeting of the minds or did you come close to any meeting of the minds?

A We did not; our proposal was rejected, and I believe I am correct in saying to the Commission that it was rejected without an engineering study being conducted at that time to attempt a new determination on the basis of information as it had been developed as to what new consideration would be given to barrels of oil in place.

MR. KIRGIS: That's all, Mr. Shivel. Now, I don't know how you want to proceed with cross examination.

MR. EPPERSON: I would like to ask Mr. Shivel a question just for the record.

CROSS EXAMINATION

BY MR. EPPERSON:

Q In your conference with Pure did you not have authority to speak for the royalty owners at the same time?

A I had the authority to speak for the royalty owners, yes, with the exception that I informed the unit at that time that the negotiation that we would conclude would have to be again presented to the royalty owners for

final acceptance.

Q But the royalty owners were interested in joining the unit?

A All the royalty owners were very much interested in joining the unit.

MR. EPPERSON: I think that's all.

THE WITNESS: There was no reluctance on their part.

BY MR. JERSIN:

Q Mr. Shivel, if you care to, you mentioned the number of barrels that the Pure or the unit offered the Delaney lease to come into the unit. Would you care to state what your counteroffer was?

A That was in essence a negotiating thing, of course, and our offer at that time, and as I say, our engineering study was not complete by any means, and of course we have done in the ensuing months a great deal more work on it, our offer at that time was in the nature of 26 barrels. That was negotiating at that time. We had not then concluded our investigation in arriving at this determination of a million and a half barrels of oil in place, in which we have full confidence, and so this was a negotiating effort at that time to attempt some means by which we might join the unit.

REDIRECT EXAMINATION

BY MR. KIRGIS:

Q Mr. Shivel, you mean 26 barrels for the tract?

A For the tract.

Q Not per well?

A No.

MR. HAFFKE: It was per well, wasn't it?

THE WITNESS: For the tract.

Q Now, was that for both primary and secondary participation from the unit standpoint?

A That was. Let me consider that just a moment. I cannot answer whether that was based--that 26 barrels was based on the 14,000 barrels per day present production from the total field. It would have a varying percent then for primary and secondary recovery. I want to stress again that that was a negotiating thing.

Q From the standpoint of negotiation is there any advantage to being in the unit which does not exist if you are outside the unit, as is presently the case?

A Very considerable advantage. For instance, in the last nine months our operating costs on the Delaney lease have been $426--I would correct that figure and be glad to--but, $426 per month average for the last nine months. Now, it is quite obvious when the unit is presently operating at about twelve cents per barrel of oil that there is a tremendous advantage to being in the unit as opposed to being out of the unit from a cost standpoint, tremendous advantage.

Q Is there any advantage in being in the unit from the standpoint of the length of time in which you would participate in recovery from the pool as a whole?

A I would say there is no doubt of it. In the first place, any allowable granted to wells on the Delaney tract today is not a fixed time over a period of years. All oil wells decline, as we all well know; all wells decline. They are either declining from the running out of total fluid or they decline from the encroachment of water and the absence of oil, so the figure we would have under unit joinder would be perpetuated throughout the life of the unit, but a figure given as an allowable today on wells on the Delaney tract is of an indefinite duration. They obviously will decline.

COMM. DILLON: Are there any further questions of this witness?

COMM. BRETSCHNEIDER: None.

MR. STOCKMAR: I would like to ask for a recess to consider examination of all of the witnesses, if we may.

COMM. BRETSCHNEIDER: All right.

(Recess taken.)

COMM. BRETSCHNEIDER: Gentlemen, we can resume the hearing now. Do you wish to proceed now, Mr. Stockmar, with your cross examination?

MR. STOCKMAR: Yes, I would like to recall Mr. McLeland for cross examination.

COMM. BRETSCHNEIDER: Mr. McLeland.

JOHN McLELAND

called as a witness on behalf of Petroleum Inc., having been previously duly sworn, resumed the stand and testified further as follows:

CROSS EXAMINATION

BY MR. STOCKMAR:

Q Mr. McLeland, I would like to go through some of your exhibits to make sure I understand why they were presented, and we can focus on what might be the problems here. As I understand Exhibit 1, it is primarily a reference map and sets up the cross-sections, so we really have not much occasion to talk about it, is that right?

A It also shows the revision in the zero lines of oil in place in the southwestern area.

Q As calculated by you?

A That is correct.

Q Will you please refer to Exhibit No. 2, the first cross-section?

A Yes, sir.

Q As I understand it, the cross-section purports to show the "J" sand and does not purport to show any net productive sand or anything; it is simply the "J" sand itself, is that right?

A It shows the total interval of the "J" sand that

is considered productive in the Adena Field. Now, no, not all of that interval is productive; the productive interval would be within this section colored yellow.

Q The productive interval is within the interval colored yellow?

A The pay sand gross interval.

Q If we were to extend the yellow lines in all directions we could probably do so as far as this exhibit is concerned?

A That is correct.

Q In other words, we would carry this cross-section clear across the Denver-Julesburg Basin and it would show basically that the "J" sand is present with variations and so forth?

A I am not a geologist, Mr. Stockmar; I do not know how far this "J" sand goes before it may discontinue.

Q I am trying to see if there is any other function than to show that the "J" sand does exist in a sizeable area?

A It does exist in a sizeable area to the west from the available logs that I reviewed. The "J" sand does continue to the sections in the immediate vicinity to the west.

Q Do you know of any instances in the Denver-Julesburg Basin where the "J" sand is not present?

A I cannot state that since I am not a geologist and I have not run into that. I think the "J" sand is generally

present throughout.

Q Does Exhibit 2 or Exhibit 3 show anything more than that the "J" sand is present; if not we will stipulate that it is present.

A It shows also structure.

Q Oh, in terms of the slope of the "J" sand?

A That's right.

Q Well, that is better shown by your structural map, Exhibit 4, is it not?

A That is correct.

Q Now, this Exhibit 4 was presented to show the continuity of the structure north from the unit area, is that correct?

A That is correct.

Q Will the same structure contours continue on to the north and to the south indefinitely?

A I cannot answer that without having the available information to look at the logs and also the well data that is available in the extended areas that it may go.

Q You mean that to the extent that the "J" sand does go these contour lines will not continue, that there is not always some point that it is of particular depth?

A That is always some point that it will be at a particular depth, yes, sir.

Q Then we can extend this map to the full extent of

the "J" sand?

A I believe that is correct from the---

Q And the contour lines will be roughly parallel throughout the---

A This will establish a general regional trend of the J" sand.

Q But this can be brought over to Little Beaver, to any of the other fields in the "J" sand?

A Now, you are citing a field that I am not familiar with, sir. I do know that there is an Aurora Field south and west of the South Adena. I am sure that these same contours, whether they are the same elevation, but it could be extended; maybe structurally it could be extended to that point.

Q Again I am trying to find things that we can pass over. Is there anything that the structure map shows except the fact that the "J" sand does have a dip and strike throughout its entire region and particularly here?

A It shows particularly the structure within the Adena Field as defined by our maps. It shows the same structural position with respect to what is now considered South Adena. It also shows the structural position relative to the Adena Field.

Q But it doesn't show anything with respect to oil

in place or anything of that nature?

A It does not.

Q Are you acquainted with the Eddy Fisher Casper well which is located--it is not shown on your map, but we have an elevation for it which is ten or twelve feet off from your structures here?

A Would that be the No. 4 well?

Q I believe so; it would be in Section 34.

A No, sir, that is outside of the limits of my map.

Q Would you please refer to Exhibit 5, Mr. McLeland?

A Yes, sir.

Q Again does Exhibit 5 have anything to do with the calculation of the finding of oil in place?

A No, sir, it does establish pictorially from the commencement of the structure map working towards oil in place, but it does show gross thickness rather than pay thickness.

Q Again it simply varifies that the "J" sand is present up and down this area of Morgan County?

A It also shows the thickening and thinning of the "J" sand in various portions of the Adena Field.

Q Will you please refer to your Exhibit 11?

A Yes, sir.

Q Now, this is a structural map on top of the "J" sands differing somewhat from yours. Does it show anything

at all with respect to oil in place?

A No, sir.

Q I believe you stated that the only difference between your map and this was the showing on the Core Laboratory map, Exhibit 11, of a postulated permeability barrier. Do you have such a permeability barrier postulated on your map?

A The only permeability barrier that we have postulated on our map, it is not present on the structural map.

Q We will come to it on another exhibit?

A That's right.

Q All right, sir, and referring to your Exhibit No. 12?

A Yes, sir.

Q Again the Core Laboratory geologic section, does this exhibit have anything to do with showing oil in place?

A No.

Q Did you study the entire Core Laboratory report in which this exhibit was used?

A I have read the Core Laboratory report. To state that I have studied it thoroughly, I cannot. I think you would have to read that report and its many pages several times to be able to say that you had fully studied it.

Q Do you happen to recall that this particular cross-section was one of many that was used by Core

Laboratory to draw the initial oil isopach which we did exhibit but not present as an exhibit?

A No, sir, I am not familiar with that.

Q Well, have you utilized this exhibit in some other fashion?

A The only usefulness of this exhibit was to show the continuity of structure and the extension of the "J" sand from the Adena Field into South Adena. It does not postulate a permeability barrier; in other words, give any indication that the permeability barrier does exist in this cross-section between South Adena and Adena Field proper.

Q Then you have not used this to determine your permeability barrier?

A No, sir.

Q Do you take exception to Core Lab's use of the information---

A I do not know; as you mentioned, you asked me previously their exact purpose of this cross-section. Since that time and the utilization of present new wells that were developed in the area, I would assume that the permeability barrier that they show on their structure map is incorrect, and I do not believe you can argue that point.

Q If that's all those are for I think we won't need to bother further with those exhibits that we have talked about now. May we turn to your Exhibits 1-A and so forth?

A Yes, sir.

Q With respect to Exhibit 1-A with reference to the Delaney No. 1 well, I believe you testified that below the depth of 5808 feet which you had shown as your cut-off point here, that you had cored an additional five feet, is that correct?

A That is correct.

Q And that was found to have no oil saturation?

A As far as the residual oil saturation as determined in laboratory analysis, those additional five feet did not contain a measurable oil saturation as reported from the laboratory.

Q With respect to Exhibit 1-B, the Delaney No. 2 well?

A Yes, sir.

Q If I may try to reconstruct with you the mechanism which you used to calculate the porosity, permeability, water saturation and oil saturation of all of the sand below 5852, which is the majority of the sand included here, as I understand you started with a comparison as shown by Exhibit 1-C of the log porosity and the core porosity of five upper samples or five of the upper samples in that

well, is that correct?

A Mr. Stockmar, I would like to go back to one previous statement you made within this question. You said that I calculated the oil saturation for that section. I did not; I calculated only porosity, and that was the primary utilization of the electric log. I did not calculate oil saturation; I did not calculate permeability from the log.

Q Your starting point or your first step was with an electric log?

A To determine porosity below the depth cored.

Q Can you read oil in place from an electric log?

A You cannot read oil in place from an electric log.

Q It is simply a tool?

A It is a useful tool in the industry.

Q What is it that you did read from the electric log?

A I determined and calculated quantatatively from the electric log the porosity of the section below that which was cored.

Q By reference or comparison, you made a comparison between the log porosity as you could read it, which I presume is subject to interpretation and some error?

A That's correct.

Q And compared that with the core porosity, which again is no doubt subject to some error?

A Correct.

Q For five samples?

A Correct.

Q And constructed a graph, Exhibit 1-C?

A Yes, sir.

Q And by some mechanism drew a line through there?

A It is a mean average line drawn through the points that were calculated.

Q Well, there are an infinite number of mean average lines that you can draw through these points?

A It is a matter of interpretation, sir.

Q It is entirely a matter of your interpretation; in other words, you could draw a mean average line in any direction through these points?

A I do not believe that, sir.

Q You mean that between any five points of some magnitude you cannot find a mean?

A You will find a mean; the trend of those five points is in the direction of the line as it is drawn in relationship to log porosity and core porosity.

Q But still a sizeable degree of interpretation?

A You may assume that.

Q Well, having constructed or worked up this chart then you went back to the log porosities as estimated for the uncored sections?

A As calculated, sir.

Q All right, sir, as calculated from the uncored section, and then working through this chart which you created you arrived at what you have listed here as a core porosity?

A That is true.

Q And these core porosities that you arrived at are in every case but one substantially higher than the core porosities of the part that you actually did core?

A That is correct.

Q And then by a similar mechanism of some kind you took a large average of core porosities and again found some kind of a mean relationship between the porosity and the permeabilities in the general area of the field?

A It is a presentation of core analysis data from eighteen wells in the immediate area of the Delaney lease; it is a plot of porosity vs. permeability.

Q Did you make a separate plat or similar study of the Delaney 1, 2 and 3 wells alone?

A I did not.

Q Confining it to the immediate vicinity?

A I did not, sir.

Q Then you have lumped in here information from wells many miles away?

A No, sir.

Q Several miles away?

