



2-27

pgs 1-50

BEFORE THE OIL AND GAS CONSERVATION COMMISSION
OF THE STATE OF COLORADO

IN THE MATTER OF THE INVESTIGATION TO
TAKE MEASURES TO PREVENT WASTE OF OIL
AND GAS IN THE RANGELY FIELD IN THE
STATE OF COLORADO.

CAUSE NO. 2

PURSUANT TO NOTICE to all parties in interest, the
above-entitled matter came duly on for hearing at the State
Capitol, Denver, Colorado, at the hour of 10:00 o'clock a.m.,
November 21, 1955.

BEFORE:

Mr. Warwick Downing, Chairman
Mr. H. C. Bretschneider, Commissioner
Mr. F. M. Van Tuyl, Commissioner
Mr. W. A. Dillon, Commissioner
Mr. Prescott Eames, Commissioner

APPEARANCES:

E. G. Knowles, Esq., Denver, Colorado,
Lee S. Osborne, Esq., Los Angeles, California,
D. O. Churchill, Esq., Los Angeles, California,
Read Winterburn, Los Angeles, California, for the
Union Pacific Railroad Company;

Walter E. Will, Esq., Denver, Colorado,
T. O. H. Mattson, Denver, Colorado,
Tom T. Freeman, Denver, Colorado, for the
Texas Company;

F. L. Kirgis, Esq., Denver, Colorado,
R. M. Williams, Esq., Bartlesville, Oklahoma,
Jack Turner, Bartlesville, Oklahoma, for the
Phillips Petroleum Company;

APPEARANCES: Continued

R. W. Sullivan, Esq., Denver, Colorado,
L. M. Lamar, Esq., New Orleans, Louisiana,
E. N. Dunlap, Denver, Colorado,
A. L. Vitter, New Orleans, Louisiana,
John W. Woolfolk, Esq., New Orleans, Louisiana, for
The California Company;

John W. Stayton, Esq., Austin, Texas,
Samuel Butler, Jr., Denver, Colorado,
Max S. Loy, Denver, Colorado,
R. J. Corbett, Denver, Colorado, for the
Sharples Oil Corporation;

T. J. Files, Esq., Casper, Wyoming,
T. Murray Robinson, Esq., Tulsa, Oklahoma,
R. B. Laughlin, Esq., Casper, Wyoming,
R. B. Giles, Casper, Wyoming,
M. O. Hegglund, Casper, Wyoming, for the
Stanolind Oil & Gas Company;

Peter Holme, Jr., Esq., Denver, Colorado, for
McLaughlin interests;

Fred Evans, Esq., Salt Lake City, Utah, for the
Equity Oil, Weber Oil, and Utah Southern;

M. F. Westfall, Cody, Wyoming, for the
Husky Oil Company;

A. J. Jersin, Denver, Colorado, Deputy Director,
Sam Freeman, Esq., Denver, Colorado, for the
Oil and Gas Conservation Commission.

(Whereupon, the following proceedings were had.)

I N D E X

<u>Witnesses</u>	<u>Direct</u>	<u>Cross</u>	<u>Redirect</u>	<u>Recross</u>
Martin Hegglund	9	25		
R. B. Giles	39	58	81	83
Jack Turner	85	96		
T. O. H. Mattson	97	111		
J. Howard Barnett	132	153	159	
E. N. Dunlap	163	196		

Exhibits

<u>Stanolind</u>	
<u>Ex.</u>	<u>Page</u>
1	10
2	15
3	20
4	40
5	45
6	47
7	49
8	51
9	54
10	55
11	56

<u>Phillips</u>	
<u>Ex.</u>	<u>Page</u>
1	86
2	87
3	89

<u>Texas-U.P.</u>	
<u>Ex.</u>	<u>Page</u>
1	101
2	102
3	103

<u>(Barnett)</u>	
<u>Ex.</u>	<u>Page</u>
1	137
2	139
3	140
4	141
5	142
6	143
7	144
8	146
9	150

<u>California</u>	
<u>Ex.</u>	<u>Page</u>
1	163
2	164
3	171
4	172
5	174
6	180
7	183
8	184

CHAIRMAN DOWNING: We are ready now for the Rangely Case. Let me inquire first, have the operators gotten together in the meantime on anything?

MR. KIRGIS: Judge Downing, the inquiry is broad. I don't know what the intended scope may be.

CHAIRMAN DOWNING: Well, let's ask if the operators got together on the field rules to apply on the Rangely Field.

MR. KIRGIS: All the operators except the California Company have reached an agreement as to an order, a proposed order, to be presented to the Commission.

CHAIRMAN DOWNING: Why haven't the California people and the other operators agreed?

MR. KIRGIS: They have not been asked to; all the other operators have.

CHAIRMAN DOWNING: All right, you might make an opening statement so we can find out just where we are and what we have before us.

MR. KIRGIS: May I proceed in that instance?

CHAIRMAN DOWNING: Yes, sir. If you will proceed and tell us what you have agreed to then we will ask the California Company to say what they want.

MR. KIRGIS: I am Frederick L. Kirgis, representing Phillips Petroleum Company. In an effort to aid the Commission as I indicated a moment ago, certain of the operators in the Rangely Field have had a series of meetings and conferences;

the effort being to arrive among themselves at a single proposal which might be presented to this Commission and might be supported by an integrated presentation of evidence. The companies who have done this are Sharples Oil Corporation, Stanolind Oil and Gas Company, The Texas Company, the Union Pacific Railroad, and Phillips Petroleum Company. Let me say at the outset that in a spirit of cooperation each of those operators has compromised his original position to some extent. Each, I think, has given up on some of his own views and desires in an effort to be able to reach an agreement among those operators and in the hope that by doing so we might be of some assistance to the Commission, in the saving of time to the Commission, and in the avoidance of four or five contrary proposals as we have so often had before.

Now in aid of this program I shall make an opening statement on behalf of all of the operators whom I have named, that being all of the operators other than the California Company. At the outset let me emphasize that each of these operators, and including specifically my own client, does not commit itself to any of the elements in this proposal except for the purposes of this proposal. Also each of the operators expressly reserves to itself the right, as conditions may change in the future in the judgment of each operator, to request any modification or any complete change of theory as far as that is concerned if this order should be adopted by the

Commission today. In other words, it is an order which we think is fitting for present conditions in the field. We do not know and I dare say none in the room are wise enough to know whether it will continue to be fitting to conditions in the field in the future. Therefore, we would like to have it clearly understood that our joint sponsorship of this proposal does not foreclose any of us from seeking a modification of this proposal or a complete change of this proposal when circumstances may, in our own judgments, so indicate for the future.

Under the proposed order it is our engineering estimate that as of today somewhere in the neighborhood of 7 million cubic feet per day might be flared in the Rangely Field. Now as to the order itself, we have many copies here and it might be best to pass them around. I will explain the order briefly, but we have a number of copies which we will pass around so you might have them before you.

I will explain the order very briefly, but I think I will cover all the main points, and the complementation you may see in the written form. In substance this proposed Order, which would become 2-27 if adopted, permits a maximum flare of 150,000 cubic feet per day per well. At the same time it is anticipated that all of the operators would agree, and all of those on behalf of whom I am making this opening statement are willing to agree, that they will continue to use their installed

compressor capacity to full capacity during the pendency or the effectiveness of the order.

Now an injection well is to be allowed under this proposed order 150,000 cubic feet per day also that would be attributed to each injection well and could then be transferred from that injection well to a well actually producing the amount of gas in excess of 150,000 cubic feet per day per well, if there be an excess and the order will permit it, if, and only if, it is used in one of the following ways: If it is returned to the Weber formation; if it is returned to another formation which has been shown by them to be feasible for the storage of gas; if it is used for field operations; if it is sold for beneficial use; or if in the interim period it is used in aid of a pilot program to evaluate the storage possibilities in a formation other than the Weber. Then there is the specific provision in the order also regarding this so-called pilot program which would permit any operator or any group of operators to proceed with a pilot program for the purpose of determining the feasibilities of storage of gas in the Entrada formation as distinguished from the Weber formation.

Now as to gas flare, each well would be allowed a 10% tolerance and that tolerance would have to be adjusted within the second succeeding month. Let me point out that the order is on a per well basis, 150,000 cubic feet per well, but from an administrative standpoint that seems difficult; so

therefore the order provides that in the administration of the order it shall be done on a battery basis but with the express provision that no well attached to any single battery shall have attributed to it any amount of gas in excess of that which it physically is capable of producing. In other words, if there is a well in a particular battery that can produce only 100,000 cubic feet of gas, that battery will be allowed only that amount of gas for that well; there won't be an extra 50,000 to be spread some place else.

The order also provides for monthly gas-oil ratio tests in the same manner as has been provided before. Also the order provides, as have prior orders, for the making of full reports to the Commission, and that includes in this instance specifically reports on the pilot program which may be conducted in the Entrada formation. Now that in substance is the order to the full extent that it has been possible to do so. In the drafting of this order we have used the same form of provision and statement that has been used by the Commission in prior orders. Now as is obvious, this proposed order does not place a top allowable on oil production.

Now in support of this order there will be an integrated program of proof. Stanolind Oil and Gas Company will bear the principal burden of presenting evidence in support of and in explanation of the order itself. In addition to that, Stanolind will as to its own properties present evidence

in disproof of the claim which has heretofore been made by the California Company that there has been a drainage pattern established in the field which is injurious to the correlative rights of the California Company; and in that connection, of course, Stanolind will also introduce proof that under this order there will be no injury to the correlative rights of the California Company. Then Phillips Petroleum Company will present evidence as to its properties, also addressed to the same problem of drainage and correlative rights, which proof we believe will show that the operation of the Phillips properties in the western end of the field, which is the portion of the field that is most subject to controversy, there is no practical or substantial injury to the correlative rights of the California Company. Then the Texas Company, joined by Union Pacific and Sharples, will present evidence in connection with the proposed pilot program for injection and storage of gas in the Entrada formation. Studies have been made, paper work has been done, evidence of the results of that work will be submitted, and the engineering evidence as to the feasibility of Entrada storage will be given, and as to that the evidence will point out to the Commission just how that pilot program is expected to be undertaken and what proof may be expected from it.

That in substance will be the evidence presented by the operators other than the California Company. In all we

sincerely believe that this evidence will demonstrate fully the wisdom and the desirability of our proposed Order No. 2-27 as a conservation measure properly adapted to current conditions in the Rangely Field as a means of maintaining production at current levels from by far the largest oil field in the State of Colorado and as the only true means under current conditions of protecting the correlative rights of all the parties in the field. Now if we may, we are ready to proceed with the evidence by Stanolind Oil and Gas Company.

CHAIRMAN DOWNING: Did I understand that your proposal was you would agree to inject gas to the capacity of your present plant?

MR. KIRGIS: That is right.

CHAIRMAN DOWNING: That doesn't appear in the order, does it?

MR. KIRGIS: Yes, it appears as a finding. We did not put it in as an order on the theory the Commission would not wish to make such an order after the Supreme Court decision of last year.

CHAIRMAN DOWNING: All right, does any of the Commission want to ask Mr. Kirgis any questions to clarify the statement?

COMMISSIONER BRETSCHNEIDER: I would like to ask one question. You mentioned in your remarks in the beginning that currently there was about 7 million cubic feet of gas being flared.

MR. KIRGIS: It is our estimate under this order currently there would be about 7 million flared.

CHAIRMAN DOWNING: That is what you estimate this order would result in, 7 million feet a day of flaring?

MR. KIRGIS: That is right.

CHAIRMAN DOWNING: All right, does California Company wish to make an opening statement now?

MR. FILES: I am T. J. Files of Stanolind Oil and Gas Company. I would like to enter the appearance for myself and T. Murray Robbinson, R. B. Giles and Martin Hegglund. One of the chief purposes of the hearing today is to allow us to put on our evidence relative to drainage and we are ready to put it on and we would like to proceed in that manner if it's agreeable to you.

COMMISSIONER BRETSCHNEIDER: I think we should have the evidence of the group to follow up Mr. Kirgis' preliminary statement so we could have the entire picture before us, and then later California Company I suppose will want to be heard considering their position as regards the plan now being presented. I think as long as we have heard Mr. Kirgis' remarks we should hear all the testimony that support his remarks and I believe we should hear them now. I don't know what you want to do about it but since we have in our minds what Mr. Kirgis has just outlined and explained I think they should follow with all the details.

CHAIRMAN DOWNING: Let me ask, does the California Company want to make an opening statement and give us a better idea of what the issues are?

COMMISSIONER BRETSCHNEIDER: They don't know what the issues can be because they haven't heard the detail.