A At the most I believe two miles; maybe not that far, if we would get down and use a straightedge.

Q Well, anyway from the calculated porosity of these uncored sections, and by reference to what appears to be a general scheme of relationship, you have again derived for the Delaney No. 2 permeabilities for the uncored sections, is that correct, sir?

A The first part of that statement I am not certain of. You say from a calculated porosity of all of the uncored sections; I used only core data from the eighteen wells to establish Exhibit 1-D.

Q I was speaking of the Delaney No. 1 uncored section only.

A Of the Delaney No. 2 uncored section it was compared by porosity and graph on Exhibit 1-D to obtain the permeability for the uncored section. Maybe that was what you had reference to, sir.

Q Then the permeabilities of the uncored section of the Delaney No. 2 well are entirely the result of calculation?

A That is correct.

Q Would you please look at the measured depth of 5861?

A Yes, sir.

Q I see that you have a calculated core porosity of 17.1.

A Yes, sir.

Q Which is identical with the core porosity of two other sections, 5158 and 5189?

A What?

Q I believe it is 5858 and 5859?

A Yes, sir.

Q But there seems to be a very wide discrepancy in the permeability calculation; how can that be?

A I assume, sir, that the decimal point has been misplaced on this exhibit, that if you would move that to the left it would read 170 instead of 17. I am sure that the calculations are very similar, if you go through your own exhibit, Pure's exhibit, to determine an oil in place calculation, that the same factors were used.

Q But the permeability has been calculated from this core porosity?

A It has not been calculated; it has been referred from this Exhibit 1-D. It was not a calculated permeability.

Q Exhibit 1-D again involves questions of judgment and interpretation and so forth?

A It does to some extent, yes, sir.

Q Then as I follow the next step, having both the

porosity and permeability and the height above the water-table, you were able to by reference of some kind arrive at the water saturation of these uncored sections?

A Your company should be quite familiar with the method used to obtain a water saturation, sir; it is your own exhibit which was presented at a previous hearing.

Q Nonetheless, it was another chart or table which was an interpretative matter, and which the third tier in the interpretation, we might say---

A It is, but you also in all of your calculations on every well in the pool as far as I know utilized the same table provided you had core analysis data available.

Q Were you present at any of these engineering committee meetings at which all of that was done?

A No, sir, I was not.

Q Do you realize that the Engineering Committee would have tossed out all of these calculated footages---

MR. KIRGIS: I object to that question; it asks for a guess on the part of the witness. It seems to be only a method of making a statement by counsel.

MR. STOCKMAR: The objection is well taken.

Q Well, anyway having gone through this tier of references you finally by subtraction arrive at the oil saturation, is that correct?

A Yes, sir.

Q Then of the cumulative oil in place shown with respect to the Delaney No. 2 you have by methods similar or somewhat similar to that used by the Adena Engineering Committee arrived at a cumulative oil in place figure of 3878?

A For what well, sir?

Q For the Delaney No. 2?

A Through the interval of 5852; through 5852 we had 4335.1.

Q Yes, I think that's correct. The balance then of the over 8,000 that you show as the total cumulative has been derived by this scheme of calculation and reference and so forth?

A I do not like the word "scheme", sir. It was a calculation. It was the remaining portion through the method as was described.

Q And it has been confirmed by the geologist's report which indicates that the sand looked somewhat the same as it did somewhere else?

A I think it has definite bearing and backing on our calculations.

Q You don't need to answer if you don't feel well qualified as a geologist, but wasn't his description fairly descriptive of all the "J" sand in the Julesburg Basin?

A I do not know that, sir.

Q You are an engineer?

A Yes, sir.

Q Were you a participant in determining how the Delaney No. 2 well should be completed?

A No, sir.

Q Was that done under your direction?

A No, sir.

Q Do you have any idea why only six feet of the low porosity, low permeability, low saturation section of this well was that which was perforated?

A My only conclusions from that are that there were nine known feet from the core analysis that would make a well; it was felt that this nine feet would drain the area even though additional pay section existed below. That was sufficient interval of perforation.

Q Does it seem practical now to go back and reperforate the well into this section?

A That is a matter of management decision, sir, and I do not recommend that.

Q Have you by any chance calculated the average core porosities for the section where actual cores were taken?

A For this interval cored on Delaney No. 2, is that the question?

Q Yes, sir, would you accept 10.6 as an average core

porosity?

A I believe 10.6 would be in the order of it.

Q Would you accept 14.6 as the average core porosity of all of the uncored, the calculated section?

A I would have to do that calculation; it looks in the right range. I believe it is close to it.

Q Your calculated core porosities then are substantially higher then than the measured core porosities?

A You are referring again to calculated core porosity. That is not right; it is a calculated log porosity referred to core---

Q The referred core porosity then is substantially higher than the measured core porosity?

A It definitely appears so.

Q By fifty percent or in that range, forty percent?

A Again I would have to average it out to see.

Q Would you accept 27.8 millidarcies as the average permeability of the cored section?

A You may be low; I am not certain. I would have to average it out myself.

Q Would you accept 50.8 as the referred permeability for the uncored section? Even that is low because of this typographical error that I haven't included here, over 50.8?

A It may be, but I would have to calculate it to accept it.

Q Approximately twice the permeability referred from calculations over and above that which could actually be measured?

A No, sir, the well was not cored in that interval, so therefore this is a different sand. You are trying to relate up the hole a different part of the sand to a portion that was not cored.

Q Well, that seems to be the entire basis of your Exhibit 1-C, that there is a relationship between it which is sufficient for these calculations.

A As far as porosity is concerned.

Q But the permeability is a direct function of the porosity, so we are saying the same thing, are we not?

A We established that through core analysis data on Exhibit 1-D.

Q Well, to get back to the point, will you agree or disagree that the permeabilities of the uncored section as you have registered them here average two times that of the permeability of the cored section?

A That may well be, but again I say I would have to average it out to determine that.

Q I presume that in addition to studying the Delaney tract wells you made a study of logs and cores in the entire field?

A Not of the entire field, sir. I have looked at

most of the logs in the entire field; I have not calculated every one.

Q Is it your opinion that the field insofar as you have studied it uniformly shows a higher porosity and permeability in the upper sections of the sand?

A There are places in the field where the upper portion of the sand is more permeable and has a higher porosity. There are also places in the field that I have reviewed that show the reverse, a higher porosity and a higher permeability in the base.

Q What seems to be the more usual case?

A I cannot say that, sir, without having the full data to look at.

Q Mr. McLeland, you were not present at any of the engineering committee meetings at which these many, many determinations were made to find the factors for oil in place. You have testified, however, that you have used the same process in making your calculations, is that correct?

A That is my conclusion from statements that were made to me by, I believe, Mr. Weiler and also by discussion maybe with Henry at one time, Mr. Overstein.

Q Did that Engineering Committee to your knowledge ever calculate porosity?

A No, sir, they did not; but, they did average as

between wells where there was a well that was in the confines of the Adena Field, average from surrounding wells.

Q Then this method of calculating porosity was never used by the Adena Committee?

A I cannot answer that directly, not being at the meetings; I don't know whether they did or not.

Q Well then, you are not certain that you have used the same approach to finding oil in place as the Adena Committee has used?

A The only thing that might differ from that would be in the development of porosity and permeability. From that point on I am sure it is the same, or I think it is the same process they used. I used the same exhibit that was given to the Petroleum Inc. offices that they used and utilized in preparing and calculating oil in place for all of the wells in the field.

Q Have you or have you not used the exact method that the Adena Committee used to find oil in place?

A As was mentioned previously, I calculated porosity. I related that to permeability through core analysis data in the immediate area. I do not know whether the Engineering Committee used that method of not. Beyond that I am certain it is the same method.

Q In fairness you will have to say that you did not use the same method as the Adena Ingineering Committee?

MR. KIRGIS: I object to that; the witness has stated precisely where he has used the same method.

COMM. DILLON: I think the question has been answered.

Q You did not use the method in its entirety?

A No, sir, as far as I know.

Q Have you made calculations for the oil in place in the entire field on your method?

A No, sir.

Q You have simply accepted for the bulk of the oil in place work the work of the Committee?

A I have accepted with the exception of my revision here and as to how my revision affects the oil in place calculation for the Delaney tract, and that only. That is our primary concern as a member of Petroleum Inc.

Q Then you have constructed a map where oil in place determinations were made on one basis in part of the area, and in part of the area oil in place calculations were made on another basis, and have correlated the two together?

A I cannot make a statement on that point. I did at that point revise their map; I did not change any of their map above the area of interest in this immediate area. I think I will have to get the Exhibit 7-A, which is not up there. There was a slight revision; we changed it to

make the lines conform outside of the Delaney tract.

Q But if the calculations were not made on the same basis then we are mixing up apples and oranges a little bit on your map, are we not?

A We may well be, I do not know.

Q That's fruit salad, basically?

A That's your assumption, not mine.

Q Now, Mr. McLeland, if we look at your Exhibit 6, the net pay isopach, the large-scale map has been placed up there. I believe that you testified that the findings of the Adena Committee and your own findings with respect to Delaney well No. 1 were substantially similar?

A I think they are in fairly close agreement to No. 1.

Q And that the findings with respect to Delaney No. 3 to the north were substantially similar?

A There is a difference of a slight order between my calculations and theirs which would be negligible, or the error that would occur in two people interpreting from one exhibit.

Q But that on your map you have shown a net pay thickness of 23 feet?

A Yes, sir.

Q Which includes 17 feet of the calculated or referred oil in place?

A No, sir, it contains nine feet that was granted by Pure Oil Company. The rest of it was from my own interpretation from the electric log.

Q And 16 of the 23 feet---

A Sixteen and nine are 25, sir.

Q Thank you; 14 of the feet then have been based on your calculated oil in place?

A That is correct.

Q Or referred, or whatever you call it. Now, may I ask if we can indulge in what I do not believe to be a hypothetical question: Would your contouring have deviated substantially from that performed by the Adena Committee if your own determinations had only resulted in nine feet of pay?

A I don't know, sir.

Q You didn't do the contouring?

A It was prepared under my supervision; this 23 feet is the result of my own calculations. The result of the footage was taken not only from your data, your engineering report as far as the pay section existing in the wells, but it was also from review of electric logs.

Q Would you please refer to Exhibit 5, if you can do it handily at the same time, the small one will do. This is a gross sand thickness and information on what has been called the Goedert No. 1 well on the Delaney

tract, the dry hole?

A Yes, sir.

Q You show a sand thickness of 24 feet?

A Yes, sir.

Q And zero net pay?

A Yes, sir.

Q For the Delaney No. 3 well you show a sand thickness of 23 feet?

A Yes, sir.

Q And 9 feet of pay?

A Yes, sir.

Q For the Delaney No. 1 well you show 21 feet of sand thickness and 9 feet of pay?

A Yes, sir.

Q For the Delaney No. 2 well you show 27 feet of gross thickness?

A Yes, sir.

Q And 23 feet of net pay?

A Yes, sir.

Q So in that particular area only four feet of the sand is not net pay, is that right?

A Yes, sir.

Q How do you explain the discrepancy of the--or rather I should say the inconsistency between the ratios between those figures?

A Sir, I could have extended log calculations for Delaney 1 and also Delaney 3. I chose not to do so because the base of their core did not show permeability on these wells. The well that was cored and the well in question, the Delaney No. 2, was bottomed in pay. It had, as you can see on the exhibit, permeability and porosity. This is quite a similar circumstance to what was done in the formation and the calculation of oil in place within the Adena unit. When a well was stopped coring within the pay section there are many instances where they extrapolated and carried the wells to the base of the sand section or to additional volume of oil in place calculations for that particular well.

Q But this Delaney well No. 2 is the only one of these particular four wells that was not cored?

A Now, what do you mean by that, sir?

Q It was not cored; it was not cored all the way through the section?

A I do not believe that the Delaney 1, Delaney 2 or Delaney 3 were cored all the way through the sand section, sir. I stated previously that we had five additional feet on one of the wells. The core was analyzed, which did not show permeability, did not show oil saturation. For Delaney No. 3, I stated previously that there were three more feet that had been analyzed

in the laboratory that did not show permeability.

Q Have you made any calculations or comparisons, I should say, of log porosities and core porosities in these other wells?

A As far as our wells are concerned?

Q Yes, sir.

A No, sir.

Q It seems like an easy way to check the validity of that kind of procedure, but you felt it was not necessary?

A Yes, sir.

Q Did you have any hand in the selection of the drill site for Delaney No. 3?

A No, sir, I did not.

Q Do you have any idea of why with all this thick sand pay to the south they would choose to drill thinner sand pay to the north instead?

A No, sir.

Q Mr. McLeland, I would like to submit to you a microlog on the Delaney No. 2. I have to rely on you; I don't even know how to unfold it. I would like to have you ascertain the feet of pay by microlog separation in this sand section.

A Qualitatively? The porosity that was calculated from this log, sir?

Q I am speaking about the number of feet of sand pay that can be determined by microlog separation.

A It appears from this there would be in the order of 20 feet, sir.

Q As I recall your core log and oil in place logs showed 23.

A That is correct, sir, however if you will note the bottom foot did not have any oil saturation calculation on it. I would say you could safety assume that it is within a very close range of what has been stated as being pay for that well.

Q Mr. McLeland, if you will please refer to Exhibit 7, which is the original oil in place isopach?

A Yes, sir.

Q Mr. McLeland, you heard Mr. Weyler testify that at the last meeting of the Adena Engineering Committee a representative of Petroleum Inc. was there when determinations with respect to the feet of net pay were made. I understand that you were also there, is that correct?

A Yes, sir.

Q Now, Mr. Weyler testified that the only objection raised by Petroleum Inc. at the time to the Adena unit calculations revolved around one additional foot of net pay, which was granted.

A As you say, sir, I was present at that meeting.

There was not general acceptance, there was not a motion made for acceptance of the calculation by Pure Oil Company by the Engineering Committee, as I recall it, sir.

Q But no objection was raised after the additional one foot was granted?

A My calculations had not been done at that time and I did not raise an objection at that time to the statement.

Q As I understand Exhibit 7 the contours here again show lines of equal original oil in place?

A Yes, sir.

Q What did Mr. Kavaler call this little desert here?

MR. KAVALER: An abortion.

A A mudhole, I believe.

Q A mudhole. We sort of have one grand oasis here with a few little deserts. You confirm that within the contours of the zero line there is no original oil in place?

A I cannot confirm every acre that is within that zero oil in place line. I do say that with the data it appears that the zero oil in place line would cover that area, yes, sir.

Q Immediately to the west of the mudhole there is another zero line?

A Yes, sir.

Q Now, what lies between?

A Recoverable oil in place insofar as we know. If a well was drilled in that spot then we would have definite proof and be able to say in fact whether recoverable oil in place exists there or not.

Q But without any knowledge, without any actual knowledge you have reasoned that to be a channel of some kind connecting the Bruce well with the Adena Field

A It's value lies somewhere between zero and 5,000, sir, as far as recoverable oil in place.

Q Mr. McLeland, would you if you don't mind marking up one of your exhibits, would you please draw a fairly visible circle around each of the dry holes that exist in the southwest end of the field there?

A Yes, sir, first I will start with one that has been previously included by the Pure Oil Company, being the Dewey No. 8. The next one which is at the edge or on the edge of the zero oil in place line that Pure has presented, or which I have shown on my zero oil in place line for this mudhole, so-called, is the Dewey No. 7. The next dry hole in the immediate area proceeding south would be the Bruce No. 2, which is outside of the zero oil in place line that I have constructed in this area. The next adjacent dry hole is in this area, which is the Goedert No. 1, which is in the northwest of the northeast of Section 26, primarily

the Delaney tract.

The next one is the Edith No. 1, which was drilled by Lion Oil Company and located in the northwest quarter of Section 26. The next one that I would spot would be the Robison No. 1, which is located in the south half of Section 25, and do you want to go on south?

Q I think that's enough.

A Do you want this one down here?

Q Yes, sir.

A Yes, sir (marking on exhibit).

Q Now, I notice that in one of your later exhibits here you have indicated the Delaney No. 3 well was a dry hole. What is its status?

A It is not shown, I don't believe, as a dry hole, or I missed on my supervision again. It should be temporarily abandoned at the present time; it is not producing---

Q I don't want to get into semantics, but is there a difference? Is it a producible oil well?

A It will produce oil, sir.

Q From what zone?

A From zone "J". It produces seven barrels of oil per day.

Q But it has been abandoned how long?

A It has produced several months; I think our latest month figure that I saw as producing oil--for a short time

it was shut down.

Q When did it last produce?

A Well, I am going to have to call on somebody else to answer that, sir, but I know that it has been producing since it was completed a few months.

MR. KIRGIS: If you would like to have that information Mr. Shivel can give it to you.

MR. SHIVEL: It has produced 473 barrels.

MR. STOCKMAR: Mr. Shivel, may I inquire what it did produce in April of this year?

MR. SHIVEL: April of this year it produced a portion of the month, 32 barrels, just a portion.

MR. STOCKMAR: How many days?

MR. SHIVEL: I do not know, but just a few days in the first part of the month.

MR. STOCKMAR: Would you accept eight days?

MR. SHIVEL: I don't know; I would accept something probably in the order of five days; it makes six and a half, seven barrels a day.

MR. STOCKMAR: May I direct the Commission to its own record with respect to production from this well? We may be mistaken; we show average daily production of four barrels, production for eight days.

Q (By Mr. Stockmar) Mr. McLeland, would you have any objection to also drawing a circle around the Delaney

No. 3 well?

A Yes, sir.

Q You don't want to lump it as a dry hole?

A No, sir.

Q Would you mind drawing a "X" through it so we can know where it is then?

A I believe you can see it, but I will draw a "X" through it.

Q Mr. McLeland, is that Delaney No. 3 well in your judgment capable of producing from any other horizon?

A It is.

Q Would you have any objection--it is outside the scope probably of this hearing--but if you have no objection, if you have any idea what the well will do?

A We do not know, sir. All we have is a drillstem test through the "D" sand, but which indicated recovery of oil on drillstem test. We did not know that we will get oil when we perforate, but we think we may get it.

Q How many feet of oil was there all together?

A I can't answer that, sir; I think it was in the neighborhood of three to four, but don't hold me to it.

Q Coming back to these dry holes which we have drawn here, I am particularly interested in the four in the northwest corner. You have connected the westernmost two with a zero contour?

A Yes, sir.

Q And the easternmost two with a zero contour?

A Yes, sir.

Q Even though they are obviously further apart than on an east-west basis. What is your reasoning behind not connecting them on an east-west basis?

A In the first place if you will note I think that what is the structural top map as prepared by core laboratory showed the same existence of this trough down here. They did postulate because of the lack of development at that time a permeability barrier existing up and around the Goedert No. 1. They then themselves had a tie-in as far as one of their map presentations.

Q As shown by the map which we presented here?

A I believe that's right, sir.

Q And there has been quite a bit of additional drilling since that time?

A The additional drilling was done only to destroy their postulated permeability barrier which they had drawn through the Delaney lease.

Q You think it would be an unreasonable construction to run your zero line across between those northern two dry holes, another zero line to the southeast across?

A I think a well drilled in there would prove one way or the other.

Q But now you don't really know which way it really should be?

A I conclude that it should be drawn this way or I would not have done it, sir.

Q Mr. McLeland, may I refer you, please, to your Exhibit 7-A?

A Yes, sir.

Q May I ask you to scale off from the map how far apart these two wells are which you are comparing?

A I pointed them out the other day; this is the Lion Oil Company Albert No. 1, and this is the well (indicating) on Exhibit 7.

Q A mile and a half or so?

A A mile and a half, I would judge.

Q From your exhibit I see this minus 1147 indicated as the oil-water contact?

A Yes, sir.

Q The comparable section then is much closer to the oil-water contact in the Delaney No. 2 well than it is in the Lion well?

A That's correct, sir.

Q It is right just above the oil-water contact?

A I believe it would be in the order of four or five feet.

Q Was it your testimony that these logs were

substantially identical?

A It is of close similarity with respect to the development of the 16-inch resistivity curve.

Q But as far as the SP curve is concerned you would not call them---

A I would say that the SP looks better on the Delaney No. 2 than it does on the Albert No. 1.

Q What is the magic behind this 16--what is it, ohms?

A The 17 ohms.

Q Or inches, whatever you said.

A It is 17 ohms resistivity. The dash line shows the same cut-off point. The one was utilizing core analysis data whereas ours was utilizing the calculation of porosity showing similarity in the cut-off point with respect to the magnitude of the 16-inch resistivity scale.

Q To your knowledge did the Adena committee use the curve that you have used here or did they use the long normal curve on the far right?

A As far as I know, sir--what do you mean now? Let's state this again so I will know exactly what you are talking about.

Q Well, in making comparisons and studies of this nature do you know whether or not you followed the same procedures that the Adena Engineering Committee did?

A I was not present in the Adena Engineering

Committee; we did have a member there. I think it was Bob Caffrey; I am sure it was, and he stated to me that the 16-inch curve was the one that was utilized.

Q Let's move on if we may to Exhibit 8, Mr. McLeland.

A Yes, sir.

Q Would you once again repeat what the purpose of this exhibit was?

A The purpose of this exhibit is to show the oil production from unit-operated wells in the immediate vicinity of the Delaney tract.

Q Would you mind taking your pencil again and drawing a line around the area you are talking about?

A Yes, sir; all producing oil wells within that area are the reported oil production as shown on this graph.

Q How many wells have you listed as producing?

A Tract 81-A, No. 2 and 3; Tract 69, No. 1, which would be ten wells, sir.

Q How many wells in the same area were not producing during this period?

A That I can't answer because I have got this plotted since 1955, sir, and I don't know just how many were completed.

Q Why don't you count the wells on there and we will take off ten then?

A There are approximately 15, sir.

Q 15 non-producing wells?

A No, sir, total wells, 15 or 16 wells.

Q Now, you have testified previously that your purpose in showing this is the high rate of production from this area?

A That is correct, sir, for one particular well in an instance.

Q Well, we are talking about 11 wells here on this exhibit.

A Yes, but I also point out, sir, that for the month of November 5,800 barrels of stocktank oil of the total of 9,400 was produced from one well in the area which was the---

Q Look under Exhibit 9 just a minute.

A Yes, sir, but---

Q If you will stay with Exhibit---

MR. KIRGIS: Let the witness finish his statement, please.

A With respect to November of 1957 you will note that the monthly oil production reported from all of the wells in the area was less than 10,000 barrels, and I made a previous statement that the Scanlon No. 5, the direct offset, produced in excess of 5,800 of those barrels for that month, which is over half of the oil production from that entire area.

Q I see that you have included here well No. 1 on Tract 84 as a producing well?

A Well, it is the Shell Plumb No. 1, and I think it has been shut down. As far as production from it, it has had some production since oil production came from that well. I think now it is converted to water---

Q My information is that during the period of this chart it was converted to an injection well.

A If I recall properly this chart is extended only to 1958 through March, and if I recall rightly the Pure Oil Company entered before the Commission and asked for permission of conversion of that well in January. I may be wrong on that, but I think that was one of the wells that they asked for permission to convert the well, so it does not act as an input well throughout the life of this curve shown on here.

Q Well, at a daily permitted rate of 14,000, a production averaging--what was the figure--1,000 barrels a day from the wells in this area? That's approximately---

A It is about 10,000; I have listed here ten wells, 10,000 would be 1,000 barrels per well per month.

Q Per month?

A Per month.

Q Which is 33 barrels a day average, something like that?

A Yes, sir.

Q What does that amount to in terms of the total field production?

A 1,000, 14,000, 1/14th.

Q About seven percent of all the wells in the area outlined in black?

A Yes, sir, but I again want to call your attention to the fact that the Scanlon No. 5 well in the month of October and November produced a sizeable portion of that volume of oil.

Q May I ask what the Scanlon wells Nos. 1, 2, 3 and 4 immediately adjacent to that well produced in that period?

A I have the data and I can look it up if you want me to.

Q Would you please?

A Yes, sir. Now, you are speaking of what period, sir?

Q Well, the period that you were talking about here.

A In all of 1957 the Scanlon No. 1, the No. 2---

Q Well, excuse me; which is the period again?

A That is shown by the next exhibit, is that what you are referring to?

Q That's probably the period from May to November of 1957.

A It shows that the only well that was producing on the Scanlon tract was the immediate direct offset for Scanlon No. 5 during that period.

Q The other four wells were not producing at all?

A Were shut in, sir.

Q Well, as a reservoir engineer do I gather you place some significance on the fact that a particular well in the reservoir has produced at that particular rate, has some bearing on the problem before us today?

A It has a bearing on the problem before us with respect to the data that you presented, the construction of the isobaric maps. I feel that it has a definite relationship to what has happened in the area during the periods that you have under discussion in your presentation. The isobaric presentation for December of 1957 and the isobaric presentation for the first part of this year.

Q It has some bearing on our preparation of the maps, you say?

A Yes, sir.

Q Would you clarify that for me?

A My conclusions are that at the high rate of withdrawal of the Scanlon No. 5 through November of 1957 caused a drastic reduction in bottomhole pressure within this immediate vicinity. It had an aerial effect unknown; then by shutting that well in and maintaining it shut-in

until the April isobaric pressure map was constructed, you had a rising build-up in pressure. This allowed for your indication of migration of fluid in that direction.

Q Do you think the wells should not have been shut-in? I am puzzled at what you are driving at.

A Yes, sir, if the Scanlon No. 5 had not been shut-in and all of these other wells had not been shut-in I do not believe that your isobaric maps would have shown the same situation.

Q Do you know why the well was shut in?

A Sir, you are asking me to reflect upon your own company, and I do not want to do that.

Q Were you present at the Adena Engineering Committee when it was determined to cut back production below the MER?