MR. SULLIVAN: I think we will wait and see what is unfolded before we attempt to make any statement.

CHAIRMAN DOWNING: All right, we have no right to force you to make an opening statement. All right, you may proceed with your evidence.

MARTIN HEGGLUND

called as a witness on behalf of Stanolind Oil and Gas Company, being first duly sworn, upon his oath testified as follows:

DIRECT EXAMINATION

BY MR. ROBBINSON:

Q. State your name please.

A. Martin Heggund.

Q. What is your profession?

A. I have a Degree in Petroleum Engineering from the Colorado School of Mines in 1941.

CHAIRMAN DOWNING: This witness has testified frequently and if there is no objection he will be considered as fully and adequately qualified.

Q. What is your capacity with the Stanolind Oil and Gas Company?

A. I am District Engineer for the Casper District. I

might say the Rangely Field is within this district.

Q. You have participated in conferences at which the recommended order was agreed upon by the various operators in the field?

A. Yes, I have.

Q. In connection with that have you made a study of this reservoir for the purpose of discussing the question with the Commission as to whether or not under the existing circumstances it is a reasonable order?

A. Yes, I have.

Q. In connection with your study have you prepared any charts which you wish to show to this Commission?

A. Yes, I have three charts that I wish to show the Commission.

Q. There has been placed on the easel an exhibit marked Stanolind's Exhibit No. 1. What is shown thereon please?

A. By Exhibit No. 1 I have shown a Performance Comparison of a typical solution gas drive reservoir versus that of the Rangely Field, that is the Weber Reservoir of the Rangely Field. The chart as drawn from the typical reservoir you will note is specified, "undersaturated oil", which so happens is the situation for Rangely. By an undersaturated oil, for the benefit of the Commission, I might add that that pertains to a type of oil that does not contain all the gas in solution at a given initial reservoir pressure that it is capable of

carrying. An illustration might be at 2500 pounds the reservoir might be capable of holding 500 cubic feet per barrel in solution, whereas possibly it only has 400 cubic feet per barrel in solution; therefore it is termed "undersaturated". The primary purpose of showing this comparison lies in the fact that in a solution gas drive reservoir, rate has no bearing on ultimate recovery.

Now I would like to elaborate by going to each of the individual charts and illustrate some of the pertinent factors of this typical reservoir with the Rangely Weber Reservoir. You will note on the left hand scale that I have plotted Reservoir Pressure. On the right hand scale I show Gas-Oil Ratio in cubic feet per barrel. Both of these variables are plotted against cumulative oil recovery in per cent of original oil in place.

Let's examine the fine features of this performance. Early in the life of the reservoir due to the fact that oil is undersaturated, you will note a fast decline in reservoir pressure. Then after the reservoir pressure reaches this so-called saturation point, solution gas will start to evolve and expand the oil and that is then the primary force that moves the oil to the well bore. Simultaneously, your gas-oil ratio starts at a low level and proceeds at that low level until it arrives at that so-called bubble point or saturation point and then you start producing gas over and above the solution

ratio. Then you will notice an accelerating trend in gas-oil ratio. That trend will reach a peak near the latter life of the reservoir, at which point your gas is essentially dissipated. Then your gas-oil ratio will decline fast to your economic limit. Likewise, you will note that your pressure from that peak of gas-oil ratio declines to your pressure at abandonment conditions. This typical chart illustrates that for a reservoir of this type, primary oil recovery would possibly be in the order of 20%. Of course that can vary with individual reservoirs depending with the oil itself in that reservoir and other pertinent reservoir factors.

Now let us examine what has happened at Rangely. The left hand scale you will note is being plotted as pressure, the original pressure in Rangely was 2750 pounds per square inch at a 900 foot datum, which I might say is the accepted datum by the engineers for making pressure comparisons. The reservoir pressure has declined rapidly during the initial stages and has shown some tendency to flatten since that point, being this point in here. Gas-oil ratio started out initially making approximately 300 cubic feet per barrel, was fairly level in value for some period of time or some period of cumulative oil production, and then just like the typical reservoir has had an increasing trend in magnitude. The purpose of this chart is to illustrate that Rangely is acting very logical with respect to being a solution gas drive reservoir.

Q. I observe you do not have on there anything which indicates the rate at which the reservoir is produced?

A. That is correct.

Q. Is it for the reason that in this type reservoir the rate of production has an insignificant effect upon the ultimate recovery?

A. That is right. I might add that the only way you can increase recovery from this type of a reservoir is to by some means maintain that reservoir pressure to a higher level than it would naturally follow. By that I mean if gas were returned to the reservoir within economical and practical limitations that would have some bearing on maintaining the reservoir pressure at a higher level than it would otherwise, in which case your pressure curve would follow a trend that would enable you to arrive at some higher ultimate recovery.

Q. Then the only conservation element involved is in flattening that pressure curve?

A. That is right.

Q. Now do you have another chart which you have prepared in connection with your testimony here?

A. Yes.

COMMISSIONER VAN TUYL: May I ask a question on this chart. At what point on the chart on the right did the injection come in, Mr. Heggland?

THE WITNESS: The early phases of gas injection. Let

me qualify that. The pilot injection was back at this point here, but the fieldwide injection began at a point of approximately 6% of oil in place.

CHAIRMAN DOWNING: Let me ask, has our program of reinjection been a complete failure?

THE WITNESS: In my opinion, from a reservoir standpoint, I think it has been of some benefit. There are some factors that have made it difficult for individual operators in localized areas in the field, it has given them some serious problems.

MR. JERSIN: But on a field basis it has been of a benefit?

THE WITNESS: I feel so far it has been of some benefit, yes.

CHAIRMAN DOWNING: In other words your company and all the other companies joined in this reinjection program, spent a lot of money in it, and now that it's over it has accomplished very little, do you think, practically nothing at all?

THE WITNESS: Mr. Downing, I think it has accomplished some purpose, yes. I think it has been of value but I think we do have a situation in the field where it is almost impossible for the operators to continue to return all of the gas and I think we have to look toward other resolutions to take care of the problem.

CHAIRMAN DOWNING: In other words, the testimony before was that gas reinjection would result in an ultimate recovery of from 30 million to 80 million barrels. Is that testimony wrong?

THE WITNESS: That is something pretty difficult to evaluate that quantitatively, and frankly I don't know.

CHAIRMAN DOWNING: That 80 million was the estimate of Mr. Zorichak who was then our Director, and he was a pretty competent man. You don't agree with him?

THE WITNESS: Mr. Downing, I wish that this field were unitized and then I think I could stand up here and say there would be a lot of benefit from gas injection.

COMMISSIONER VAN TUYL: Isn't it true, Mr. Hegglund, that there is evidence that your reservoir pressure curve is flattening out there, which is beneficial?

THE WITNESS: Yes, we have had some flattening in the past two years.

Q. I refer you now to Stanolind's Exhibit No. 2. What have you drawn this chart to illustrate?

A. I have drawn this chart to clarify in the minds of all present the actual disposition or distribution of gas in the Rangely Field as divided between injection; fuel, sales, and shrinkage; and non-utilized gas, which some might prefer to call flare or vent. You will note in my preparation of this chart that I have gone back to the beginning of 1954 to get an

appropriate background on what has happened whereby I can properly illustrate what might happen in the near future. Now let's examine the features of this chart. On the left hand scale I have shown oil production which I have plotted in terms of daily oil. Higher on the left hand side I show a plot of gas-oil ratio as experienced in the Rangely Weber Reservoir. Then on the right hand side I have a scale showing the daily gas production or distribution in terms of millions of cubic feet per day.

Let's briefly review the history since 1954. Oil production for the year 1954 was proceeding at an approximate rate from the total field of 60,000 barrels per day. During late 1954 the production was increased due to market circumstances to a value between 64 and 65 thousand barrels per day, and you will note that up to the present time that oil production has been approximating 65,000 barrels per day. The gas-oil ratio during that period of time had a value of approximately 900 cubic feet per barrel in early 1954, has risen steadily as would be expected, and it is now at a value very close to 1700 cubic feet per barrel.

Q. That is the average field ratio?

A. That is the total field ratio. Attendent with that gas-oil ratio increase is your production of gas which has likewise increased, and in referring to our scale you will note it was running approximately 55 million cubic feet per

day in early '54; whereas as of the current day the gas production is very close to 115 million cubic feet per day. During this period of time the operators have been injecting gas with a very minimum of flare. On this chart the red is indicative of the gas that has been injected; the green is indicative of the gas that has been utilized in the field for useful purposes, fuel, miscellaneous sales, process shrinkage at our gasoline plant, fuel for our compressors in the field; and the yellow band represents what has been flared in the Rangely Field, and you will note that it has been insignificant.

Q. Now that chart represents actual figures to what date?

A. It represents actual figures through September, 1955, which is the latest source I have with the complete data.

Q. Thereafter it represents a projection?

A. From that point it represents a projection which is based upon my study as to what will happen within the foreseeable future.

Q. Is that estimate based on an interpretation of what will happen under this proposed order if it be adopted by this Commission?

A. Yes, sir.

Q. And then give us the bases for your various projections of the three types of uses of gas, the three things which will happen to the gas.

A. Let us take these projections one at a time. For the

daily gas production curve, which is the overall production curve, I have projected the gas production based upon gas-oil ratio trends, making a review of each operator's situation, and I have assumed that the field rate would continue at approximately 65,000 barrels per day. As of September, 1955, the field was injecting approximately 80 million cubic feet of gas per day, and under our proposed order we would continue to use our present compression facilities, so by our order we would automatically be taking care of 80 million cubic feet of gas per day from the field. I might add that during November, I have seen one or two weeks data, and probably this value here would be conservative because during the first week of November there was almost 84 million per day being handled in the field through compression facilities. I made a study of the fuel sales and shrinkage and uses in the field, and during the last five or six month period approximately 24% of the produced gas was being utilized in the field in the form of fuel, miscellaneous sales, shrinkage, and other useful purposes.

Q. So you kept that at a constant factor?

A. Therefore I applied the 24% to the total production to extrapolate the volume of fuel, sales, and shrinkage. Then the sum of the red and the green subtracted from the total gas production represents the possible venting of gas in the field.

Q. During the period shown on that chart, does that take into consideration any increase in injection facilities or

any increase in sales?

A. No, sir.

Q. Have you another chart prepared which represents this gas percentagewise?

A. Yes. I believe it would tend to elaborate and clarify this picture.

COMMISSIONER BRETSCHNEIDER: Before you leave that I would like to ask one question. Did you have a particular reason for ending your chart at June, 1956?

THE WITNESS: My reason for ending the chart at that point was that I felt that such factors as storage would enter into the picture, there would be the possibility of gas sales entering into the picture, and those things would so enter the picture that I just didn't feel I was justified in projecting this thing any farther.

Q. Probably you had in mind the possible sale of gas to the Northwest Pacific Pipeline which is coming through Rangely?

A. That is a possibility.

MR. JERSIN: Does that 80 million injection represent the injection capacity of the entire field right now?

THE WITNESS: Frankly it appears that it's a little higher than that based upon the data from the first week of November. That information was available when I prepared this chart. There is apparently capacity for about 84 million cubic

feet per day based on the first week of November.

CHAIRMAN DOWNING: Mr. Robbinson, you haven't designated these maps by number or letters?

MR. ROBBINSON: They are designated at the top of each exhibit.

CHAIRMAN DOWNING: This is No. 3?

MR. ROBBINSON: This is No. 3 coming up. When we get through we will have a set of these maps for the convenience of the Commission.

CHAIRMAN DOWNING: You are leaving the maps here for cross examination?

MR. ROBBINSON: Yes, they will be kept here.

Q. What has Exhibit No. 3 been prepared to depict?

A. The purpose of Exhibit 3 is to more clearly demonstrate what I estimate the current flare would be in the Rangely Field under our order as contrasted to what it would be on June 1, 1956, whereby we can actually and honestly review the situation. I would like to begin by showing you the figures that I believe are typical today. Daily gas production is now running 115 million cubic feet per day.

CHAIRMAN DOWNING: What does that represent?

THE WITNESS: That is the daily gas production from the Rangely Weber Reservoir.

CHAIRMAN DOWNING: That is actual production or the potential?

THE WITNESS: Mr. Downing, it was 111 million cubic feet per day in September and by extrapolating our data it is our estimate that it is running 115 million cubic feet per day. Under our proposed formula we would be handling 80 million through present compression facilities. Our gas usage based upon 24% of the total gas production is 27.6 million cubic feet per day. The sum of our gas compression and our gas use subtracted from 115 million gives you 7.4 million per day as a flare. In terms of percentage, the gas compression would be 69.6%, the shrinkage and other useful purposes would be 24%, the flare would be only 6.4%; and you will note that is a very small percentage as compared to the total gas production.