A Yes, sir.

Q And in doing so to shut in the high MER wells?

A Yes, sir.

Q Did you vote for that?

A Yes, sir.

Q Where is the reflection on the unit operator?

A The reflection is, sir, that previous statements in engineering committees, meetings that I attended, have shown constantly that there was an increasing GOR from the entire field. I think in the month of November the field average was in the order of 1,800 or 1,900 cubic feet per

barrel. We always noted and it was explained to us that the gasoline plant capacity was being exceeded. For that reason it was necessary to reduce the withdrawal rate.

I would assume from this that prudent operations were not exactly being taken care of with respect to that well when it was being produced at 3,280 cubic feet per barrel as compared to the field average of 1,800 or 1,900. Does that answer you, sir?

Q You think it is not a prudent operation to produce at that high a gas-oil ratio, is that right, sir?

A I do not, sir.

Q What is the gas-oil ratio of your own wells, may I ask?

A The gas-oil ratio of our well prior to this last test was in the order of a thousand cubic feet per barrel. The last test in May was reported to us as being the No. 1 well, the direct west offset to this well that we have been speaking of, to have a GOR of 2,614 cubic feet per barrel.

Q And yet you continued to produce it?

A We are continuing to produce it, yes, sir. You produce this well for a considerable length of time at an excess to that gas-oil ratio at some value reported as 3,280 cubic feet per barrel, sir.

Q But that's not prudent practice, by your own statement of a moment ago?

A We did not feel it was, sir, no, sir.

Q It is not prudent practice then to produce your well at that rate?

A We do not know that it will stay at that high GOR.

Q That isn't what I asked you: It is not prudent practice to produce your well at the rate of 40 barrels a day then?

A I cannot answer that, sir; that will be upon your own judgment. You are making that conclusion yourself, sir.

Q No, I am asking you if operation at that particular gas-oil ratio is---

A I do know that there is a further limitation imposed by Order 26-30 which curtails or imposes a limitation of production allocation to a tract. That is based upon a gas volume allocated to the entirety of the Adena Field, which I believe is 25,173,000 cubic feet per day. For that reason the GOR's themselves on these wells, no matter which way they go, and I cannot tell you which direction they will go, will impose a limitation upon those particular wells.

Q That has not yet occurred, I gather?

A Providing your Order 26-30 is approved by the Commission.

Q Speaking of the past---

A 26-30 did rule for some time, sir, I don't know.

Q What is imprudent operation in the unit is prudent operation outside, is that the conclusion that I should draw?

A It should be, sir.

Q Mr. McLeland, you have just testified that by excessive rates of production from a particular well you have drastically lowered the bottomhole pressure, is that correct?

A I feel that that may have been done. There is nothing direct; that is a conclusion that I have reached.

Q Do you have any information that will support that statement?

A No, sir.

Q I would like to offer you a bottomhole pressure measurement taken on this particular well in April of 1958; it was not shut-in, it was floated. I would like to have you read for the Commission what the flowing pressure was after twenty-two hours of constant flow?

A The flowing pressure was 1,057 on a test of this well as stated here on this data sheet.

MR. KIRGIS: Is this the No. 5?

THE WITNESS: This is Scanlon No. 5.

Q This is Scanlon No. 5. Do you consider that an excessively low pressure?

A It is low probably with respect to the pressure

that was shown on the isobaric map that was presented prior to that time. I assume that there was a drop in bottomhole pressure from the previous isobaric presentation.

Q If you would like to refer to these maps we can take them out. It is my understanding that the Scanlon No. 5 well had a higher flowing pressure than the projected shut-in pressure of your well.

A That well may be, sir.

Q Would you like to refer to the isobaric map?

A I would, sir. I want to point out one thing. Can you state exactly how long that well had been producing before you took this test?

Q Twenty-two hours.

A And how long had it been shut-in, sir? Excuse me for asking you questions instead of you asking me.

Q Well, in answer to your question, Mr. Witness, all I can do is refer to our tabulation here which showed the production of 1,063 barrels from that well during the month of March, 141 during the month of April, which of course included the time with respect to this test, and if you can derive any further information from the data sheet about the test, why, you are welcome to it.

A No, sir, the only thing that I can say is the months that you did not mention have been shown on the conversation reports as the well being shut-in, from

November, or I think there was a small amount of production in December, and no production in January or February was reported to the Oil Conversation Department, so that has a definite bearing on the pressure that you find presently.

Q But this well was opened and allowed to flow over twenty-four hours before this flowing test was made?

A Yes, sir, it would appear that it was.

Q Did you want to say something about the pressure maps?

A No, sir, I think I have covered that in my previous testimony.

Q You do not believe that we lowered the bottomhole pressure to a pressure lower than that on the Delaney tract, do you?

A That I don't know unless I had a pressure within the period of high rate of withdrawal, and I don't think that you can say that it was not lowered below that point.

Q You are not trying to show that there was migration from the Delaney tract to the unit, that's what I am driving at?

A There could well have been, sir; I think that is an obvious conclusion.

COMM. BRETSCHNEIDER: Mr. Stockmar, when you get to the proper point we will go to lunch.

MR. STOCKMAR: I think I have reached it and I

would like to excuse the witness as far as I am concerned.

COMM. BRETSCHNEIDER: We will go to lunch then.

(Whereupon, at 12:35 o'clock p.m., May 28, 1958, the proceedings were recessed until 1:40 o'clock p.m., the same day.)

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P R O C E E D I N G S 1:40 p.m.

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COMM. BRETSCHNEIDER: Gentlemen, we are ready to proceed. Mr. Stockmar, are you finished with the witness, Mr. McLeland?

MR. STOCKMAR: Yes, sir.

COMM. BRETSCHNEIDER: Does anyone else wish to cross examine this witness?

MR. ROBISON: If the Court please, I would like to cross examine Mr. McLeland.

JOHN McLELAND, a witness called on behalf of Petroleum Inc., having been previously duly sworn, resumed the stand and testified further as follows:

CROSS EXAMINATION

BY MR. ROBISON:

Q Mr. McLeland, in your study of the area does your compilation indicate that the south half of 25, Township 1 North, Range 58, had more oil and gas in place than indicated by the Pure Oil Company maps?

A My revision in the south half of 25 certainly would increase it to some extent. I did not take that into consideration and work out the calculated oil in place for that tract.

Q You couldn't give us any estimate then?

A It would increase it from the present allowable,

I believe, by 26-30 from 52 to probably in the order of 60. That's just an estimate; now, I don't know.

MR. KIRGIS: I have a few questions on redirect if there are no other questions on cross; they will be quite brief.

COMM. BRETSCHNEIDER: All right, sir.

REDIRECT EXAMINATION

BY MR. KIRGIS:

Q Mr. McLeland, during your cross examination by Mr. Stockmar a point was made in Mr. Stockmar's language comparing apples and oranges, if I understood him correctly, and it had to do, I believe, with the asserted fact that the calculations made in the north portion of the field where you took those calculations from the unit Engineering Committee were not made on the same basis as your calculations in the south part of the field. Do you recall that testimony?

A Yes, sir.

Q Is there in your judgment as an engineer any significance in the difference in the forms of computations made in the two portions of the field on your exhibit?

A I do not feel there are significant differences; I think we are going by a different route to arrive at approximately the same answers, and if they had considered the lower section of the core they would have come out with

the same figures, or very close to it.

Q Do you have any belief as to which of the two methods, yours or theirs, might be the more accurate?

A Of course it is only my opinion, but I believe that I have applied engineering concepts which should be recognized, and it is just as good as other methods that they used in the formation of the unit.

Q Well, did they in the northern portion of the field assign oil in place values to tracts where there were no cores in the wells for analysis?

A Yes, they did.

Q How did they do it, do you know?

A From review of this engineering calculation and the statements made in this book in the northern portion of the field there were several wells that did not have core analysis available. Some of these were in the immediate area of the oil-water contact. I believe if I recall rightly that the State No. 6 did not have a pore on that well, and to obtain a hydrocarbon pore volume or barrels per acre value for that well, they averaged the adjacent forty-acre developed wells that did have core analysis available. This is a straight average of adjacent wells and not applying any data from electrical logs other than a comparison to see that the sand section is there.

Q Now, another point in the cross examination, you

were interrogated with regard to dry holes and were asked to mark dry holes, or let us say abandoned wells, on Exhibit--is it Exhibit 7 on which those marks now appear?

A Yes, sir.

Q And you then were interrogated as to why you drew your lines in a generally northeasterly-southwesterly direction rather than in a generally east-west direction?

A Yes, sir.

Q Can you explain that any more fully?

A I believe that the oil in place map has a direct comparison to the continuity of the structural top of the "J" sand. Therefore, the structural top shows the favorableness of the sand for the accumulation of oil and the direction of the trend should be in this direction as shown by the contour lines on this map.

Q Now, at another point a question was asked, and I am inclined to think that it was misunderstood and you may or may not, therefore, wish to change your answer. Mr. Stockmar was interrogating you regarding gas-oil ratios, and brought out the fact that there is a gas-oil ratio currently on the Delaney lease in a certain fixed amount which is unimportant to my purpose. He then asked you, if I understood his question correctly, whether imprudent operation in the unit would become prudent operation outside the unit, and you said yes. Did you understand the

question that way when you made that answer?

A No, sir, I did not hear the word "imprudent." I thought it was prudent against prudent, and I assumed that equality should take place between the two.

Q Now, on this matter of gas-oil ratios will you state whether in your opinion the operation of the Scanlon No. 5 as portrayed by our Exhibit No. 9 has had any direct effect upon the gas-oil ratio of the Delaney tract?

A It is my opinion that the withdrawal rates in the immediate area of the Delaney tract caused a reduction in bottomhole pressure in the immediate area, which could well have had effect upon the Delaney No. 1. Assuming that the bottomhole pressure was drawn down because of this high withdrawal rate, it is a consequence of lower pressure that you would break out more gas in solution, therefore resulting in a higher gas-oil ratio.

Q And is that operation on the Scanlon No. 5 such that it could directly affect the Delaney tract?

A That is my opinion.

MR. KIRGIS: No further examination.

COMM. BRETSCHNEIDER: There being no further examination of the witness, the witness is excused.

(Witness excused.)

COMM. BRETSCHNEIDER: Mr. Stockmar, do you desire to cross examine any of the other witnesses?

MR. STOCKMAR: I think we will waive cross examination of the other witnesses.

COMM. BRETSCHNEIDER: Are there any more witnesses to be presented by either of you?

MR. STOCKMAR: We may wish to have about five minutes of rebuttal evidence, but I understand that Lion does have a presentation. I would like to see where that fits in.

MR. WESTFELDT: I would like to call Mr. Struble.

(Lion Oil Company Exhibit No. 1 was marked for identification.)

MR. WESTFELDT: If the Commission please, in my questioning of this witness I am going to refer to the Lion Oil Company. As the Commission knows, that is a division of the Monsanto Chemical Company, but I think in all the testimony so far it is referred to as Lion, and probably will simplify the transcript.

RICHARD STRUBLE

called as a witness on behalf of Lion Oil Company, was duly sworn and testified as follows:

DIRECT EXAMINATION

BY MR. WESTFELDT:

Q Mr. Struble, would you please state your name, address and occupation?

A My name is Richard Struble; my address is 1320 South Fenton, and I am a geologist for Lion Oil Company.

Q Have you testified before this Commission before, Mr. Struble?

A Yes, I have.

MR. WESTFELDT: I would like to ask that the Commission accept Mr. Struble's qualifications as an expert witness.

COMM. BRETSCHNEIDER: Yes, sir, we will if there are no objections from other parties.

Q Mr. Struble, on the blackboard is an exhibit marked Lion Exhibit No. 1. Do you have a copy of that in front of you?

A Yes, I do.

Q What is that exhibit, Mr. Struble?

A It is a structure map on top of the "J" sandstone showing my interpretation as to the permeability barriers and the oil-water contacts in the southwest portion of the Adena Field.

Q And it also shows the structure contour lines on top of the "J" sand, is that correct?

A That is correct; they are the solid lines. The permeability barriers are the hashered lines and the oil-water contact the dashed lines.

Q And did you prepare this exhibit?

A I did.

Q Mr. Struble, will you state what the sources of

information for the preparation of this exhibit were?

A Core analysis was used to determine the permeabilities. Electric logs and core analyses were used to determine the oil-water contacts.

Q And what was used to determine the structure contour lines?

A The top of the "J" sand was picked from the electric log.

Q And was there some seismic work?

A This is a sub-surface map, but the seismic map does varify the structural picture.

Q Mr. Struble, along the southwesterly corner of what is now known as the Adena Field and extending into the Delaney tract you have a line that is indicated as a permeability barrier. Now, will you please explain how you arrived at that line and located it as is shown on this map?

A You mean this one or this one (indicating)?

Q Yes, the one that---

A The easternmost line?

Q The one that bounds the southerly end of the Adena Field going into the Robison lease and the Delaney lease and up northerly into the Goedert leases.

A My determination of this permeability barrier came from core analysis and core descriptions in the Dewey,

Lynn Dewey 7 well.

Q Now, where is that located?

A It is in the southeast northwest of the southwest of Section 24. Core analysis indicated that this well had no permeability and no oil saturation. Drawing the line down through the Petroleum Inc. No. 3 Delaney, the average core analysis millidarcies, based on ten samples, was 7.7 millidarcies. Coming down through the Delaney 1, the average permeability, 12 millidarcies based on nine samples, and in the Delaney No. 2, 26 millidarcy average, based on ten samples.

Continuing the line swinging back to the east, the Lion No. 2 Robison had an average of 26 millidarcies based on eleven samples; the Lion No. 1 Robison had no permeability at all. It is my opinion from studies in the Denver Basin with the cretaceous sands that a decrease in permeability means that you are approaching a strandline or a barrier, and these low permeabilities along this line indicated to me that we were closely approaching a barrier which I have drawn as shown on my map.

Q Well, Mr. Struble, you say there is a decreasing permeability; does permeability increase to the north and to the east of this line of wells you have just described?

A It does.

Q And, Mr. Struble, I notice another line to the

west of the line that you have just described that also indicates a permeability barrier. Will you please give the Commission the information on which you based that conclusion?

A Yes, sir, I put the permeability barrier based on the Goedert No. 1 well which is due east of the Bruce through that well because it had zero permeability and no saturation based on twenty-five samples.

Q That well was drilled by Lion Oil Company, is that right?

A That well was drilled by Lion Oil Company. The well north of the Bruce, the No. 2 Bruce had an average of 17 millidarcies permeability based on five samples. The reason for putting the barrier between the No. 1 and the No. 2 Bruce is as follows: An oil-water contact of minus 1145 was picked off of core analysis and electric log in the No. 1 Bruce. The No. 2 Bruce had five feet of permeable section above this oil-water contact, and in the core description had no show, no stain, and in the core analysis had no oil saturations; therefore, a barrier must exist between the Bruce 1 and the Bruce 2, and that was the reason for connecting the line between the No. 2 and the No. 1 into the No. 1 Goedert.

Q Mr. Struble, before going on, you are giving permeability information on these wells, and is that the section

of the "J" sand above the oil-water contact level?

A That is correct, only that section.

Q And you show the oil-water contact line of minus 1145, is that correct?

A Yes, sir, around the Bruce.

Q Now, will you proceed with the line indicating---

A The line indicated just east of the No. 1 Edith is based on the fact that there was an average 16 millidarcies permeability based on three samples. There was a section of ten feet that analysis was made; only three samples had greater than 2.5 millidarcies, which indicated to me again that we were approaching a permeability barrier. As you can see from the No. 1 Bruce well, which had 12.7 millidarcies average based on thirteen samples, permeability decreases in each direction away from the well except to the west, and that is the reason for the permeability barrier separating the Bruce well from the Adena Field.

Q And the oil-water contact line shown on this map lies west of the Bruce No. 1 well, is that correct?

A That is correct; it is the dashed line west of the Bruce well.

Q Now, Mr. Struble, let's refer to the southerly portion of this map in the area known as the Adena South Field, and I wonder if you would give us--well, first of all you have an oil-water contact line, and what is the elevation

at that point?

A Minus 1122.

Q And was that picked from wells drilled in that area?

A It was.

Q And what wells?

A It was picked principally from the Eddie Fisher No. 4 State.

Q Where is that located?

A That is in the southeast southwest of the northwest of Section 35. That well was perforated at 1121, from 1121 to a minus 1133, and immediately went on production at seventy-five percent water and twenty-five percent oil. Two months later it was making ninety-six percent water, and temporarily abandoned. From the core analysis and the electric log I could also pick the oil-water contact of 1122 from our No. 2 Doll well.

Q And where is that well located?

A That well is in the northeast of the southwest of the northeast, Section 35.

Q Now, Mr. Struble, will you give further information with respect to those two wells you have just described as to permeability and saturations?

A The permeabilities in the No. 2 Doll well were 9; the average permeability was 9 millidarcies based on six

samples above the oil-water contact. I have core analysis on the Eddie Fisher well, and the upper four feet above the 1122 oil-water contact in this well had permeabilities of 32, 73, 66 and 96, and had saturations, oil saturations. The one foot core analysis below the oil-water contact had 47 millidarcies permeability and no oil saturation.

Q Will you give what information you have with respect to the Eddie Fisher No. 1 "D" well in the southeast of the southeast of the northwest of Section 35?

A That is the British-American 1-D well.

Q British-American---

A It had no permeable section above the oil-water contact of 1122, however it did have two feet that had oil saturation.

Q Now, moving still farther easterly will you give the same information with respect to the British-American State well in Section 36 in the northwest of the northwest of 36?

A British-American F-2 State had no permeable section, no oil saturations.

Q Would you explain to the Commission further, Mr. Struble, the permeability barrier line shown around the east and the south?

A Yes, sir, this line, the northern end of it between the Doll No. 2 and the British-American F-2 State, is drawn

just because the F-2 State had no saturation and the Doll 2 had five feet of saturation showing a barrier through there. The Ryan Doll Delaney well in the southeast southeast of Section 35 had a drillstem test from minus 1088 to minus 1118, which is above the oil-water contact, and it recovered only 190 feet of slightly gas-cut muddy water, so I put my barrier through there. The sand in the section was reworked and tite, and very indicative of permeability, approaching the permeability barrier.

The Eddie Fisher No. 3 well in the southeast southeast of the southwest of 35 had an extremely tite sand section and no drillstem tests were taken, so that indicated the approach of the permeability there. Then I just continued it until it crossed my oil-water contact at 1122, and the field is limited to the south and to the east by the permeability barrier, and to the north and to the northwest by the oil-water contact at minus 1122.

Q And that minus 1122 is compared with minus 1145 or 1147 in the Adena Field, is that correct?

A That is correct.

Q And is it your opinion, Mr. Struble, that this Adena South area is therefore a separate source of supply from the Adena Field itself?

A It is my opinion based on the oil-water contact and my interpretation of the permeability barriers, I

believe that this barrier that surrounds the South Adena Field would probably connect to the one that surrounds the Bruce, leaving the area between Adena and these two fields an area of no permeability extending in a northwest-southeast direction.

Q Do you want to point that out on the exhibit that is up on the blackboard?

A That would be this general area between the permeability barriers, an area of no permeability which would separate these two fields from the Adena Field proper.

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

COMM. BRETSCHNEIDER: Does anyone wish to interrogate the witness?

MR. KIRGIS: I have some questions.

COMM. BRETSCHNEIDER: You may proceed.

CROSS EXAMINATION

BY MR. KIRGIS:

Q Mr. Struble, I am particularly concerned with these permeability barriers you have delineated in here on this exhibit. They are located, I understand, by hypothesis basically, is that not correct?

A By hypothesis and a wealth of information from wells, fields in the Denver-Julesburg Basin.

Q Looking at your exhibit and particularly let us look at the east half of Section 26.

A Yes, sir.

Q Do you have any basis for determining how far you place that permeability barrier to the west of any one of the three wells shown there?

A Yes, sir, on the basis of the average permeability or the permeable section within the total "J" section.

Q Can you tell from that whether it should be 150 feet or 300 feet or 100 feet? Can it be worked down that closely?

A No, sir.

Q Now, I am not sure you were the witness, although I think you were, who produced an exhibit called Lion Oil Company Exhibit A at the hearing before this Commission in July of 1956; did you present that exhibit?

A I don't recall the exhibit.

Q Here is the exhibit (handing exhibit to the witness).

A No, sir, I did not.

Q Are you familiar with it?

A I have seen it, yes, sir.

Q It was a Lion Oil Company exhibit, was it not?

A Yes, sir.

Q Do you know or do you not whether that was

predicated on the same type of calculations that you have used in your present Exhibit 1?

A I imagine it was.

Q Was this prepared in your office, do you know that?

A In Lion's office?

Q The office with which you are connected?

A Yes.

Q Now, I call to your attention that this Exhibit A for the July, 1956 hearing shows this permeability barrier, presumed permeability barrier, in the east half of Section 26 as including only, as allowing only a very small part of that east half of 26 unaffected by the permeability barrier, are you familiar with that?

A My information is---

Q That is true, only a very small part is shown there?

A Yes, sir.

Q And your present Exhibit 1 shows a considerably larger area of the east half of 26 unaffected by your permeability barrier, is that correct?

A A smaller portion.

Q A larger portion of it which is not affected by the permeability barrier?

A You mean this area in here, or this area (indicating)? There is a larger area affected by the barrier now

than there was then.

Q Much larger, isn't it?

A Yes.

Q Could you--perhaps you don't want to and if so say so--but, could you trace this former permeability barrier as shown on your Exhibit A in pencil on your present Exhibit 1?

A Sure (marking on exhibit).

Q Thank you very much. So now as appears there the location of the permeability barrier as you have it on your present Exhibit 1 would allow a considerably larger portion of the east half of 26 to be in the permeable area than was true on the July, 1956 exhibit, is that right?

A That is correct, sir.

Q Now, why should there be that change?

A Because of the additional development in the area.

Q Then that would mean that the original calculations weren't very accurate, wouldn't it?

A No, not necessarily, I don't believe so. They were the best interpretation at that time.

Q Right, but they are now known to be inaccurate?

A That is correct.

Q Therefore your interpretations on Exhibit 1, though the best that you in your opinion know today, could be wholly inaccurate, is that not right?

A I believe, sir, that we have better control now for the barrier than we did at that time. We had 35 millidarcies of permeability in the Goedert 3 well when this line was drawn. We now have 7 millidarcies in the Delaney 3, which indicates that we are close to a barrier. We had 113 millidarcies in the Scanlon 5, and now we have only 12 in the Delaney 1. We still had 113 to bring the barrier in here (indicating), so I don't believe that now with these low millidarcy permeabilities that we are very far off of our barrier.

Q Now, let me ask you this, and I am looking at your Exhibit No. 1 produced here today: The Delaney No. 3 is the northernmost of the three Delaney wells, is it not?

A That is correct.

Q And you show permeability there of roughly 7 millidarcies, correct?

A That is correct.

Q Then the next one to the south is the Delaney No. 2, and you show a permeability there--I mean it is the No. 1?

A The No. 1, yes, sir.

Q You show a permeability there of roughly 12 millidarcies, correct?

A Correct.

Q Then the furthest one to the south is No. 2, and you show 26 millidarcies there, is that correct?

A Yes, sir.

Q Does that look like a pinch-out to the south, or does it look like a broadening or betterment to the south?

A I think on my exhibit I do stay away from the No. 2 well more than I do the No. 1 and the No. 3.

Q But if I understood you awhile ago you said that the theory upon which these estimates are made are that you have pinch-outs. Now, I suppose if you have a consistent pattern of pinch-out to, let us say, the left, by the same token you have a pattern of improvement to the right, do you not?

A Until you reach another barrier.

Q Until you reach another barrier?

A Yes, sir.

Q But you are using this method of computation or estimate for the purpose of finding out where the barriers are, am I not right?

A Yes.

Q Then how in the world can it be said that the barrier is going to swing around to the south of the No. 2 within a distance of what, an eighth of a mile, I believe, as you have it depicted here, when the trend of the permeabilities from north to south is not pinch-out but increase?

A The reason I put my line around the south is for the same reason that I do between the No. 5 Scanlon well

and the No. 2 Robison well. In the No. 5 Scanlon well I have 113 millidarcies. By the time I get to the No. 2 Robison the average millidarcy permeability is 26, so you do have some control, a little bit of control to draw your barriers in.

Q Well now, isn't that indulging in assumption that the barrier must be drawn into an east-west position to close off there? Can't one just as well indulge the assumption, and perhaps more properly indulge the assumption, that it should never be closed off in an east-west direction, but continues with two lines perhaps coming down to the south, and in support of that I cite the fact that you have an increase in permeability from north to south in the three Delaney wells from 7 to 12 to 26, and yet just south of the one where it is 26 you say the barrier appears.

A That is correct, because I have the control on the south end of Adena Field showing that the permeabilities decrease in that direction.

Q But they do increase in those wells, do they not?

A In these three, yes, sir.

Q That's right; so you have then a situation where as far as I could assume it may be open-ended heading south, isn't that perfectly possible?

A I don't believe so.

MR. KIRGIS: No further examination.

REDIRECT EXAMINATION

BY MR. WESTFELDT:

Q Mr. Struble, you have said that the wells in the Adena Field to the north and to the east of this line of wells that is just inside your permeability barrier have higher permeabilities. Can you give some examples of that other than the Scanlon No. 5, which you have already given?

A Yes, sir, this Goedert No. 2 well had 148 coming south to the Scanlon No. 2, 118 millidarcies, to the Robison No. 1, zero.

Q And directly south of this southwesterly corner of the Adena Field you have the oil-water contact at minus 1122, is that correct?

A Yes, sir, that is correct.

Q And also in the northwest quarter of the northwest quarter of Section 36 you again have a well with no permeability, is that also correct?