Now going to the chart on the right, which represents my estimate for June, 1956, gas production from the field will approximate 131 million cubic feet per day. If compression facilities are utilized they are automatically taking care of 80 million per day. Our useful requirements will be up to around 31.5 million cubic feet per day, which then leaves you 19.5 million cubic feet per day as a possible flare. I say possible flare because I believe and hope by that time we will have other factors entering into the picture to help take care of this gas. Back to our percentage comparisons, you will note that the present compressors will take care of 61% of the total gas production, again our requirements are based upon my estimate of 24%, which leaves us a flare of 15%, which I still

believe to be very nominal when compared to the total gas production.

CHAIRMAN DOWNING: How many feet a day would that amount to?

THE WITNESS: That is 19.5 million cubic feet per day.

Q. Mr. Heggland, have you made any estimate as to how many cubic feet of gas per barrel of oil it is that is actually being flared out there or would be flared under this order in November of 1955?

A. Yes, I have. Based upon these figures as of November 1, the flare in terms of cubic feet per barrel of oil produced calculates out at 114 cubic feet per barrel.

Q. Now that is less than the number of cubic feet of gas that was contained in each barrel of oil in this reservoir in virgin conditions?

A. That is correct, under virgin conditions there were approximately 300 cubic feet in each barrel.

Q. There wouldn't be any way to produce the barrels of oil without producing at least 300 cubic feet of gas?

A. That is correct.

Q. Yet at this late date in the history of this field there is only 114 cubic feet per barrel that is being dissipated?

A. That is my estimate based upon our formula.

Q. Now what would be the projection even in June, 1956,

if this order is adopted and the projections come about?

A. Based upon 65,000 barrels of oil per day, and based upon the flare of 19.5 million cubic feet per day, that would provide you a flare ratio of approximately 300 cubic feet per barrel.

Q. Just about at that time will reach a flare of the number of cubic feet that is actually contained in each barrel of oil that was in place in that reservoir?

A. That is correct.

Q. Now have you had a chance to check the reasonableness of this 15% flare with what is being done in great oil production areas in this country where conservation has been practiced for years?

A. I reviewed data available from the Texas Railroad Commission as to the volumes of gas that they have estimated to be flared in 1953 and 1954 from their oil reservoirs.

Q. Now how did that compare with the figures here?

A. I found that for 1953 and 1954 approximately 15% of the produced gas from oil reservoirs was flared.

Q. That is in both years?

A. There was a slight deviation. It was in excess of 15% in 1953 and slightly under 15% in '54.

Q. Why did you happen to pick the figures from the State of Texas?

A. For two reasons: One being the fact that it is a

state that has accurate data ready for comparison, in fact it is the only state that I know of; and secondly it is one of the older producing states in so far as the oil production is concerned, and they have had a commission in effect there longer than any other state.

Q. Then on the basis of your entire study, do you believe that this would be an unreasonable flare to enable the operators to produce the oil from the Rangely Field?

A. I believe this projected flare will be reasonable.

Q. As a matter of fact since it's almost the solution ratio it's quite reasonable?

A. Yes, sir.

Q. You said that the rate of oil production was of little significance in a reservoir of this type. Have you been generally acquainted with the actual producing rate of the Stanolind Oil and Gas Company in this field?

A. Yes, I have.

Q. Have you had an opportunity to follow the performances and see the various tests which were made on their wells?

A. I have reviewed the data from our properties constantly, yes.

Q. In your opinion have you run across anything which would indicate to you that any rate at which Stanolind properties has been produced has in any manner decreased the ultimate recovery from that reservoir?

A. I have seen no adverse effect from rate. I might add that the average gas-oil ratio of Stanolind properties for the month of September was 909 cubic feet per barrel as compared to the field average of 1691.

Q. Then the actual producing rate of the Stanolind properties is substantially below the field average in gas-oil ratio?

A. Yes, sir.

Q. So that Stanolind actually is employing less gas per barrel to produce its properties than is generally being employed in the field?

A. That is right.

MR. ROBBINSON: You may cross examine.

CROSS EXAMINATION

BY MR. FREEMAN:

Q. Mr. Hegglund, initially the Commission asked you about the possible increase of oil production should this gas injection program be followed, and I notice that the program you offer includes gas injection. If there were no other considerations, speaking solely from a conservation viewpoint, in your opinion would there be an increase or has there been an increase in oil production due to the fact that the Commission has attempted to require gas injection?

A. I can't say truthfully to this date that oil production would have been at a higher rate or a lower rate as of

the present time. Actually as I understand the situations in Rangely the field has not been produced to capacity today.

Q. Do you think that a continued gas injection program, eliminating any other considerations, would increase the ultimate recovery of oil?

A. In my opinion it would possibly tend to increase the ultimate recovery, but that would have to be modified by the degree of efficiency and control that could be effected in the future.

Q. Would you elaborate a little on that statement.

A. Well, briefly it boils down to this: that at the present time gas injection is proceeding at Rangely under a situation whereby we have dispersed injection under competitive operations. If we had the field unitized, again we would be in a position to better effect that control and thereby obtain a higher degree of efficiency.

Q. You made the statement that Stanolind is not at this point producing at its capacity. What do you estimate is the capacity of Stanolind?

A. It's very difficult to state in exact quantities unless we had complete fieldwide capacity tests, but I believe we have considerable unused capacity there as of the present date.

Q. Have you taken any capacity tests lately?

A. We started a program to more evaluate our wells during

the early part of the month, but our program was more or less tempered by this restriction of 300 barrels per well per day top, so we do not have our results complete.

Q. The only estimate you can make is that you are not producing at capacity, but you can't state to the Commission about what you think your probable capacity might be?

A. Not in concrete terms, no.

Q. Under your present program what is the highest theoretical flare that could be produced?

A. The highest theoretical flare?

Q. Yes, sir.

A. In other words, you mean by adding up the flare by batteries and ignoring the factor of gas compression and injection?

Q. That is right.

A. My figure was computed at roughly 49 million, but with the stipulation of using present compressors it would have no meaning.

Q. In Mr. Kirgis' opening statement he said the flare would be 7 million if this plan was adopted, assuming the operators all agreed to reinject. Under this rising curve how long would it remain at 7 million do you estimate, how long a period of time?

A. Well, if you look at my chart there you will note that I show it to be 7.4 as of November 1, and as of June, 195.

It would be presumedly as long as your ratios are increasing the value progressively increases. The average over the period might be 12 or 13 million feet per day.

Q. One last question. Do any of the Stanolind wells at the present time produce at their capacity?

A. Within practical limitations, yes. Most of our wells on the east side of Rangely are producing at capacity as near as we can determine; but possibly not absolute capacity, that is pretty difficult to do from a mechanical standpoint.

Q. But your wells on the east side of the field are at the present time in your opinion producing at their capacity?

A. In general.

MR. FREEMAN: That is all.

CHAIRMAN DOWNING: What are the rates of those east wells you have?

THE WITNESS: They vary quite widely. We have a few wells that are comparable in rates of 10 to 15 barrels a day, some of those wells as high as 150.

CHAIRMAN DOWNING: Is that the highest?

THE WITNESS: I am talking about the east side of the field. I am talking in terms of generalities too on the east side.

CHAIRMAN DOWNING: What is your highest well on the east side of the field would you say?

THE WITNESS: I wouldn't know without actually

checking the data.

BY MR. JERSIN:

Q. Mr. Heggland, you said you were taking some capacity tests now in the process of making a complete survey of your wells, is that right?

A. We initiated the program for the purpose of getting a better understanding of conditions in the Rangely Field.

Q. Have you taken any tests of the wells on the west side of the field yet, Stanolind owned or operated wells on the west side of the field?

A. A few wells, yes.

Q. Would it be possible for the Commission to obtain that information as soon as Stanolind completes that survey?

A. I am sure it could be arranged.

Q. The Rangely Engineering Committee tests in no way represent capacity tests for Stanolind?

A. Not in all cases, no.

Q. On the wells on the west side of the field operated by Stanolind.

A. That is right.

MR. FREEMAN: Mr. Chairman, in view of the fact that many of these production reports are in the Commission office, I would like to make an offer of proof of all our records on production to be included in this hearing for your consideration

CHAIRMAN DOWNING: Is there any objection?

MR. SULLIVAN: We have no objection to the admission of that.

CHAIRMAN DOWNING: There being no objection, that evidence will be considered.

BY MR. SULLIVAN:

Q. It's rather curious to me, Mr. Heggland, that in your description of these last two charts that you have indicated no percentage of gas injection out of the 69 and the 61 per cent that would be injected into the Weber. Can you project those percentages under your proposed order? Give us an estimate of what you think they might be.

A. That will have to be tempered by volumes that might possibly go into the storage proposal which will be heard, I believe, at a little later time.

Q. I was going to question you about that storage but if you are going to go into it later I will reserve that. Now let me ask you this: Wouldn't the natural result of injection into any zone other than the Weber eventually cause operators desiring to inject into the Weber to cut down their Weber injection in self-defense?

A. I believe the proposal could possibly be handled by giving all operators a chance to participate in any storage proposition on some kind of a proper ratable basis.

Q. I don't think that answers my question. Wouldn't injection into some other reservoir than the Weber induce those

operators desiring to inject into the Weber to either eliminate or to cut down their Weber injection?

A. That would depend upon how stringent this operator you are talking about felt about participating in any storage proposition.

Q. Now you refer to this as storage of gas. Does that have any utility at all toward further oil recovery from the Weber?

A. It possibly could have if storage is proven effective. It could have a bearing upon saving some gas for use during the latter life of the field and the operators might be very glad to have it at that time.

Q. For what purpose, to reinject into the Weber?

A. That is one purpose, sales, reinjection into the Weber

Q. Well, is it a choice somewhat between flaring the gas and storing it? Is it a disposal program at this point?

A. To me at this point it's a problem of looking at each and every solution collectively and individually.

Q. Is it a choice of burying the gas rather than cremating it?

A. I don't know whether I agree with your terminology there, Mr. Sullivan.

Q. Mr. Heggland, do you realize that you are the first Stanolind witness in four years of proceedings under Cause No. 2 who has ever cast any doubt about the merits of Weber injection?

A. That possibly could be true.

Q. Have you changed your mind about the advantages of Weber injection since July 14, 1955?

A. Mr. Sullivan, I believe if you go back to my testimony today--

Q. I intend to.

A. I made the statement that gas conservation within economic and reasonable limitations should tend to increase ultimate recovery.

Q. Well, may I read to you briefly from the record of July 14, 1955, in the hearing before this Commission in Cause No. 2 on page 139. "Mr. Hegglund: It is our opinion that the Rangely Weber reservoir should be produced on the most efficient basis possible. This will require the minimum dissipation of gas for each barrel of oil produced, in so far as is practical under present conditions at Rangely. Accordingly, we do not adhere to the excessive flaring of gas but instead favor continuance of gas injection to the fullest extent that is practicable. Continued gas injection will result in the minimum pressure decline, will maintain productivity from a reservoir standpoint at the optimum level, and will provide the highest pressure level possible which is desirable for well stimulation measures that have recently become so important in this and other fields in increasing the ultimate recovery of oil." Do you remember saying that?

A. Yes, sir.

Q. Do you think that storage into some other reservoir than the Weber will result in minimum pressure decline, will maintain productivity from a reservoir standpoint at the optimum level?

A. Mr. Sullivan, we are attempting to proceed here on what is a practical plan, and I believe my statement there meant we were in favor of injecting and saving as much gas as is practicable. Now we are in a situation at Rangely that admittedly it's requiring a little give and take.

Q. Now let me read on, on page 140 of the record of that same hearing at the bottom of the page you say: "With high ratio production, gas would be dissipated, and unless returned to the reservoir, its useful purpose in so far as the reservoir is concerned would be at an end upon reaching the surface with its associated oil." You remember saying that?

A. Yes, sir.

Q. Now as a matter of fact, Mr. Heggland, you have to some degree changed your mind since July 14, have you not, about the merits of gas injection into the Weber?

A. I have changed my mind with respect to what is practical.

Q. In other words, it's a part of the compromise, is that it?

A. Well, yes, sir.

MR. SULLIVAN: Thank you, that is all.

CHAIRMAN DOWNING: Any other questions?

MR. EVANS: Yes, sir. My name is Fred H. Evans; I represent Equity, Webber Oil, and Utah Southern Oil.

BY MR. EVANS:

Q. I would like to ask you a question with reference to your Exhibit No. 1. Now as I gather from your statement, that exhibit was to illustrate that Rangely is acting as a typical solution gas drive reservoir, is that right?

A. That is correct.

Q. And at the point on the right hand side, which represents the Rangely, it is at a point which is almost comparable to the typical situation shown on the left hand chart?

A. That is correct.

Q. And you haven't attempted to project that right hand chart beyond this point and in the same manner you have the other two exhibits, is that right?

A. That is correct.

Q. Now I assume that you mean that Rangely will continue to act as a typical solution gas drive reservoir?

A. That is correct.

Q. And I also remember in your testimony that you did not include in your left hand chart any gas injection?

A. That is correct. This is a typical depletion of a solution gas drive reservoir.

Q. Now I also assume, on Exhibit 2, by assuming no injection in your other charts that the gas was being utilized

other than by putting it back into the ground, it was flared or something was done with it.

A. On the left hand chart of the typical reservoir?

Q. Yes.

A. Something was happening to it.

Q. Now your Exhibit No. 2 has a very marked proportion in red which represents gas injection, is that right?

A. That is correct.

Q. Now are any of the other lines on that chart going to vary if there was no gas injection?

A. During the period of the forecast it is possible there might be some variation within some very close tolerances.

Q. So that the red portion, while it's the most prominent thing on the chart, actually represents an insignificant factor, is that right?

A. I believe the red represents a very important factor.

Q. Well, now that is what I am trying to get at. You say the Weber Reservoir is going to continue to act as that average solution drive reservoir. Now what does the red have to do with any of the lines on that chart? What if there was no red?

A. I misinterpreted your question. The purpose of the red here was to illustrate the relative percentage of the produced gas and of the effort being made to handle that gas in the field.

Q. So it has no relationship or no effect upon, say, your daily oil production line?

A. That is difficult to say precisely, but I believe for the period of forecast it would have no bearing.

Q. So that when you propose an order merely asking for limitations on flaring and this so-called finding about injection, what you are saying then is that it has no relation to conservation and that means nothing, isn't that right?

A. No, that isn't true. Although I stated that the oil production would continue at the 65,000 barrel level, there would undoubtedly be some limitations on gas within the field.

Q. Undoubtedly there might be some limitations, but on the basis of your testimony this order has no relation to conservation because you believe that you could flare it all and still get the same production?

A. That isn't what I said.

Q. Then I certainly misunderstand your testimony.

A. My whole testimony was directed--

MR. EVANS: No further questions.

BY MR. FREEMAN:

Q. On that red that you have 80 million cubic feet of injection, under your proposed order you made no allowance on your chart for what might be put into other reservoirs. Would that be taken out of this 80 million figure that you have injection or where do you expect that to come from?

A. During the early phases of pilot storage it could very well come out from the red.

Q. Then as a practical matter under your proposed order, 80 million might not be injected into the Weber Reservoir, is that correct?

A. That is true. I do believe at some point in here we are talking about initiating some pilot storage, and whatever that volume of storage is it could affect this curve here.

Q. But you are intending to take that stored gas not out of the non-utilized gas, you are intending to take it out of the gas injection gas that you have marked on this chart, isn't that right?

A. That is right, the idea there being it is foolish to ask the operators to invest thousands and thousands of dollars for a brief pilot period.

Q. Let me ask you this question again. When you put this gas in storage that you are proposing, the gas that you are going to be putting in this storage, you intend to take out of this 80 million gas injection figure rather than the non-utilized figure so that actually your 80 million is not a constant figure, is that correct? As more and more is stored, less and less will be injected into the Weber Reservoir.

A. Into the Weber or any other reservoir.

CHAIRMAN DOWNING: I would like to ask what you mean by injected into any other formation which has been demonstrated

to be reasonably feasible for gas storage. Who is going to decide that?

MR. ROBBINSON: May I suggest to the Commission these questions about injection this witness is not prepared to answer, but there is a witness here who will tell you all about the injection program before the total of our testimony is over.

CHAIRMAN DOWNING: That will be another witness?

MR. ROBBINSON: Yes, and I think he is prepared to answer all your questions about where the compression facilities will come from and so forth.

CHAIRMAN DOWNING: Do you wish to introduce those exhibits?

MR. ROBBINSON: Well, at the conclusion, because we have them bunched up in a group for the Commission's convenience and at the conclusion we will introduce them all.

CHAIRMAN DOWNING: Mr. Freeman, I want to clarify your offer to introduce our records. Was that confined to our productive records or all our records pertaining to this field?

MR. FREEMAN: I was going to later make an offer of proof of all our records, but if you will accept it and if there is no objection I would like to introduce all the records that we have on the field.

CHAIRMAN DOWNING: Any objection? If not, it's so ordered. In other words, we are all open to you, but naturally

we will give consideration to the work of our staff.

MR. JERSIN: Mr. Downing, that would include all of the records prepared by the Rangely Engineering Committee, the monthly reports, the weekly activity reports, and any special reports, and that would include the trial testimony and correspondence in regard to that testimony or any matter in Rangely, is that correct?

CHAIRMAN DOWNING: I assume it includes everything. Are there any further questions of this witness?

(Witness excused.)

R. B. GILES

called as a witness on behalf of Stanolind Oil and Gas Company, being first duly sworn, upon his oath testified as follows:

DIRECT EXAMINATION

BY MR. ROBBINSON:

Q. State your name please.

A. R. B. Giles.

Q. What is your profession and training, sir?

A. I graduated from the Pennsylvania State University in 1948 with a Bachelor of Science Degree in Petroleum and Natural Gas Engineering.

Q. You are now connected with the Stanolind in what capacity, Mr. Giles?

A. Petroleum Engineer in the Division Office.

CHAIRMAN DOWNING: If there is no objection, he will be considered qualified.

Q. How long have you had available under your observation the data from the Rangely Field?

A. I have studied Rangely for some six years.

Q. There is shown on the easel now Stanolind's Exhibit No. 4. What is that, sir?

A. That is a result of the bottom hole pressure survey at June, 1955, as compiled by the Rangely Engineering Committee, the Rangely Engineering Committee being composed of engineers of each of the operators, including the California Company in the Rangely Field. All pressures are the result of a 72 hour build-up period and they are referred to a common datum or level of minus 900 feet so that all pressures are relative on this map. With reference to the legend, the yellow denotes greater than 2000 pounds per square inch pressures; the green in the range of 1500 to 2000 pounds per square inch pressure; the blue is lower pressures in the order of 1000 to 1500 pounds per square inch; the red is the lowest pressures in the field, under 1000 pounds per square inch, predominantly covering the east area of Rangely. The orange markers denote the injection wells throughout the field. There are 19 wells shown; however, there are 18 injection wells now in use, Phillips Levison 16 is not now being used for injection. The bands around the various leases: the yellow denotes Stanolind's leases, we have them blocked off in Stanolind's leases but we don't have each and every Stanolind lease blocked off; the red denotes the

California acreage throughout the west area, the west area being the area west of a line that is crosshatched and drawn down through the middle of the field and representing the same boundary the California Company used at the July 14, 1955, hearing on this same cause and referred to as A-A Prime on all of their exhibits.

Q. Why did you start your study of this field by the use of this pressure map?

A. At the July 14, 1955, hearing the California Company, and since that time also, they have contended that Stanolind is draining California's operated properties in the west area. This is incorrect, totally incorrect; and we will demonstrate and prove to the Commission today that the reverse is true, that Stanolind operated properties are being drained by the California Company.

Q. Now are these pressures the pressures which are reduced to a common level for purposes of showing the relation of pressures?

A. Yes, sir.

Q. What do you mean by reduced to a common level?

A. I mean the Rangely Engineering Committee reduced to a common level at a datum within the Weber formation so that all pressures are related or relative to one another; structural relief takes no place in this investigation.

Q. Now is the physical law of nature that the direction

of the pressure differentials absolutely control the movement of fluids in a reservoir of this type?

A. Yes, sir, it's a basic law of physics.

Q. Then the fluids within this reservoir are moving from high to low pressure?

A. That is correct.

Q. So that if we wished to study the question of migration of fluids across lease lines in this reservoir we must study pressure maps?

A. That is the only criteria.

Q. That is the only basis on which it can be determined?

A. That is correct.

Q. Do you have something else you want to say here now?

A. Yes, sir. You will notice that the orange arrows, which I have stated depict the gas injection wells in the Weber formation, are in the areas of highest pressure throughout the Rangely Field, except in one place, the northwestern portion of the structure under Stanolind's Mary Hagood lease there are no gas injection wells on that lease. Now the question comes up, why are the pressures higher on the Mary Hagood lease? There may be several factors to answer this question, and one of which could be the activity of a limited water drive from the westerly direction on the northwestern portion of the structure in helping to keep pressures up. However, performance to date indicates that water influx will

not likely have a significant effect upon reservoir performance. Now another factor which may not have created the situation but in my opinion could have aggravated the difference in pressure between the Stanolind Mary Hagood lease and California's offsetting A. C. McLaughlin lease was the redistribution of lease quotas from the Emerald lease to the A. C. McLaughlin lease of the California Company in August of 1951.

Now this rightfully deserves a little explanation, so let's go back seven years ago, and for a given month the Salt Lake Pipeline arranged to take oil from Rangely in line with the market available to the operators using that line. Utah Refining Company attempted to take close to that amount taken by the Salt Lake Pipeline. Generally Utah's top per well pipeline quota was based on the average top per well per line quota of approximately 150 barrels of oil per day of the Salt Lake Pipeline. Now this system worked pretty well for several years until the California Company saw fit in August of 1951 to shift its quotas to take substantially more from certain leases in the western portion of the field on a per well basis than Stanolind was producing from its offsetting properties; all the while Stanolind's production from each lease was being limited to an amount based on Utah's top per well pipeline quota. The situation after approximately one year of disproportionate withdrawals in favor of the California Company has since been remedied by Stanolind to the extent that Stanolind

is producing its leases, those low gas-oil ratio leases on the western flank of the structure, to prevent avoidable drainage and Utah is taking such additional oil as will be produced in line with this policy. Now understand, gentlemen of the Commission, that at the July 14 hearing the California Company brought up the point of disparities, and we feel we have no other recourse than to show the Commission exactly what did take place.

Q. Now you say that the California Company was the first one that didn't produce its leases by the limitation of 150 barrels per lease, but in substance took the room in the pipeline from one lease and produced it from another, is that correct, Mr. Giles?

A. That is right.

Q. Now have you made a graph of the leased production from the various leases out in this west end area to indicate to the Commission what happened?

A. Yes, sir. Stanolind Exhibit 3, Comparison of Lease Quotas, Rangely Field, Colorado. Now the upper half of this graph concerns the California Company, the legend being on the right and the explanations of the legend on the left. On the lower part of the graphs are Stanolind's lease quotas for its three big west area leases. On the left hand side is the barrels of oil per day per well. It is duplicated for Stanolind and ranges from 100 to 160 barrels of oil per day per well,

and as I said duplicated for the California's chart from 100 through 220 barrels of oil per day per well. The bottom scale is the year 1951 and 1952. Under the California Company the blue concerns the A. C. McLaughlin lease, California's biggest and best area; the red denotes the Gray "A" lease in the west area; the brown the Emerald lease also in the west area; and the green being the Salt Lake Pipeline quota. For Stanolind the blue is the Mary C. Hagood lease; the brown the M. B. Larson lease; the red the L. N. Hagood lease; and again the green being the average quota.

Now according to Stanolind's portion of the graph in the lower half of Exhibit 5, note how Stanolind's quotas as between its three big west area leases, the Mary C. Hagood, the M. B. Larson "A", "B" and "C", and the L. N. Hagood lease maintain a consistent uniformity with each other on a per well basis over the period of 1951 to mid 1952; mid 1952 being the point in which the California Company has stated that Stanolind resorted to the withdrawal rate disparities, thereby causing the serious production disparities. Now in referring to the California's quotas as between its leases, I have one point to make at this time. California Company contended in more particularly on page 76 of the hearing transcript, the same transcript Mr. Sullivan referred to previously, that its production rates if not close together were almost comparable over the period of 1951 and 1952. Let's see if this is true.

California's quotas as between its leases did remain comparable until August of 1951, at which time a departure took place. This shifting of quotas as between its three big west area leases became more appreciative with time, and at the end of 1951 the California Company obviously shifted its Emerald lease quota shown in brown on Exhibit 5 to the blue colored A. C. McLaughlin lease; the A. C. McLaughlin lease being located directly between Stanolind's two biggest west area leases, the Mary C. Hagood and the L. N. Hagood lease. Now, gentlemen of the Commission, to say that Stanolind in mid 1952 started the redistribution of lease quotas is incorrect, totally erroneous, as the facts shown on Exhibit 5 clearly indicate beyond any element of doubt exactly what did take place.