A The sand was tite and there was only two samples analyzed. The core description said the sand was of low to very low permeabilities and no tests were taken.

Q I am referring to the British-American F-2 well in the northwest quarter of Section 36.

A That well had no permeability and no oil saturation.

Q And you also have other wells of low permeability

west of the Delaney wells, such as the Goedert No. 1 and the Lion No. 1 Edith, is that correct?

A That is correct.

Q And with respect to the location you show of this permeability barrier line just west of the Delaney wells, that's your best interpretation of all the information to date, is that correct?

A That is correct.

Q And you think you included a reasonable area of the Delaney tract within that line?

A I believe so.

MR. WESTFELDT: No further questions.

RECROSS EXAMINATION

BY MR. HAFFKE:

Q Mr. Struble, how long have you been with Lion in this particular area?

A Three and a half years, sir.

Q Were you there at the time they drilled that No. 2 well?

A I do not believe so.

Q Where did you get your information as to the location of that particular well?

A From our base maps.

Q From your base maps?

A Yes, sir.

Q Do you happen to have ever been on the ground out on that forty acres?

A No, sir, I have never been on that forty acres.

Q You have no record of having an offcenter spacing allowed there?

A No, sir.

Q You couldn't challenge my statement that from an actual examination of the record that well is in fact considerably southeast of where it is shown on your map?

A No, I could not challenge it.

Q The best we have been able to survey it it is a little bit southeast of center of that quarter?

A Yes.

Q Now, on the No. 1 Ryan I think you called it in the southeast corner, do your records reveal whether they ever got a core on that well?

A Yes, sir, they had a core, I believe. Let me see; yes, sir, they have a core from 5722 to 5949, sir.

Q Now, I am curious about assumptions; if I remembered your testimony how many millidarcies did you say, 32 on the No. 3 Goedert?

A 35, sir.

Q 35?

A Yes, sir.

Q And on the No. 3 Delaney it is 7?

A That's correct.

Q A decrease of 25, is that correct?

A That is correct.

Q And then over here on the No. 1 Goedert you say it is zero?

A That is correct.

Q All right; now then, I observe here on the No. 1 Robison--what was your millidarcies?

A Zero.

Q And what was the No. 2 Robison?

A 26.

Q And what was the No. 2 Delaney?

A 26.

Q Now, if I am correct you put up a permeability barrier right through here?

A That is correct.

Q Which according to your scale here you go from 32 to 7, a decrease of 25, with a known zero over here?

A Yes, sir.

Q Decreasing, and from this 32 to this permeability barrier you give over forty-acre spacing to get your permeability barrier?

A Yes, sir.

Q When you have a known decrease. Here you have a build-up this way and you have a build-up this way, and you

still maintain that that shouldn't be over 10 or 15 acres outside of the increase, is that correct?

A That is correct.

MR. HAFFKE: I believe that's all.

REDIRECT EXAMINATION

BY MR. WESTFELDT:

Q I would just like to ask Mr. Struble one question: With respect to the location on the ground of that Leon Doll No. 2 well, to the best of your knowledge is the location shown correctly on this Exhibit 1?

A It is a Powers location as far as I know, and platted from the table, yes, sir; as far as I know it is correct.

MR. WESTFELDT: I have no further questions.

COMM. BRETSCHNEIDER: No further questions; the witness is excused.

(Witness excused.)

MR. STOCKMAR: If there are no further presentations, I would like to recall Mr. Weyler for about three minutes of rebuttal testimony.

MR. ROBISON: If the Commission please, I would like to introduce the Robison Exhibit No. 1.

(Robison Exhibit No. 1 was marked for identification.)

COMM. BRETSCHNEIDER: All right, sir.

MR. ROBISON: It is a production report from your own Commission on the Scanlon No. 2, 3 and 5 wells, and that indicates some important things in this.

COMM. BRETSCHNEIDER: All right, we will put it in the record.

MR. WESTFELDT: Mr. Chairman, I believe I overlooked asking the Commission to receive in evidence Lion's Exhibit 1, and ask that it be received.

COMM. BRETSCHNEIDER: All right, we will receive it in evidence and put it in the record.

(Lion Oil Company Exhibit No. 1 was received in evidence.)

COMM. BRETSCHNEIDER: You may proceed, Mr. Stockmar, if you like.

COMM. DILLON: Were you through?

MR. ROBISON: I wanted to make some statements about that.

COMM. BRETSCHNEIDER: Do you want to make a statement?

MR. ROBISON: Yes, sir; the tabulation of the figures indicated by that report on the Scanlon No. 2, 3, and 5 indicated a total production of almost 200,000 barrels, to be exact, 199,358 barrels of oil that had been produced to the present time. I think the report is up to the month of March; it does not include the month of April,

for some reason. Of that amount the Scanlon No. 5 well has produced a total of 107,000 barrels. Those items, I think, if you are to adopt an original oil in place theory on the allocation on these wells, must be considered. I don't think that point has been brought up in this hearing. Mr. Kavaler brought up some important things about encouraging exploration in the outlying area. If that is not done correlative rights are bound to be injured, and so we will never have a chance or opportunity to find that oil. The No. 2 Robison came in flowing approximately 300 barrels per day, and for a short time produced without restriction, but after that it was cut down to 40 barrels a day. At the same time I think the testimony has been given that the Scanlon No. 5 well was producing in November of 1957 a total of 195 barrels a day. Mr. Kavaler brought up the point that if you are going to have regulation you have to have it on both sides of the fence, and I think that is important to this hearing. I believe that's all I have.

COMM. BRETSCHNEIDER: All right, thank you very much. We will receive this exhibit in evidence.

(Robison Exhibit No. 1 was received in evidence.)

JACK WEYLER

called as a witness on behalf of Pure Oil Company, having been previously duly sworn, resumed the stand and testified further as follows on rebuttal:

DIRECT EXAMINATION

BY MR. STOCKMAR:

Q For the record, Mr. Weyler, you are the same Jack Weyler who testified previously?

A Yes, sir.

Q You were present during the interrogation of the witnesses for Petroleum, Inc.?

A Yes, sir.

Q During that time you heard criticized or impugned your determinations of the total oil in place in the reservoir. Can you contribute any additional information that might provide confirmation for your calculations?

A Yes, sir, we have had remarkably good success in predicting when wells would water out on our water injection program, and that data is highly dependent upon the volumetric determinations that we have made and other aspects as far as our flooding tests go; but, we have predicted a flooding out of these initial producing wells along the--directly offsetting the water injection wells--within a matter of weeks, which gives rise to a very, very close approximation of the average actual known volume of hydrocarbons in that area, which we computed and which are represented by the maps we have previously presented to the Commission.

Q Thank you, Mr. Weyler. The production from the

Scanlon lease, particularly the Scanlon No. 1 lease, has seemed to come forward as a major issue in this case. Again the abilities of the unit operator to properly manage the reservoir have been criticized. Would you give us a brief statement of your company's reasoning in the handling of the production from that well?

A Yes, the Scanlon 1, 2, 3, and 4 also on that property, the other four wells, not one of them has been produced since March of 1956 except for test purposes of short duration. We have the ratios at that time; those were all shut-in. Scanlon No. 5 was the most efficient, as we might call it, the lowest producing gas-oil ratio well on that property.

In our attempt to distribute, as we stated yesterday, production throughout the reservoir and not to produce too much in any one area, we did try to produce some throughout all of the west flank of the Adena Field and produce it out of those wells that were most efficient. The gas-oil ratio of the Scanlon well by test in May of 1957 was 1343 cubic feet per barrel. By October, 1958, this gas-oil ratio by test, we found it had increased to 3480. This will was thereupon shut-in in the month of December after we secured approval of all of our operating parties to cut back the Adena Field production below the allowable for efficiency purposes, and since that time this particular well has been

shut-in while the offset wells have been producing.

Q Mr. Weyler, until today has anyone raised any complaint or objection about your method of handling the Scanlon well?

A No, sir, not at all.

Q Mr. Weyler, as a member of the Adena Committee which determined the oil in place, may I ask your cooperation in taking the log of the Delaney No. 2 well and showing us what your Committee did in determining oil in place as shown by the information from that well?

A Well, the treatment that the Engineering Committee would have given the Delaney No. 2 well as far as determining pay section and thereafter oil and gas in place, would have been this: If we had done it at that time and we had done the rest of them in that same manner, or still if we do it in the same manner, we would have taken this electric log, and I am talking about first we will take the core analysis of the top of the sand as analyzed and calculate it in quite the same manner as Mr. McLeland did. Then for the lower part of the sand section we would have altered from Mr. McLeland's procedure thusly: We would have first looked at the microlog to see the very maximum pay section which could be attributed to this well, which Mr. McLeland read I believe as twenty feet, and which I believe I would read here the

way we were reading them as probably nineteen feet. So first off that eliminates four feet entirely from consideration. Then we still do not have a permeability and porosity for those additional feet.

We would have then correlated them with similar wells; in other words, wells directly offsetting that of similar characteristics. We wouldn't jump a mile and a half away and try to compare a well over there with this well that we are trying to determine some characteristics of; we would have compared it with this well, Delaney No. 1. It is right next to it; we found throughout the entire field that you could correlate reasonably well these porosity and permeability figures. In other words, the permeability and porosity figures by calculation do not correlate at all with known figures of the same structural level. We would have correlated that well with Delaney No. 1 and would have found that the Delaney No. 1, the five feet we cored had no permeability, and thereafter the Petroleum Inc. representative agreed to it, and they likewise agreed there was nothing below that five feet of core, so that would have indicated that likewise there was nothing in No. 2, and so therefore if we had used the same standards on the Delaney No. 2, which apparently is the well in question here, we would have come up not with this 12,604 exaggerated barrels per acre, but the 4,000, and so that is shown on

the unit operator's Exhibit A, I believe.

Q Mr. Weyler, that determination would have been consistent in all respects with the determinations made in other parts of the field?

A Yes, sir, that's exactly how we did it where we did have uncored sections.

Q Well, having that information would you show us how the Committee would then have proceded to contour the original oil in place isopach lines, if that's the proper term, and if there is no objection you might show it right on the exhibit there.

A From that point after we determined the 4,000, whatever it was, barrels per acre oil in place, we would have put that figure by the well as is shown on the other wells, and the contour lines would have not, this 5,000 line would have not gone over toward the west part of that property toward the Edith well, but would actually have come back in in this manner, which is practically identical with the barrier as shown here. It is in trends in the same way, although this, of course, is the zero line out somewhat from the 5,000 barrel per acre line, and the zero line would have been an extension of this line and come right around in this manner (indicating), and cut off the field in the very same manner as the Lion geologists have worked up and as the Committee has limited this field in

the past.

Q How would you have contoured the area around the mudhole there?

A Well, that area would not, not having had any oil in place out on that west half of the Delaney property, would have eliminated that mudhole in actuality and have been a barren streak separating the Bruce well and its very small reservoir from the Adena Field, and this--well, this would have come out and cut right across there as shown by our original exhibits.

MR. STOCKMAR: Thank you, Mr. Weyler, that's all.

MR. ROBISON: If the Commission please, I would like to ask Mr. Weyler some questions on one point.

COMM. BRITSCHNEIDER: All right.

CROSS EXAMINATION

BY MR. ROBISON:

Q Did you testify that the Scanlon No. 5 well was shut-in?

A In December, yes.

Q In December; is it shut-in now?

A Yes.

MR. ROBISON: I would like to point out to the Commission that the report that I submitted, Robison Owner's Exhibit No. 1, indicates that in the month of March 1044 barrels were produced from the Scanlon No. 5.

REDIRECT EXAMINATION

BY MR. STOCKMAR:

Q Mr. Weyler, did you not state that the wells were shut-in except for purposes of testing?

A Yes, I would like to clarify that point. We particularly ran probably what we call productivity index tests in the month of--is it April?

A VOICE: March.

A ---which data we were submitting to Mr. McLeland earlier, and for those test data which showed we had a relatively high flowing bottomhole pressure, we had to get some production to make those tests, and that is what it was for.

COMM. BRETSCHNEIDER: It shows on there; that's on the record.

MR. STOCKMAR: Thank you, Mr. Weyler.

MR. KIRGIS: May I ask just a very few questions?

COMM. BRETSCHNEIDER: Yes,sir.

RECROSS EXAMINATION

BY MR. KIRGIS:

Q Mr. Weyler, you indicated, if I heard you correctly, that you understood Mr. McLeland had gone a mile and a half away to get a comparative well. Did you mean to say that?

A Yes, I believe I did.

Q I believe you misunderstood the testimony in that regard then. You also stated throughout that had you made a certain computation on the Delaney No. 2 you would have done this, you would have looked at the micrologs, you would have correlated with other wells, you would not have jumped a mile and a half away, the contours would have been something. Did you do any of this?

A Yes, sir, I did.

Q When?

A For weeks and months and months.

Q As to the Delaney No. 2?

A As to the Delaney No. 2, no, but for well over 100 wells of better and worse character than the Delaney in the Adena Field.