Q. And this is solely depicted for the purpose of showing who is in whose vegetable patch first?

A. That is right.

Q. I observe on your pressure map here you have a dark line called A-A Prime. What is the significance of that please?

A. That will be used for Exhibit No. 6 to show a profile or cross section of the pressure relief in the west area.

Q. Now what is the relation of Exhibit No. 6 to this line on Exhibit 4 marked A-A Prime?

A. A-A Prime extends from the H. A. Larson lease in the north tip of Rangely through the Emerald lease of the California Company on the west area.

Q. Tell us now, sir, about what is shown on your Exhibit No. 6.

A. On the left scale is pressure in pounds per square inch gauge, ranging from 800 pounds to 2000 pounds. The horizontal scale is equivalent to 3 inches equals 2000 feet, and covers the area of A-A Prime shown on Exhibit No. 4. In other words, Stanolind's leases, the F. A. Larson and Mary Hagood are yellow color and they represent the area from this point to this point. The red colored adjacent California A. C. McLaughlin lease represents the point shown on Exhibit 4. I am showing you now to this boundary of the Stanolind's L. N. Hagood lease here and so forth until you reach A-A Prime. Now I might point out that there is no significance in how this was drawn. It could have been drawn in an entirely different manner, the angle could have been this way or this way, but it so happened that the A-A Prime went through our L. N. Hagood No. 6 injection well. So naturally the peak of the pressure is going to be quite severe, this being a high pressure just as the Mary Hagood is a high pressure, and if the A. C. McLaughlin lease lies in a sink or low pressure area between Stanolind's two big west area leases, the pressure might have been tempered a little bit if we took a different angle of A-A Prime, but it clearly demonstrates that the pressures are higher on Stanolind's Mary Hagood lease and Stanolind L. N. Hagood. The California Company A. C. McLaughlin lease lying between

Stanolind's two big area leases has a lower pressure, and this simply means one thing, that since oil cannot flow against a higher pressure that Stanolind's operated properties are being drained by the California Company in the west area, in this area of the west area.

Q. If the physical law of nature holds in that reservoir that fluids will move from the high place to the low place as far as pressure is concerned?

A. That is correct.

Q. And what you have shown on Exhibit No. 6 is you start with pressures and cross the line and they are reproduced in graph form on this exhibit here?

A. That is correct, just as if you were standing off here in the southwest corner and looking at the side picture of the reservoir.

Q. Now have you gone to the trouble of preparing something else to make this reservoir pressure a little more visible, Mr. Giles?

A. Yes, sir.

Q. If I understand you correctly, fluids in the reservoir move from areas of high pressure to areas of low pressure?

A. That is correct.

Q. Just as water moves from a high point to a low point?

A. That is correct, oil will do likewise.

Q. So you have prepared something here which transposes

pressures into elevation?

A. Pressure relief, that is correct.

Q. Pressure relief to indicate that if you place some fluid in the reservoir on the highest point on this particular illustration it would flow towards the low point in this particular illustration?

A. That is correct. Now we have taken from Exhibit 4 the two dimensions exactly of the west area of Rangely Weber pool. That is the illustration Exhibit No. 7.

Q. Now each one of those layers of laminated wood represents how much change in pressure?

A. One hundred pounds.

Q. So that if you wished to count the different pounds in pressure from one point to another point you simply count how many steps up or down on that exhibit?

A. That is correct.

Q. Would you point out on that particular exhibit now Stanolind's leases and the leases of California Company and see whether or not the oil is running from California Company's leases to Stanolind's leases.

A. The yellow flags denote Stanolind leases, the red flags California leases in the west area. The yellow boundary represents Stanolind's blocked acreage in the west area, the red the California Company's operated properties in the west area. Notice that the Mary Hagood lease in the northwestern

portion of the structure lies several steps or several hundred pounds higher in pressure than the California's adjacent A. C. McLaughlin lease shown in blue on this exhibit. Likewise, Stanolind's L. N. Hagood lease is under a higher pressure than California's offsetting A. C. McLaughlin lease; so that will show once more that oil, even though Stanolind is producing a certain few of its wells on the Mary Hagood lease at higher rates than the California Company is producing from its offsetting A. C. McLaughlin lease, the pressures are higher on the Mary Hagood lease and oil can only flow from high pressure to the low pressure area.

Q. Even though there is disparity in current rates of production, that in no manner changes the present direction of the flow of fluid in rest?

A. Not at this time. That is the flow of the reservoir at this time.

Q. Now this information which you have shown here first on this map and now on that exhibit comes from the Rangely Engineering Committee, does it?

A. That is right. It is not Stanolind's interpretation, it's the Rangely Engineering Committee's work.

Q. So that does not represent any interpretation of yours. Now do those correspond exactly to the contour lines of the isobaric pressure map shown here?

A. Exactly.



01138282

2-27
11/21/55

pgs 51-100

Q. What further study have you made, sir, in connection with this pressure information on this reservoir?

A. I have taken pressures in the west area and weighted them by area and also by oil in place.

Q. I take it that going across an exhibit of this kind it would be hard in all instances to exactly say what transpires as to each lease line.

A. That is correct.

Q. So in order to come back now to a more positive evaluation of this information, you have done it by area?

A. That is correct, that is the usual method employed in weighting pressures for simplicity.

Q. We have on the easel now Stanolind Exhibit No. 8. What is that please?

A. Stanolind Exhibit No. 8 is weighting pressures by area for the west area of the field taken for the purpose of this study because it was the area that California Company contended the serious disparities were taking place, based again on the Rangely Engineering Committee interpretation of pressure contouring as a result of the June, 1955, pressures at the same referred to datum of minus 900 feet. Now here is precisely what we did: For each and every tract in the Rangely pool, particularly the west area -- well, let's take the California's Raven "A" lease that comprises of two tracts; tract numbers being contained in the Rangely Engineering

Committee report of February, 1949. We measure the area of the tract, 80 acres in each case, and we measure the average pressure under each 80-acre tract.

Q. How do you mean measure the average pressure?

A. We measure it by means of an engineering method by means of a planimeter, simply measuring the area between pressure contours.

Q. In other words, you actually measure the area of that lease which lies between two pressure lines?

A. That is correct.

Q. By means of a planimeter?

A. By means of a planimeter. The average pressure under these two tracts, tract 2-30-4, the average pressure is 1276 pounds per square inch; under the Raven "A" tract 2-31-2, another 80-acre tract, the average pressure is 1154 pounds. We simply multiply the two columns denoted by area average pressure and come up with the product. In this case the product is 102,080. For the second tract in the Raven "A" lease the product of the two factors, area and average pressure, is 92,320. Then we go to the Raven "B" lease, its tract is 2-30-2, 80-acre tract, average pressure by means of a planimeter was 1365 pounds. We take the product of the area, 80 acres, times 1365 pounds, to obtain 109,200.

Now we do that for each and every tract of California's operated properties on the west area and we do the same

for Stanolind, but now doing that for each tract for California we come out with a total for California of 6,570.72 acres underlying all their tracts on the west area. The total product, adding up all the products, 8,954,370. We divide the total area of the tracts into the total product and we come out with a weighted average pressure by area of 1363 pounds per square inch.

Q. Those are the figures which are shown on your exhibit?

A. That is correct.

Q. So that after weighting the average of all of Stanolind's leases in this west segment and all of California Company leases in the west segment, what is the figure as to each of the two companies?

A. As shown on Exhibit 8, the weighted average pressure, using the weighting by area method, shows Stanolind operated properties in the west area to have an average pressure of 1409 pounds per square inch; whereas the California's average pressure is lower by 46 pounds and is 1363 pounds per square inch.

Q. So that means taking into consideration all the leases in this entire area, the average pressure under each acre of Stanolind's leases is higher than the average pressure for each of the California Company?

A. That is correct, we have an exhibit to illustrate that.

Q. What would have to be your assumption about who is

draining whom?

A. Stanolind is being drained by the California Company; there is no other conclusion. Exhibit 9, again the same method is used, it's weighting by area. It is the result of the summary table shown on Exhibit 8. Now let's just consider that all of Stanolind's operated properties' oil is contained in the left hand tank, and all of the oil under California's operated properties in the west area is contained in the right hand tank. As we just have shown, the average pressure under all of California's operated properties in the west area is 1363 pounds per square inch; under all of Stanolind's operated properties in the west area the weighted average pressure by the weighting by area method is 1409 pounds per square inch. Gentlemen, oil can only go from this tank of higher pressure to this tank of lower pressure; from Stanolind to California.

Q. Did you weight it out on another basis?

A. Yes, sir.

Q. What other basis did you employ?

A. Considering oil in place as taken from the Rangely Engineering Committee report of February, 1949.

Q. How did you arrive at a figure of oil in place?

A. We used a 3 millidarcy cut-off, which simply means that for purposes of computing oil in place the Rangely Engineering Committee considered permeabilities of 3 millidarcies or greater. Now a 3 millidarcy cut-off is reasonable for this

reason: The California Company at the July 14 hearing, Exhibit G, I believe it was, I know it was, showed that the actual performance of the west block or the west area of Rangely was under a 3 millidarcy cut-off in permeability. So we are merely taking oil in place with a 3 millidarcy cut-off, representative of actual performance today. Again the west area, again the same type of a calculation, except instead of weighting by area we weight by this oil in place.

Q. Now are these figures yours, or do they come from somewhere else?

A. They are not mine or Stanolind's, they are the Rangely Engineering Committee's.

Q. All right.

A. For the Raven "A" lease, comprising again the same two tracts, Rangely Engineering Committee report showed 6.6 million barrels under that tract. For tract 31-2, 4.3 million barrels. For the same planimeter method the average pressure under these tracts was obtained, and of course it's the same as shown on the weighting by area method, 1276 pounds per square inch for the Tract 2-30-4; 1154 pounds per square inch for Tract 2-31-2. Again we take the product of the oil in place times the average pressure, which in this instance would be 8,421.6.

For the other tract on Raven "A" lease, the product of oil in place times average pressure would be 4,962.2. We

do the same thing for Tract 2-30-2 comprising the Raven "B" lease, and we do it for each and every California operated property in the west area, and do it for Stanolind. The total, we add up all the oil in place figures; California, 621.4 million barrels, the total of all the products 853,133.4 We simply divide the total oil in place under all California's operated properties in the west area into the product, the total of the products, to obtain the weighted average pressure of 1373 pounds per square inch gauge.

Q. Now that gives you the pressure, the average, pressure, which exists in that reservoir on each of the properties of the two operators in question?

A. That is right.

Q. And what does it show in respect to the average pressure which each barrel of oil is under in the reservoir as it underlies the two properties of these companies?

A. The average barrel of oil for Stanolind operated properties in the west area, weighting by 3 millidarcy oil in place, is 1522 pounds per square inch. For the California Company it is only 1373 pounds, a differential of 149 pounds, and yet the California Company claims we are draining them.

COMMISSIONER BRETSCHEIDER: Did you make the same kind of a comparison on the 1 millidarcy category?

THE WITNESS: No, we took the 3, sir, because it represents actual performance. Now Exhibit 11 shows the same

tank comparison. The average barrel of oil under Stanolind operated properties in the west area of Rangely Weber pool is under pressure of 1522 pounds. The average barrel of oil under California's operated properties in the west area is under a pressure of 1373 pounds; a differential in pressure being 149 pounds per square inch. Again, gentlemen, the oil can only flow from the high pressure tank to the low pressure tank; from Stanolind to California's operated properties.

Q. Now, sir, have you made up a collection of all Stanolind's exhibits in sort of a folder form here?

A. Yes, sir, we have.

Q. These are accurate in every respect except that one is a picture of the model rather than being a copy of the model?

A. That is correct.

MR. ROBBINSON: We now have copies of these and we would like to hand one to the reporter for his use and have copies for each of the Commissioners. We offer in evidence all of the exhibits, but I think they can be identified simply by the copy which we will furnish the reporter rather than by these big and more bulky charts.

CHAIRMAN DOWNING: Any objection? If not, the exhibits will be admitted.

THE WITNESS: The only significant difference between the charts shown in the brochure and the charts we have displayed by placards is Exhibit 4. We have not placed the lease

boundaries of Stanolind's block, but, however, this is also being introduced as evidence for the Commission's benefit.

MR. ROBBINSON: In this instance we will introduce the large chart. That is all the testimony we have at this time.

CHAIRMAN DOWNING: Mr. Sullivan, do you wish to cross examine?