Q But you did not do it as to the Delaney No. 2?

A No, that well wasn't drilled. Now, we just went through what would have been done had we had that well at that time, or what we could still do right now with the same field rules applying, the same factors used, and the same methods of computation.

Q Well, your use of the phrase "would" throughout indicates that even as now you haven't done it, is that right?

A Yes, we have; those figures are shown on our Exhibit A.

Q Then what was the significance of the word "would" which was emphasized in every question and every answer?

A Because I was talking about a Committee would, and we did this in our development geological department using the same thinking, same ground rules, same factors as the Committee would have done. The map, as I say, before also was submitted to the Committee for its observation.

Q Did you not understand that Mr. McLeland in making his determinations on the Delaney No. 2 made them in substantial part from the core which was taken to the extent it was cored?

A Yes, but I am of the very firm opinion that those computations made by Mr. McLeland are substantially in error.

Q In what respect?

A In respect to the fact that he cannot derive the proper answer for the actual porosity, and therefore permeability that would exist if it had been cored and analyzed.

Q Then on the wells which were not cored in the unit to which you have given values, instead of using that method, you used the method of analyzing cores of nearby wells, is that right?

A That's right, because we knew that method was much better than the calculation of porosity.

Q Is the calculation of porosity an accepted engineering practice, nevertheless?

A It is an engineering practice. I cannot agree to the acceptance of it; it is done.

Q You think it is---

A But it is a very, very weak tool in the determination of porosity. If it were not we wouldn't spend so much money coring and analyzing wells.

Q You think it is better to take another well entirely and to look at the porosity and permeability there and then make the assumption it would be the same in the well which was not cored?

A In the Adena Field if you do it in the manner I described, without question.

MR. KIRGIS: No more questions.

COMM. BRETSCHNEIDER: Any more questions of the witness by anyone? (No response.) You are excused.

(Witness excused.)

COMM. BRETSCHNEIDER: Did you have another witness?

MR. STOCKMAR: No more witnesses; I would like to make a closing statement. If you are ready for that I would like to make one.

COMM. BRETSCHNEIDER: We are ready for it; are you

going to be long?

MR. STOCKMAR: No, sir.

MR. EPPERSON: I represent the Goedert family, a widow and seven children who have a half interest in this Delaney tract, and for the benefit of the new people on the Commission I think this matter is all in evidence, and I think that a little short review of what happened to this tract might be helpful to the Commission. This tract was originally included in the proposed unit. There was a tract factor assigned to it that would have produced about $700 in royalty over the 27-year period. Now, that's total royalty over the 27-year period.

Our people declined to sign the unit agreement with that tract factor on this particular half section of land. No, I guess that included 480 acres of land total, all of 26, except the one 40-acre tract. Lion Oil Company had the lease on this property; Lion re-leased it. It was taken out of the unit, and the land owners or the royalty owners were then able to obtain a most favorable lease from Petroleum Inc. This lease as most of the Commission know provides for continuous drilling program on each 40 acres, and after the second well, I believe, came in the proration was reduced, or the limitation of the production was down to 9 barrels of oil, and then the subsequent orders and hearings came on in which certain relief was granted.

Now, contrary to what I have been accused of I am in favor of unitization. I think it is a fine thing; I think it should be done. I agree with Mr. Kavaler that all of the oil production in Colorado should be unitized, but it should be unitized on the basis that the people get the proper tract factors who are the owners of this royalty. Now, this is not in evidence, and if it is objectionable I wish somebody would say something, but there has been evidence today concerning certain compromise figures that were suggested by the operators of the unit to Petroleum Inc. and Petroleum Inc. to the operators. On the part of the land owners the suggested figure that we would have agreed to in order to enter this unit would have been a tract factor that would have produced 25 barrels of oil per 40 acres. Now, that is as far as we have ever gone into the offer to join the unit. The whole program, the whole scheme of this thing--and I use the word advisedly--seems to be that there is an attempt by the operators of this unit to impose upon this Commission the duty of limiting this factor, in effect making it a unit factor which they cannot do by law under forced unitization, and I would like to have the Commission bear that in mind in your deliberation; thank you.

COMM. BRETSCHNEIDER: Thank you very much.

MR. STOCKMAR: Thank you all for listening,

gentlemen, so long and patiently, a day and a half or so here. Actually this matter seems to have boiled down in the hours we have spent here to a rather simple situation. What stands out very clearly was more than we hoped for as a rather almost unanimous acceptance by the lease operators of the perpetuation of the oil in place allocation theory. With that past us we seem to have only two and possibly only one major issue remaining, the first of which is the actual determination of the oil in place on the Delaney tract. Even there we are in substantial accord as to the Delaney No. 1 well, the Delaney No. 2 well, so we come down almost entirely to the calculations of oil in place demonstrated by the Delaney No. 2 well. I think we have conclusively shown by affirmative testimony on our own part and by cross examination that a good two-thirds of the oil in place allocation that has been sought has been based on a series of hypotheses, estimates, charts, quite a towering structure of cards.

At the same time we have that evidence as the affirmative evidence of one man who has spent only a few months--confirmed it was, though, by Mr. Kavaler. On the other side we have the years of work by a Committee including Petroleum Inc.'s man which arrived at our position. If there remains any question in your minds and the staff is burdened no doubt with a review of both sides of the case

here, we would be very happy to offer to submit the final determination of oil in place in the Delaney No. 2 well to arbitration, in effect. I say arbitration because we would be perfectly willing to furnish people to perpetuate the argument on an inch by inch basis, if necessary, if the Commission staff would deem that useful to it.

I think we come back to the foundationstone of Mr. Weyler's position, and that is that the evidence we have presented is the best that we can do on the basis of the facts that are today available. There has been no expression that they are absolute, that they are exact. They are simply the best that can be derived today. Another question which I thought would be a very substantial issue in the case is the question of drainage of the unit tracts. The substantial part of the unit's testimony was in support of proof that substantial drainage had occurred, would continue even under our proposal, and should be reduced since it cannot ever be entirely protected against and still leave enough to cover operating costs. There has been no contest with respect to that fact, so maybe it is no longer an issue, but again if it is in the minds of the Commission or its staff an issue, we will be perfectly happy to have the field shut down in its entirety, have bottomhole pressure bombs run in the wells in the area in question, and justify our interpretation of the pressure and drainage situation.

I might add that if anyone thinks that might be expensive to them that the unit operator will be happy to pay for pulling the rods and whatever is necessary. With response to the question that has arisen about unitization, all we can do now is to reiterate what we have done at every hearing, that the door is always open to negotiation for entrance to the unit. We should look at the door and define it; we have a unit agreement which is our committment to some 450 other royalty owners, so there is a frame around the door anyway within which people must enter; but at the present time as always we would be delighted to receive application to join the unit and it would certainly receive generous response.

I think that the question of whether or not the Bruce well in South Adena is in fact part and parcel and a contributing factor to the Adena Field proper has been finally settled by our own testimony and by that of Lion. I don't know whether it needed to have been done because it has been an established thing recognized by the Commission for a long time now. When I started out I was decrying the loss of a million dollars. I don't know whether that was conservative or not; at 113 barrels a day we seemed to jump to a million-six all of a sudden, and if the field will produce for eighteen years before blowdown we may have twice that; but, it is still a very substantial amount of money

that we are talking about, and is a lot of, even at thirty-five cents an hour, which is what I get, there is a lot of money being spent here today.

COMM. BRETSCHNEIDER: You ought to be on our payroll.

MR. STOCKMAR: That's twenty-four hours a day. To sum up, we ask that the Commission adopt as an order for the future handling for the field allowable the distribution of the permitted field allowable on the basis of our Exhibit C, allotting to tracts 81-D and 83 the barrels per day and the gas per day established in Exhibit C. Thank you very much.

MR. KIRGIS: May it please the Commission, I will try to emulate Mr. Stockmar's excellent example of being brief. I agree with him that in large part, not exclusively but in large part, this matter is a question of whose oil is in place where and who is right. In that I want to point out, just in case it might be overlooked, that I think it was brought out in Mr. Weyler's cross examination, that even his estimates on material balance and all of those things still related to and were founded upon the oil in place concept, so that I think it is true that all of the evidence here relating to the basic issue is dependent for analysis upon the acceptance of one value for oil in place as distinguished from another.

Now, I do want to point this out; it has been pointed out before, but much has been made of it, I think, at one time and another here, that Petroleum Inc. had a member of this Committee which did the basic work. That is true, but I think it has also been clearly brought out by the evidence that the member of the Committee did not commit Petroleum Inc. to the interpretation thereof. He indicated the acceptability of that work for purposes of negotiating toward the formation of a unit, and nothing else. I also want to repeat what I said in my opening statement, and I will do it very briefly because I am sure you have it in mind, and that is that those things which may be accepted by people for purposes of negotiation for agreement are not necessarily those things which they may accept for the purposes of this Commission, that this Commission has the further duty and function of determining what the true facts are, and cannot assume that what people said they will compromise on for an agreement is necessarily the true fact.

This is a situation where insofar as the Delaney tract is concerned the agreement did not come about. As to the other Petroleum Inc. tracts the agreement did come about, not initially, and when it did come about it did not come about on the basis of allocation of oil in place. It was a bargaining figure and was different from the allocation

of oil in place. Now, efforts have been made to get together on similar negotiations as to the Delaney tract, as has been pointed out. They have failed because the parties have been too far apart. That just puts it simply.

Now, Mr. McLeland has appeared before this Committee and he has presented his work in detail. He has explained every bit of it; he has explained what he has done. The Commission will have to make its own determination as to whether they accept Mr. McLeland's work. We think they should; we think the work has been done painstakingly and competently. Now, as to the matter which was referred to by Mr. Stockmar that this gets down in large part to the evaluation of what is shown as to oil in place as to the Delaney No. 2 well, I agree that that is a large part of it. It isn't the whole thing; there is an area factor, of course, involved in addition to the factor of how much oil is in place below the Delaney No. 2; but, it is our position that the method used by Mr. McLeland is an accepted engineering method and on analysis by the staff of this Commission will be accepted as an acceptable engineering method. On the other hand, the unit didn't even look below the place at which cores were taken at that well. They said, "It was cored to this point; that is the end of it." They didn't go beyond that. I think that is an unjustified conclusion; I don't see how it can be supported.

Now, whether Mr. McLeland's method of determining what was below it is the best or isn't the best seems to be a matter of disagreement. Two engineers have said that it is the best, and one has said that it isn't. Now, two against one doesn't make one right and the other wrong. That you can see, but I wish to point that out to the Commission. I understood Mr. Stockmar to suggest that this matter might be submitted to arbitration, and that I don't understand. The Commission is here and under the statute has the responsibility of deciding this case. We have submitted it to the Commission, and I think the Commission, unfortunately for the Commission, can't escape that responsibility.

Mr. Stockmar also mentioned the matter of drainage. I wish merely to point up what is I am sure apparent from the testimony which we have given, and it is founded on our Exhibits 8 and 9 and the interpretations thereof and effect thereof by both Mr. McLeland and Mr. Kavaler, that the method of operation of the nearby wells, and particularly the No. 5 well as a direct offset to the Delaney, has itself had a direct effect upon any questions of migration, any questions of pressure, any questions of GOR. Now, I am not saying and Petroleum Inc. is not officially taking any position that the unit operator has done something wrong from the unit standpoint. We are members of the unit,

too, but we are merely saying this, that whatever the motives may have been, and let us say that they were the finest, the results are the same, and the results have directly affected the Delaney tract as to pressures and GOR's, and that that is full indication of what can happen in the future; and again I am not imputing improper motives to the unit.

The unit has its problem of developing the property, protecting its property the best way it can. I don't begrudge them the necessity for facing that problem, but I do say that that problem existing, the Delaney tract is in a position where it must have both consideration and some protection, whatever may be appropriate, and Mr. Kavalex made a suggestion along that line.

Now, as to the ultimate problem here, we think it goes further than these oil in place studies. We have made our own oil in place studies because we wanted to do two things: one, we wanted to check for ourselves the work which has been done regarding oil in place and heretofore presented to this Commission; secondly, we wanted to have something to present to the Commission that it could consider on the basis of the theory heretofore adopted by the Commission. As I understand it in Order 26-30 the Commission has adopted a theory of allocation based on oil in place. As the Commission will recall from the hearing

which preceded that, we have serious doubt as to whether that is a valid and proper thing to do, but we wanted to come before the Commission this time not saying, "We think you did wrong," but saying, "Having done what you did let us analyze it and show our side of the picture on the basis and the theory which has been accepted," and that we have tried to do in good faith and at great pains and with an infinite amount of work; but, we do want to make the point beyond this, and this relates in substantial part to Mr. Kavaler's testimony, that this is an edge tract. We have to concede that, of course, it is perfectly obvious, that there is an edge tract problem. Even if one assumes the validity of an oil in place theory for allocation of production, it cannot necessarily be applied by use of the ruler or a fixed measure to edge properties, because if it is, as Mr. Kavaler pointed out, then you are never going to get the edge east of these fields defined and there may be oil lost and never recovered, and it is not the function of this Commission to permit that to happen. This Commission as it knows far better than I, is charged with the responsibility for securing the greatest ultimate recovery of oil in the State of Colorado and preventing the largest possible amount of waste. Consequently accepting this theory, and basically we do for the purposes of this hearing, even though we might quarrel with it at another time, still

for edge properties there must be some modification of the theory. Now, I think it is perfectly evidence that that is so. From the proposal made here it will be recalled that originally a year and a half ago the oil in place theory, as the oil in place was calculated by Pure Oil Company, the unit operator, gave nine barrels to this tract, and who in the world can drill and operate a well on nine barrels, or who in the world would be foolhardy enough to drill one who when he got through with the well he would have nine barrels, whether he thought it because of the geological position or whether he thought it because of the imposition of a rule by the Commission.