MR. SULLIVAN: I don't want to hurry things, Judge, but it's five minutes after twelve and maybe some of these people want to adjourn for lunch.

CHAIRMAN DOWNING: If you want to cross examine we will return for that purpose.

MR. SULLIVAN: I intend to cross examine but I will do it whenever you like.

CHAIRMAN DOWNING: We will recess this portion of the hearing until two o'clock.

(Whereupon a recess for lunch was taken.)

AFTERNOON SESSION

CHAIRMAN DOWNING: Now let's proceed with Rangely. What is next? Who wants to present some more testimony?

MR. SULLIVAN: I believe Mr. Giles was tendered for cross examination, Mr. Downing, when we left off for lunch.

CHAIRMAN DOWNING: Yes, you may proceed.

CROSS EXAMINATION

BY MR. SULLIVAN:

Q. Mr. Giles, you started your testimony out by the

statement that you had been studying Rangely for six years, is that correct?

A. That is correct.

Q. So that you should be consistently and constantly prepared on the happenings in every day production over there, should you not?

A. Yes, sir.

Q. Mr. Giles, if you had been studying this field for six years on a consistent basis, when did it first occur to you that Stanolind was suffering drainage in the west end of the field?

A. At the July 14 hearing you people contended we were draining California Company, and that brought the point to a head.

Q. But was that the first time that it had occurred to you that you were being drained?

A. Not the first time, no, Mr. Sullivan, but the purposes of the Commission's hearings since it had been placed into the record that the California Company was being drained by Stanolind based on your contention, we had no recourse but to show the Commission exactly what is taking place.

Q. In other words, it was high time for you to adopt some countermeasure?

A. It's high time we get our facts into the record to dispute and refute your claims.

Q. Then do I judge correctly this is a defensive move on the part of Stanolind?

A. No, the best offense is to come here and refute your position, and that is what we have done.

Q. If then this situation, as I understood your opening remarks, has actually occurred ever since 1951 and 1952 according to your Exhibit 2, I believe it was, then this was the first time after July 14 that the situation really called for some action on your part?

A. Let me say it this way: The California Company contended that they are being drained and they are asking for a top limit on oil to protect their leases from drainage. It's certainly high time that we have something in the record that will refute that because we are firmly convinced there is no need or justification for top oil limit in Rangely because you are not being drained; Stanolind is being drained.

Q. I am being lectured though, I can see that. Now since you brought the matter up, you say that a top oil allowable is no solution to the drainage problem?

A. That is correct.

Q. What is the solution to the drainage problem then in the west end of the field? What is the solution to your drainage problem, Mr. Giles?

A. No oil limit. In other words, we admittedly are producing wells on a certain few leases at higher rates than

your offset wells. Now drainage, as we sit here and talk here today, is taking place from Stanolind to California because as I have demonstrated the pressures are higher under our most productive leases.

Q. But that has been occurring with no oil limit.

A. Please let me finish, Mr. Sullivan. The drainage is occurring now and the pressures have been demonstrated to be higher. If you put a top oil limit, or if the Commission imposes a top oil limit cutting our production on those certain few leases in the western portion of the field, it would certainly freeze the situation of the drainage picture; and in my own opinion I think it would aggravate the pressure disparity.

Q. But has not this drainage been occurring with no oil allowable imposed?

A. That is correct.

Q. Then a continuation of that situation cannot be the solution quite obviously?

A. A top oil limit is even worse, it certainly won't correct the situation.

Q. I didn't ask you whether or not a top oil allowable is the answer, I simply asked you whether a continuation of no top oil allowable was going to solve your drainage problem?

A. It's going to help us prevent avoidable drainage to the best of our ability.

Q. Now would it be permissive if we erase what is

presently on the board. Now as I understand it, Mr. Giles, you, as many of us have, have built these exhibits, this one, the scale model, and also the bottom hole pressure map from data contained in the Rangely Engineering Committee reports, and particularly these are based upon the June, 1955, bottom hole pressure survey report, is that correct?

A. That is correct.

Q. Now for the edification of those people who are not familiar with the mechanics of getting information into that report, would you just briefly state where the data in that report comes from.

A. It comes from the pressures taken, under the Rangely Engineering Committee supervision in Rangely, on key wells throughout the field.

Q. But taken by whom?

A. Taken by the operators in the field.

Q. I see, then the operator's data is supplied to the Rangely Engineering Committee who compile it, is that the way it operates?

A. That is true.

Q. Now for the further edification of those people here like myself who may not be completely clear on just what a bottom hole pressure test is, would you draw a diagram there or illustrate on the board how a bottom hole pressure test is taken and what it indicates.

A. Let's consider Stanolind's well and California Company's well--

Q. No, that is not what I asked for.

A. I want to show you what happened.

Q. No, I am sorry, I must request that the witness be directed to be somewhat responsive to the question. All I want to know is how you go about getting a bottom hole pressure figure for any well, I don't care whether it's yours or Texas or mine or anybody else's well, I just want to see those factors demonstrated.

A. This is X well. Now having produced that well at a certain stabilized rate, the well is shut in.

Q. Now what is the shut-in time required incidentally under the Rangely order?

A. 72 hours represents a reasonable build-up time for particularly the west area where the pressures are comparable and generally high.

Q. Now that is followed by everybody we must assume in taking these bottom hole pressure tests, is that correct?

A. That is correct.

Q. So that as far as that is concerned then we are all on a common ground in taking these tests?

A. That is correct. Now upon immediately shutting the well in, the pressure tends to build up with time.

Q. Within the tubing or within the casing?

A. In the immediate vicinity of the well bore. Then after a given shut-in time, let's say 72 hours in line with the Rangely Engineering Committee's designation, the pressure will build up in the vicinity of the well bore to a complete build-up pressure.

Q. Then how do you go about measuring that pressure? How do you go about translating it into the data that appears in the Rangely Engineering Committee report from which all of these exhibits were prepared?

A. Using the gradient for the oil.

Q. What is the gradient for the oil?

A. Pounds per square inch per foot build-up.

Q. Could you demonstrate there with a little more diagram? Draw the inside if you will please, something depicting the inside of the casing of a well. Now you have shut this well in for 72 hours and the result is you have a standing level of fluid in the casing, is that correct?

A. That is correct.

Q. Now you must measure certain elements within that standing level, is that correct?

A. That is correct.

Q. Now how do you do that?

A. You measure the water, if there is any water, water having a gradient of .433 pounds per square inch per foot, and the oil in that annulus between the tubing and casing.

Q. Let's assume that it's a clean well, as most of the wells are in the west area, so we could eliminate the water. In addition, do you have any other weights in that column that you must take into consideration? Do you take into consideration the weight of the gas above the oil for instance?

A. That is correct.

Q. Now take me step through step. You have the well shut in and you have got these fluids rising in the casing?

A. That is correct.

Q. Then what do you do? That isn't enough to measure the bottom hole pressure, is it?

A. You translate the columns of fluid by means of a conversion factor, the gradient of so many pounds per square inch per foot.

Q. Mr. Giles, let's assume that you are taking me through just this computation step by step without translating all these things. Let's just take the assumed datum of the bottom of the well there and make all of the computations on any assumed factors that you wish to put in there just in order to illustrate this procedure of getting a bottom hole pressure.

A. All right, this is an oil column in the annulus between the tubing and the casing, and they are all referred to a common datum of minus 900 feet.

Q. That is below sea level.

A. Below sea level. You take the height of that column--

Q. How do you get the height of that column?

A. It's on a local measure. It's a device introduced by Amerada for measuring fluid levels in the annulus, or you can run a bomb. So you take the height of the oil column, times the oil gradient in pounds per square inch per foot, the height being also measured in feet, to come out with the pounds per square inch for that build-up period for that well.

COMMISSIONER BRETSCHNEIDER: Do all the operators use the same process?

THE WITNESS: Yes, sir.

Q. Don't you have to know also the altitude of the mouth of the well above sea level, isn't that important?

A. No, you are referring to a common datum of minus 900 feet subsea. You use the altitude of the well to determine what point in footage that would be opposite the formation of that well. That is true that you use it indirectly.

Q. Now then give me, if you can remember it, what was the fluid gradient that you used and which you furnished to the Rangely Engineering Committee in the June, 1955, bottom hole pressures survey report in the west end of the field.

A. I don't have that, Mr. Sullivan, at my finger tips.

Q. Would it help you if I furnished you a copy?

A. All right.

Q. Will you identify that book that I have just given you.

A. This is the Rangely Engineering Committee, June, 1955,

Bottom Hole Pressure Survey Results.

Q. Now on page 4, let's pick out the L. N. Hagood "5", for instance, and plot the factors you have across here to the diagram you have on your board and see what you get. Would you do that for me. All of the necessary information is here, isn't that right?

A. Yes, sir.

Q. You can make those computations on the blackboard, can you not?

A. Yes.

Q. It has no water.

A. That is right, it's a clean well. They applied a fluid gradient of .373 pounds per square inch per foot.

Q. Now let's stop right there. May I ask where did you get that fluid gradient of .373 pounds per square inch per fluid foot?

A. That as it looks to me on this page 4 is from the gravity of the oil, density of the oil.

Q. Now I notice, just to digress a moment, from L. N. Hagood "5" that in every other instance listed on page 4 where you use the sonolog method you also used the fluid gradient of .373?

A. Yes, sir.

Q. Is that mere coincidence? Are they identical in each well?

A. Well, the gravity of the oil is 34 degrees API.

Q. Are there any normal variations among wells in the end of the field like that from well to well?

A. Depending on the gravity of the oil there could be. I notice the gravity of the California Fee lease oil is 35.3, which would give a lower gradient of .338 compared to Stanolind 34 degree gravity oil.

Q. Now turn to page 5 and look at the fluid gradient there used by the Texas Company on its Carney and U.P. leases. Do you see anything there that is as large as .373 in that column? They are all consistently lower with one exception, are they not?

A. That is correct.

Q. Now let us go back to the bottom hole pressure survey conducted in June of 1954 on your wells, and I will hand you that. Would you mind reading for the Commission what the gradient was that you used in 1954 in reporting that same data for each of the same wells that you this year use .373?

A. .345.

Q. And what was it in 1955?

A. .373.

Q. J. E. Coltharp -- well, those are in the east end I am informed so we can jump down here to the west end. L. N. Hagood "A".

A. .345.

Q. And in 1955?

A. .373.

Q. Do you see any of those west end leases, Mr. Giles, there where you didn't use a higher gradient this year than you did last?

A. No, sir, I do not.

Q. Now did that gradient change consistently in the west end during the course of one year?

A. It evidently changed from .345 to .373.

Q. Now would you take a look at some of the other west end leases and see whether there has been a corresponding change between their gradients used in '54 and the gradient that they used in '55.

A. There have been some changes.

Q. Yes, but have there been consistent changes increasing the gradient? Can you find any leases there that has been consistently changed upward, other than your own, in the west end of the field of course?

A. The Emerald 26 changed upward.

Q. That is one well out of how many on the lease?

A. That is one well. I think you will probably find more, Mr. Sullivan, if you check.

Q. Well, I have checked them and I don't think you will find any. I didn't find any. I don't want to testify. I will give you all the time you want to examine that. Is it mere

coincidence that your gradient went up so consistently?

A. The gradient would be based on the gravity of the oil the density of the oil, and when the density of the oil increases then the gradient increases.

Q. Then do I assume that the Stanolind experienced this phenomenon exclusively in the field between June 1954 and 1955?

A. I think that one thing that might have a bearing on that would be the fact that Stanolind was producing from lower ratio wells, and the fluid in the column under Stanolind's leases could be of higher density than California where California produces higher ratio wells.

Q. But would their relative status change from one year to the next?

A. If you were handling more volumes of gas it could change.

Q. It could, but is that what caused the change between 1954 and 1955?

A. I am of the feeling that that was the likely contributing factor.

Q. If that was a contributing factor, what was another contributing factor?

A. That was predominantly the contributing factor.

Q. I see, and that was the only place that that happened in the field apparently.

A. In the west area that happened.

Q. Now let's go back to our L. N. Hagood. Let me ask you one further question first. Will not in your formula there if the PSI over FT there, if that is raised will that not give you higher pounds per square inch in your answer?

A. That is correct. However--

Q. Just confine yourself to the questions please.

A. I would like to answer the question.

Q. In other words, any time that second factor there is raised, either arbitrarily or based upon observed conditions, it will give you a higher PSI as an answer?

A. This would not be raised by Stanolind between the 1954 survey and 1955 survey arbitrarily, Mr. Sullivan.

Q. I am glad to know that.

A. And if it were raised, the rise is likely insignificant in comparison with whether or not it would serve to discount the disparities here. The pressure would still be higher on the Mary C. Hagood.

Q. Is it possible that the difference between '54 and '55 being a consistent difference was due to error?

A. No.

Q. You eliminate that possibility completely?

A. I say there was no error involved, no arbitrary dealings here.

Q. Now let's go back to L. N. Hagood "5" and take your data there out of the '55 report and work that out to just give

us the idea of what its PSI would be as a result of the use of that formula, would you please.

A. I think I will need to know the altitude of that L. N. Hagood elevation.

Q. I can supply that to you if you will accept it. It's 5437 feet. I have the well data here compiled by the Rangely Engineering Committee if you would like to check that figure.

A. No, I will take your word for that, Mr. Sullivan.

Q. You have a minus 900 datum.

A. That is correct. Now I have corrected to take into account the actual height of the oil column above the minus 900 foot datum and find that the height of the column is 2649 feet.

Q. Now what do you do with that now in your formula?

A. Take that times the gradient of .373.

Q. Now, Mr. Giles, check your multiplication there, will you, in both the first and the third line.

A. The 2649 times the gradient?

Q. No, the 3 times 2649. That should be a 7 rather than a 6 in both lines, should it not? Now what is the 981.377?

A. Pounds per square inch pressure for that particular well.

Q. That is what it gives you, isn't that enough?

A. However, we should take into account the gas.

Q. Well, let's just let that go. Just explain to the

Commission that you add the factor there of the weight of the gas column and how you do that and we will let that go.

A. By adding all the factors you will come out with a pressure of 1845 pounds per square inch.

Q. Now then, Mr. Giles, you don't suppose that whoever figured that gradient for 1955 made the same sort of an error you did in multiplying there?

A. I would imagine the members of the Engineering Committee would have checked all the results.

Q. Now let us take the same factors that you had there this year and come up with your 2649 feet, and will you multiply that by the fluid gradient that you used in 1954 for that well. Leave your result down there what you got from the 2649. It was .345 for 1954.

A. 914.

Q. As compared to 981 for this year?

A. That is correct.

Q. In other words, that slight difference between gradients in 1954 and 1955 resulted in 67 pounds difference in your answer, didn't it?

A. That is correct.

Q. Now it's the difference between your bottom hole pressures taken in 1955 that account for the figures on this chart and also the isobaric line?

A. That is correct. The gradients were increased for

due cause, however; in other words, there isn't any error involved.

Q. You have demonstrated nevertheless that that simple difference in the use of the gradient will result in certainly material and substantial differences in your bottom hole pressure.

A. It will make some difference. I wouldn't go outlandish, Mr. Sullivan, and say it was material.

Q. Well, 67 pounds out of 914 is a fair percentage.

A. Less than 10%.

Q. Then you acknowledge that there may be as much as 10% error in the figures that you have used here?

A. There is no error, Mr. Sullivan, no error whatsoever.

Q. I just wanted to make that clear. Now would you please refer to your Exhibit No. 4. Now did you draw that line A-A Prime any place else before you arrived at that location on this exhibit?

A. No, sir.

Q. How did you happen to arrive at that particular location?

A. I took the line that was perpendicular or normal to the trend on the contours on the M. C. Hagood lease. It so happens it follows through the L. N. Hagood gas injection wells. However, if you take the slope of that line anywhere across the L. N. Hagood lease in any direction the same similar type of factor will be shown that is shown on this profile, for the

simple reason that the pressures are higher on the L. N. Hagood lease than on the California A. C. McLaughlin lease.

Q. Do I take it that was the only logical place to draw the line?

A. The most logical place to draw the line is to angle it. Forget this situation here for a moment because the pressures are higher everywhere on that lease, and merely take the line that was perpendicular.

Q. That is the most logical place to draw it?

A. That is correct.

Q. But not the only logical one?

A. No.

Q. But you said you didn't try it anywhere else.

A. Just on a piece of paper, Mr. Sullivan.

Q. That is what I want to find out. Did you try it any place before you drew up this exhibit to demonstrate whatever that exhibit is supposed to demonstrate?

A. I fooled around with it, yes, sir.

Q. As a matter of fact you came up with a line that would show the most favorable circumstances, didn't you? That is just normal procedure, isn't it?

A. It shows a rather favorable circumstance. It certainly shows the disparity very clearly.

Q. I assumed that was the procedure that you followed. Now let me ask you another thing. In the use of your averages

that you have used, Mr. Giles, from exhibit to exhibit, and I think that they comprised -- would you refresh my memory on what that was.

A. Weighting by area, weighting by 3 millidarcy oil in place.

Q. That is right. Now you used lease averages there, did you not, without regard to the size of the lease, the number of the wells on the lease?

A. I used tracts.

Q. Tracts?

A. Tracts.

Q. And what was the size of the tract that you used?

A. They would vary according to the actual size of the tracts, 40 acres, 80 acres, 160 acres.

Q. How did you arrive at averages if you used different size tracts then?

A. Quite simple. Exhibit 4 is a pressure contour map as compiled by the Rangely Engineering Committee, their interpretation. Let's assume we have two tracts, one is 40 acres and another one is 80 acres. Certainly we can measure the area of that tract and the area of an 80-acre tract. Those have already been computed by the Rangely Engineering Committee, that appears in the February, 1949, report. Now as to the pressures, let's say the pressure came down in this fashion here, and this is a pressure of 1,000 pounds, pressure contour

of 1,000 pounds, and this is one of 900 pounds. Let's put another pressure on here and call this 1,100 pounds. Now certainly for this portion of that tract you can determine what average pressure exists under that portion of the tract, and likewise what the average pressure exists under the remaining portion of the tract at this point. For this point you go to the next pressure contour and get the interpolation and determine the average for that tract, and then depending on the area of that tract and the average pressure the area of this portion of the tract is averaged and you can weight the pressure for that 40-acre tract.

Q. Now indicate on there by an arrow on the lease line divided by the 40-acre tract and the 80-acre tract where the drainage occurs.

A. If the average pressure is higher on this tract than on this 80-acre tract, oil can only go in this direction.

Q. Now if the average pressure in the area varies greatly from one side of the tract to the other, will that affect the actual drainage across the lease line?

A. To a very minor extent. In comparing with the 80-acre tract, if the overall pressure is higher on the 40-acre tract compared with the 80-acre tract, again, Mr. Sullivan, the oil can only go to the lower pressure.

Q. Just for sake of hypothetical assumption here, let's assume that on the right hand side of the 40-acre tract there

is a radical difference in pressure, it's lower than it is on the west side of the tract--

A. Why assume when we know the facts?

Q. I am asking you to assume that, that if there were this abnormal, this unusual low pressure area on the east side of the tract, would there necessarily be drainage across the lease line in the direction you have now indicated?

A. If this is a lower pressure area in that portion of the tract and the overall pressure of this tract is higher, there will still be general migration of fluid to the lower pressure tract to the right.

Q. Now is that going to be the case even on the larger area? I mean assume that instead of having 40 acres there and 80 acres that those actually comprised several tracts of that same size but they remained in their same relative geometric location and size.

A. The same general comparison could be made. If the pressures are higher on Stanolind's tracts as compared to California's offsetting tracts, the oil will only flow one way, to the lower pressure, which is the case in the west area of Rangely.

Q. Now let me ask you one other question. I want to go back one more time to this gradient feature that we discussed in some detail a moment ago. If for instance the California Company had used a different gradient than the relative position

in the measuring of these bottom hole pressure tests, then this map would appear completely different in so far as the relative position of Stanolind and the California Company's properties are concerned, would it not?

A. That is correct only to the extent if you had sufficient justification and basis for increasing your gradient.

Q. Did you have that justification?

A. I would presume we had.

MR. SULLIVAN: I have no more questions.

THE WITNESS: Certainly the Rangely Engineering Committee is going to check those pressures very closely before they put it onto a map.

CHAIRMAN DOWNING: Any further cross examination?

BY MR. EVANS:

Q. On your Exhibit 11 which depicts two barrels of oil, do I understand you right that that is the overall picture?

A. For the west area, California's operated properties as against Stanolind's operated properties.

Q. And so that on the basis of that exhibit then Stanolind properties are being drained by California Company properties, is that correct?

A. You are correct.

Q. Now you have previously stated consistent with that that the oil travels from the higher pressures to the lower pressures.

A. That is correct.

Q. Now referring to your Exhibit 4 there, on the lower left hand area of the map I assume that the yellow is the Stanolind leases?

A. Stanolind's acreage is blocked along the western.

Q. Now there where the red shows right in there and up along almost to the green and up higher to the left, wouldn't the oil under your theory be flowing into Stanolind leases?

A. Now let's look at the situation.

Q. Well, just answer my question.

A. The oil would tend to flow away from the higher pressure to the low pressure.

Q. So it would be flowing into Stanolind's leases?

A. These are not all Stanolind's leases.

Q. The yellow I am talking about.

Q. That is correct.

Q. All right, then take the situation up in the upper right hand corner near the boundary line of the west unit. That is Stanolind's lease?

A. Yes, sir.

Q. Your oil would be flowing into your Stanolind lease there, wouldn't it?

A. In this localized area, yes.

Q. Well, you don't have to characterize it by that. It would be flowing into that lease area, wouldn't it?

A. It would be flowing into the general area of the lower pressures.

Q. Then take about the middle of the upper portion of those two yellow tracts there, oil would be flowing into Stanolind's leases there, wouldn't it, if it flows from a high pressure to a low pressure?

A. Now which direction, Mr. Evans?

Q. I don't know. You answer.

A. The McLaughlin unit on the one-well tract, the pressures are lower than on the Stanolind Associated Unit "A" tract

Q. Oil would be flowing into that lease, would it not?

A. It would be generally flowing in the direction of the lower pressure.

Q. Then on the other one there, wouldn't oil be flowing into it because of the high pressure area to the lower left hand

A. That is correct.

MR. EVANS: That is all.

CHAIRMAN DOWNING: Any other questions?

REDIRECT EXAMINATION

BY MR. ROBBINSON:

Q. Considerable point has been made that there is a possibility of error in the figures which have been computed by the Rangely Engineering Committee. May I ask, is California Company represented on that committee?

A. They very definitely are.

Q. They have been at all times?

A. Ever since it was formed.

Q. Was the Rangely Engineering Committee information, or information compiled by this committee, used in presenting a good portion of their figures at the last hearing?

A. That is correct.

Q. Incidentally, you did not separately compute the various reservoir pressures, did you, on these various wells?

A. No, sir.

Q. You accepted the Rangely Engineering Committee figures and worked from them?

A. That is correct.

Q. Now a point further has been made that on certain lease lines, of course, the drainage obviously is in the direction of Stanolind's leases. Was it an effort to get away from just well-by-well and lease-line by lease-line computation that you made these average pressure computations which you made

A. Yes, sir.

Q. So you could take a look at what kind of a forest it was rather than what kind of trees they were?

A. Absolutely, Mr. Robbinson.

Q. Now you made the further statement there was no necessity for an oil limit or that an oil limit in your opinion would not serve to dissipate the pressure differentials which have come about in this field. Why did you make such a statement, Mr. Giles?

A. Because in my opinion an oil limit at this time would

serve to defeat Stanolind trying to prevent avoidable drainage. We know drainage is taking place now from Stanolind's properties to California because the pressures are higher on Stanolind's operated properties in the west area, and to put an oil limit will reduce Stanolind's production from wells producing now above such an oil limit, and when you reduce the production of those wells you reduce the pressure drawdown to produce those wells. It might just freeze the condition that is now present, but certainly I think in my own opinion it would aggravate the pressure differentials.

Q. Do you believe it would be in the mind of human ingenuity to devise any kind of a formula which would level out the pressures in this area?

A. I can't conceive of a formula. Certainly a top oil limit will not do the trick.

MR. ROBBINSON: I have no further questions.

RECROSS EXAMINATION

BY MR. SULLIVAN:

Q. Do I understand correctly then that Stanolind's only hope for equitable sharing of production into that field or to put a stop to your drainage lies in your capacity to produce unlimitedly?

A. Not unlimitedly, Mr. Sullivan.

Q. How high would you like to go?

A. We would produce our wells as we have in the past. We

have always continued to produce wells as efficiently as we can. Certainly we will never exceed any limit above which physical waste would occur.

Q. Would it help your situation to limit our production?

A. It would help us if you would shut all your wells in, Mr. Sullivan.

Q. I thought that would be the idea.

MR. SULLIVAN: That is all, thank you.