Now, there has been other development since then. There was only one well on the Delaney tract at the time that proposal was made. At the time of the unit negotiation the suggestion was made thirteen barrels for the tract. As of yesterday and today that has gone up to twenty barrels for the tract, but who in the world--there are three wells there, and as has been said, the No. 3 is probably going to be discontinued in the "J" sand and probably taken back up the hole trying to complete in the "D" sand, so let's just say for practical purposes there are two wells. That's what it really is. Who is going to drill a well out there if he knows that he is apt to have a ten barrel per well limitation thrown on him? People in the oil business are

there for practical purposes. No practical purpose is served for the benefit of anybody by drilling a well from which you can get ten barrels per day, whether it is because of the conditions there or because of an order which has been imposed, and I think the Commission must recognize that fact in its determinations and deliberations on this problem.

So I repeat, basically we believe and we believe it with sincerity on the basis of much detail work, that on the oil in place theory there is roughly a million and a half barrels under the Delaney tract. Using the factor which has been recognized heretofore by the Commission that would mean 113 barrels per day for the tract, not per well, of course, counting as a practical matter as two wells it obviously means something like 57.5 barrels a well. Now, that we believe and we request the Commission to give most serious consideration to.

But over and beyond that whatever the Commission may decide, I think it must also keep in mind that an edge property has to have some recognition and some protection. Now, we were going to give to you--but I am going to foreshorten this--we were going to give you the set-up as it exists in Kansas and Texas and Oklahoma. I think the Commission knows that pretty well anyhow, but in Kansas, for instance, by statewide order a well at this depth would

have a minimum allowable of 37 barrels. In Oklahoma there is a statutory minimum of 25, but the Commission says, "Even though the legislature says 25 for certain conditions and certain depths, we are going to make it more than that." This would be, I think, around 35 barrels in Oklahoma at this depth.

Now, we don't need to go into those details, but that is a factor which has been recognized, I think, throughout by regulatory bodies dealing with the problems with which this Commission is faced, so we say first we have a proper oil in place calculation which should give to this tract 113 barrels a day. We say second that that cannot seriously injure the unit; certainly it cannot control the unit's operation. This tract is a little bitty tail on a great big dog. Third, we say that whatever the calculations may be on that, that there must be some recognition of the fact that nobody in his right mind in the oil business can drill wells when he has any expectation of getting only ten barrels per well per day, and in other states it has been recognized and allowables have been set any place from 25 barrels up, depending on the depth of the well. Someone just gave me a note that I was wrong, in Kansas that it would be 48 barrels, not 37, but that's a small matter. Those are the principles which we think this Commission must recognize, and it is on that basis that we put our case in

the Commission's hands.

MR. WESTFELDT: Even shorter than the gentleman that preceded me, I would like to say that if the Commission staff wants any assistance or information from Lion Oil Company with respect to developing any more detail on oil in place, why, the Lion people would be glad to help. Lion has heard all of this testimony and considered it very carefully and supports the position of the Pure Oil Company.

MR. KIRGIS: May I say one more thing? Each of the other parties here has offered to help the Commission staff; I didn't make that offer. We will be happy to do it, but I would say this: If others have the opportunity to sit down and discuss this with the Commission's staff, we would like to have the opportunity to be there, too.

COMM. BRETSCHNEIDER: Thank you very much.

MR. HAFFKE: Gentlemen, I represent the other royalty owners, being Mr. Delaney and Mr. Doll, their two small ones, and I think I can concur heartily in what Mr. Epperson has said. Now, our position as royalty owners is different. We seem to be more or less caught in the middle; our position here is that we have been pretty much dependent and relying upon the Commission. Probably we are quite helpless without the Commission. One thing that hasn't been observed very generally, while it has been mentioned

in the testimony, is that by the Commission's order which limited the oil in place in that No. 1 Delaney to nine barrels, that had it not been for your prudence and foresight in making a ruling we would have had Pure in this position where they have an additional club. I think their witness admitted that they would have been perfectly happy to accept that tract in the unit on the nine barrel basis. Now, if you followed the exhibits going through the first proposal that was made, it allocated just a few thousand dollars worth of oil to this whole big tract. I think conscienciously the unit engineers probably tried to present that, but there was another side to it; also they are conditioned on joining. In other words, we accept the whole tract with no further drilling.

Now, after the No. 1 Delaney came in there was an increase in that amount dollarwise. If we would have accepted their first proposals it would have just meant a few hundred thousand dollars that the unit would have gotten, not the poor royalty owners; they wouldn't have gotten any.

All right, the second proposal was before the Commission before the No. 3 came in. Now, I think they have gone up to where they come to about $207,000, but they always want it on the one-way street. "This is it, this

is the way we will accept you; if you do there is no more drilling on your unit. That's the risk you take." Now, between the first presentations and where they are now it has bothered us terrifically to think that that was possible, that they would gladly establish a small allocation even if there was more oil, that's all right for the unit to have it.

Now, we are about up to this position: We are just about totally dependent upon this Commission to create the equalizer. We are dealing from down in the hole. We are in this position, notwithstanding our best advice and counsel that we have got 1,500,000 reservoir barrels of oil in place, we can't get into the unit without their saying what, "We will take you in." Now, they have had a reverse club, gentlemen, which the experience--that is, the foresight of this Commission in previous orders--has shown has been real inequitable and has defeated the purposes of conversation. Just follow their own figure; I think we would go into the unit on a fair and equitable basis if we have the equalizing situation. Even though this Commission rules on the evidence that was presented that there is 1,500,000 barrels of oil in place, we can't get into it. The only way we can get into the unit on a fair and equitable basis, gentlemen, is this Commission making a finding as to what we really have down there that is substantially more

than they have ever conceded.

There is every reason to think that that is possible by the history that has gone on, and we have got it substantially established by good credible testimony fairly made, and I think when you compare the plats and everything else you will concur with them, and I imagine that if this Commission would sustain that and find that the equitable allowance is 113 barrels a day for 14,000 barrel unit production, we won't be playing a five man team with two players, and, gentlemen, I submit to you and I reaffirm it, that we have had the experience even in this case in a small part of how much more oil was found by making it possible.

Now, I concur with Mr. Epperson on a fair and equitable basis, and I, too, believe that a unit operation is wonderful; but, I don't concur that from poor royalty owners or land owners a million and a half barrels of oil should be made possible to a big operating unit, and they talk about money in this thing. The exact reverse is true of what they present. If there is all this reservoir of oil under it, and there is every indication that it is being enlarged constantly since the controversy has been going on, they are taking away from this tract to the advantage of the unit.

Gentlemen, I submit to you that in conscience and

equity that if the oil in place theory is to be followed the type of allocation which should be made by this Commission is a determination of a million and a half barrels of oil in place. If that is impractical, then we should have the type of marginal encouragement, the edge field encouragement similar to these other states, 50 barrels of oil per day on the wells that are drilled. Thank you.

MR. STOCKMAR: Gentlemen, I think the Plaintiff always gets the last word, doesn't he?

COMM. BRETSCHNEIDER: Well, you may have it.

COMM. DILLON: Is this Mr. Robison?

MR. STOCKMAR: Excuse me, go ahead.

MR. ROBISON: I was just going to say I think the matters have been covered pretty well by the other defense, so I am going to make the shortest one. I am all through.

MR. STOCKMAR: I would simply like to direct the Commission's attention to the copy of the unit agreement covering the unit which is on file with the Commission and which has been approved by it. In there is the clear language which will dispell the statement that Mr. Haffke just made. Under the framework which we are obligated to uphold for our royalty owners, no tracts can be admitted to the unit except that it have a producing well on it,

and on the basis of the oil in place on a particular tract we are today willing to, and would hope for admission of those particular tracts.

What Mr. Haffke may have been referring to is the granting from working interest pockets of an additional bonus to encourage the joinder of the entire Delaney tract. On that basis we have imposed a condition that these problems be set at rest forevermore and that we be allowed to proceed with the operation of the field; but, that is not a condition to entrance as provided by the unit.

I would like to also call your attention to a statement by Mr. Kirgis which I do not believe Mr. Weyler's testimony would support, and that is that he ignored everything below the core depth. That is not true and the statement was not to that effect. He gave it the same kind of consideration that similar problems were given in other parts of the field, and lastly I did not mean to suggest arbitration by some third body; I simply meant to offer cooperation to the staff in unraveling this detailed problem.

COMM. BRETSCHNEIDER: Would anyone else like to address the group now?

MR. DELANEY: Mr. Commissioner, I would, if you please. I am Mr. Delaney and Mr. Haffke is acting for us, but I would like to say this: Mr. Stockmar just has said, I think I was sitting back here a little ways; if I am

wrong correct me, that there was no condition written into any unit agreement on prohibiting further drilling in the "J" sand horizon, is that the way you stated that?

MR. STOCKMAR: Would you restate that question, Mr. Delaney?

MR. DELANEY: I said that there is nothing in the unit agreement which we would have to sign that states that further drilling in the "J" sand horizon is prohibited, is that correct?

MR. STOCKMAR: We have a development pattern on a forty-acre basis, and the unit permits only the addition without going to all 500 people again and revising the whole unit, permits the entrance at this time only of, on enlargement, of tracts upon which there is a producing well. It may be that it could have been written differently years ago, but for better or worse that's what it says.

MR. DELANEY: I hope you will excuse me, but I want to point out to the Commission that while there is nothing written in the unit agreement to that effect, that the operator of any outlying tract or the royalty owners--I know of one instance it hasn't been offered to us, because we haven't gone that far with it--but, I know with the Robison's there was a separate rider or agreement that they would have to sign to have their property accepted in the unit; that they and their operator

would not do any further drilling in the "J" sand horizon.

MR. STOCKMAR: That's precisely what I said, that that involved the bringing in of the entire tract, which is not permitted automatically under the unit agreement for a bonus to set at rest the problems.

MR. DELANEY: We have failed to see any bonus. Thank you.

COMM. BRETSCHNEIDER: Gentlemen, we certainly appreciate all of the new data which you have furnished to us; I am quite sure that you appreciate that we do know something about the Adena Field. We haven't been sitting here and working on all these problems for all these months and years without having some knowledge of the situation, but this problem is a very difficult one. We can see here and have seen during this two days now that it is impossible for your fellows to join up. It is impossible for you to agree on a basis apparently, so we have the problem of studying all the information that you have presented to us and endeavoring under our statute to reach a conclusion that is fair and equitable. I would say under the statute that you know that under our statute we are limited to a degree as to what we can do. We can't force anyone to join the unit; the only thing we can do is to prevent waste or do something to prevent waste, and to prevent abuse of correlative rights, and I think the data which you have

furnished us today gives us some type of a basis.

I don't know just exactly what it is; you know there is an order out now under which you are operating. We will have to read it first and then see in what form we can modify it. We have already talked about it in several ways, but the data hasn't changed much excepting that we now have a new basis of oil in place. That will have to be studied and correlated with the data which we already have and under which the unit is being operated. Whether or not we can come up with something between remains to be seen; but, anyway we believe that we will be able to arrive at some type of a conclusion that may, in the absence of any further development, postpone a final decision for a little while.

I don't know just exactly what it is. Aside from that I think the Commission should not discuss the matter any further. I thank you very much, and if there is nothing else to be said---

MR. KIRGIS: May I make one inquiry?

COMM. BREITSCHNEIDER: Yes.

MR. KIRGIS: I would assume this to be the fact, but I would like to varify it, that until the Commission promulgates another order the temporary order now in effect would continue, is that correct?

COMM. BREITSCHNEIDER: Yes, I think that's correct,

so therefore the meeting is adjourned.

(Whereupon, at 3:23 o'clock p.m., May 28, 1958, the hearing was adjourned.)

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REPORTER'S CERTIFICATE

I, Keith B. Watson, Certified Shorthand Reporter, do hereby certify that the foregoing transcript, consisting of pages 200 through 376, constitute a true, correct, and complete transcript of my stenograph notes taken in the foregoing matter.

Keith B. Watson
Certified Shorthand Reporter

616 Kittredge Building

Denver 2, Colorado

AM 6-0013

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LAWYER'S NOTES

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