BY MR. WESTFALL:

Q. Several times you have made reference to Stanolind's trying to maintain their position by eliminating the voidable drainage. What do you have reference to?

A. To prevent voidable drainage?

Q. Yes.

A. We are producing our wells at rates within the limits of creating physical waste. In other words, we are producing our wells on certain of the leases in the west area at pretty high rates, five or six hundred barrels a day, but we have got to produce our wells at those rates to prevent the California Company not only recovering its own oil but capturing some of Stanolind's.

Q. In bringing up this pressure differential, Stanolind is not actually asking for relief from the situation as it now exists, but merely attempting to set up an order that would prevent the situation from becoming any worse, is that correct?

A. That is correct, sir.

Q. And it is your contention that a top oil allowable per well allowable would aggravate the situation rather than alleviate it, is that correct?

A. That is correct.

CHAIRMAN DOWNING: Any other questions?

(Witness excused.)

CHAIRMAN DOWNING: Do the four companies wish to present more testimony?

JACK TARNER

called as a witness for the Phillips Petroleum Company, being first duly sworn, upon his oath testified as follows:

DIRECT EXAMINATION

BY MR. KIRGIS:

Q. Will you state your full name please.

A. Jack Tarner.

MR. KIRGIS: Mr. Tarner has appeared in these proceedings before. Will his qualifications be conceded? If not, I will be happy to interrogate him regarding them.

MR. SULLIVAN: I accept him.

CHAIRMAN DOWNING: If there is no objection, he will be considered as well qualified.

Q. Mr. Tarner, what is your position with Phillips Petroleum Company?

A. Technical Adviser to the Manager of Production.

Q. In that capacity what is your familiarity with the Rangely Field?

A. I have followed through its development and unitization efforts for about 8 or 9 years now.

Q. Are you personally familiar with the Rangely Field and its behavior?

A. Yes, sir.

Q. We have put upon the board what has been marked for identification as Phillips Exhibit No. 1. Will you state what leases are depicted by that exhibit.

A. Just two Phillips leases. I would like to go back just a little bit and say that we are studying this only in so far as it pertains to the small leases operated by Phillips in the west end of the field, and on this particular exhibit the two center leases are the Phillips Rigby and Rigby "A" leases, both one-well leases.

Q. Pardon me, Mr. Turner, but will you indicate on Stanolind Exhibit No. 4 the location of those two Rigby leases.

A. They are in about the center of the west portion of the field.

Q. Are these the two leases to which I am now pointing?

A. Yes, sir.

Q. Will you proceed.

A. All we are concerned with is the first row of offsets around the Phillips leases, and I have drawn on here the arrows

which will show the direction of fluid migration caused by the pressure differentials which were last measured in the field in June of 1955. It shows here that Phillips Petroleum Company is offset by six California wells.

Q. Pardon me, Mr. Tarner, to what are you referring?

A. I am referring here to a small chart of Phillips Exhibit No. 1 which I have penciled some figures on, but there are six California wells surrounding the Phillips leases there, and migrations that occurred because of pressure differential cause fluid to flow from Phillips leases in three instances and it causes fluid to flow from California to Phillips in three others. Stanolind has four wells offsetting those two leases, and two of the arrows show fluid migrating away from Phillips to Stanolind and two arrows show fluid migrations to Phillips from Stanolind. So we figure we are in a stand-off position here. There is as many arrows going out as there are moving in. We do not believe we have created any adverse drainage situations there respecting those leases.

Q. Do you have anything further you wish to say regarding Phillips Exhibit No. 1?

A. No, sir.

Q. Mr. Tarner, I call your attention now to an exhibit we have just put on the board marked Phillips Exhibit No. 2. Is the theory of that exhibit similar to that of Phillips Exhibit No. 1?

A. Yes, sir.

Q. Is the source of the information used on that exhibit the same as the source of the information on Exhibit No. 1?

A. It is.

Q. Will you locate on Stanolind Exhibit No. 4 the leases which are depicted on Phillips Exhibit No. 2.

A. The leases are shown at this point here in the top central portion of the west side of the field.

Q. Will you explain now what is demonstrated by Phillips Exhibit No. 2.

A. There are eight California Company wells surrounding the two Phillips leases there, and the pressure gradient in four instances will cause fluid to migrate to California and four instances it moves back towards Phillips; so we figure we are in a stand-off position there. Stanolind has two wells and the pressure gradients are both towards the Stanolind wells. I do not think that there is any exceptionally adverse conditions that have been created there.

Q. You mean by that that you think that the fact that the Stanolind wells have a pressure gradient in their favor is not material?

A. Not at the present time. Sometime it might be, but we have been operating up there under a Commission ruling and have pretty much looked after our own situation there and I don't think that anybody is able to get to us too much.

Q. You haven't anything you wish to say regarding Exhibit No. 2?

A. No, sir.

Q. Mr. Turner, I call to your attention Phillips Exhibit No. 3 which has been placed on the board. Is the source of material for that similar to the source of material as Phillips Exhibits Nos. 1 and 2?

A. Yes, sir.

Q. Has it been prepared in the manner similar to that as Exhibits Nos. 1 and 2 were prepared?

A. Yes, sir.

Q. Would you show on Stanolind Exhibit No. 4 the location of the Phillips Beezley leases depicted on Phillips Exhibit 3.

A. This is the Beezley lease. It's over in the west portion of the field, and actually the Beezley No. 2 well is the westerly most well in this particular row here; so that this lease is located in the direction where there is a small activity of water encroaching, water encroaching from the west into the east.

Q. Now referring back to Phillips Exhibit No. 3, will you explain what is shown by that exhibit?

A. It shows there that into the Phillips Beezley No. 2 wells there is oil moving from two Stanolind leases, and Stanolind takes it out on the south end from us. Over here on the Phillips Beezley No. 1 there are four arrows showing migration in, one arrow showing migration out, and three of those arrows come from California Company. We are quite fortunate there to

have a little bit better favorable position of drainage.

Incidentally, this well is making water, about 30 barrels a day

Q. Which well do you refer to?

A. The west well, 2-22. We hope we can get a little bit increased production there because as that water moves in, we don't know how far it will go, but any movement of oil caused by water coming in from the west will be over towards the California Company leases; so while we might get something from them today, they will eventually get it back.

Q. Is there anything further you wish to say regarding Phillips Exhibit No. 3?

A. No, sir, there is not.

Q. Does Phillips have any other wells in what has been designated as the western portion of the field?

A. Yes, we have the one well Larson down here, which I don't think anybody would accuse it of taking oil from anybody. It's a pretty poor well. Then the rest of our wells aren't harming anybody; they are low production.

Q. Those wells you refer to are in the eastern portion of the field?

A. Yes, the Levison lease.

Q. But there is nothing else in the western portion except the wells to which you have already referred, is that correct?

A. No, these are the only good wells we have that could cause anybody any reason to complain.

Q. Is there anything further you wish to add regarding this situation regarding drainage to or from Phillips properties in the western part of the field?

A. No, sir, except that I just don't think that currently there is any cause for anybody's alarm on drainage. Now it might develop in the future, but right now I don't think there is any problems arising.

MR. KIRGIS: Mr. Chairman, I offer in evidence Phillips Exhibits Nos. 1, 2, and 3.

CHAIRMAN DOWNING: If there is no objection, they will be received.

MR. KIRGIS: The witness is available for cross examination.

CHAIRMAN DOWNING: May I interrupt here. There is one thing that has worried me that I have thought about in this hearing. The first lesson I think we learned in conservation is the necessity or desirability of top allowables on oil, and that means the basis of conservation is an orderly withdrawal, gradual withdrawal, no matter whether it's a gas drive or water drive, that at least there are not channels somewhere along in the weak spots so a lot of the oil is by-passed. Now at our last hearing the Phillips recommended a top allowable of 300 barrels, and Stanolind advocated a top allowable of 350, and Sharples 200 I think, and Texas-U.P. didn't state any figure but said any lawful order, as I recall it would be satisfactory

to them. The California Company suggested or advocated 200. Now those were the recommendations then. Have you changed? And I say this not so much on the grounds of principle but on the grounds of waste. As I say, you take East Texas. Look what a marvelous job they have done, although their allowable has been undoubtedly way too small, but nevertheless look what has been accomplished. I just wonder why that feature of conservation is being ignored in this hearing.

MR. ROBBINSON: If I may, Mr. Chairman, I don't think there is an engineer in this room which with different reservoir mechanics would question the fact there ought to be a top oil allowable maybe in the interest of waste, but in the discussion which has come up here, I know of nothing which has been indicated that such a top oil allowable is justified or perhaps legal under the situation that exists in connection with this reservoir. Now it has been demonstrated without the top oil allowable you do have some drainage which is occurring in that field, but the top oil allowable the witnesses say would not correct it. What you have is a dispersed gas injection with other factors entering into it and the pressures within this reservoir are being somewhat distorted, but there is no indication that a top oil allowable would help that. The case is that the top oil allowable might increase it or accent it

CHAIRMAN DOWNING: Is there a field in the United States almost that doesn't have a top oil allowable?

MR. ROBBINSON: Well, if you wish to speak of market conditions which bring that about generally I will agree with you, but if I read your statute correctly you are not here concerned with market conditions.

CHAIRMAN DOWNING: No, but place the market demand allowable on the basis of good conservation.

MR. ROBBINSON: I suggest we go ahead and hear all the testimony, then I have a speech I would like to make.

CHAIRMAN DOWNING: All I want to do is to bring to your attention something that was running through my mind on the thing, why we don't hear some evidence on that. We did hear some evidence on top allowable as concerned California.

MR. ROBBINSON: Let's hear what the witnesses say, then I will be glad to make a speech that I have been keeping in reserve here.

MR. TARNER: Judge, I would like to explain my position on that. I put on 300 barrels a day and I think around 500 and 700 cubic feet per barrel for gas-oil ratio. Well, the 300 barrels per day and the 500 cubic feet per barrel would give you the 150,000 cubic feet flare per well that we are here today advocating. Now for a conservation basis the best thing to do is to watch the gas-oil ratio. The wells with the highest gas-oil ratios are the most wasteful wells and any time you adopt a 150,000 Mcf per day production per well you are limiting the amount of oil that is going to be produced from the wasteful

wells. For instance, with 150,000 cubic feet a day per well, any well with 100 to 1 ratio is cut to 150 barrels per day, so that by the adoption of that 150,000 cubic foot per well production figure you automatically limit the oil production on the wasteful wells.

Now my 300 barrels per day figure was in the interest of administration purposes. I assumed that we would have to have here a per well allowable and that you would have to have a top figure assigned to each well, but going this other route of using the 150,000 per well on producing volume I think you automatically take care of a top allowable. You are going to cut the wells with 1,000 to 1 way below 300 barrels per day; they will be down to 150 unless they inject the gas.

CHAIRMAN DOWNING: Well, I can see there is a lot of probabilities and a lot of angles, but of course I have always felt maybe there is some distinction between conservation as administered by the Commissions, as you know better, and conservation as often desired by the companies. The companies believe in conservation with a profit tinged to it, and properly, there is no objection to it; the conservation bodies believe in conservation without reference to the economics of it except in a very general way. I can see for illustration that a company would like to use gas, waste gas, in order to produce more oil, whereas that may not be in the interest of conservation as administered by a regulatory body. In other words, gas

has value, it's a commodity the same as oil, and if it can be sold it can be valuable. That angle too should be given consideration. I mean these are just things I have been thinking about, not convictions, but they have been running through my mind. As I look at it, I think this is about the toughest problem, isn't it, Mr. Robinson, about the toughest problem to come before any Commission?

MR. ROBBINSON: I don't recall having run across a tougher one.

CHAIRMAN DOWNING: All right, go ahead.

MR. KIRGIS: Mr. Chairman, I don't wish to argue the case at this time, but merely in response to your suggestions, it seems to me that an oil allowable serves one or two purposes; either it serves the purpose of fixing allowables for market demand, which is not permissible under our Colorado law, or in the alternative it serves the purpose of preventing waste. Now there may have been some assumption that fixing a top oil allowable prevents waste, but there has not I think been one shred of evidence introduced that that is so, and unless there is evidence that a top oil allowable is necessary here to prevent waste I think it's something that is outside of the ken of the Commission on this hearing and on this record. The evidence which has been presented thus far on that point, it seems to me, is directed towards showing whether or not there is any injury to correlative rights, and that testimony is being

answered in the testimony being given today.

CHAIRMAN DOWNING: I think the testimony is strongly to the point it's not necessary to put on a top allowable in order to protect correlative rights. That is the inquiry I had in mind was the waste feature of it. If a top allowable is necessary to prevent waste I assume we ought to fix it.

MR. KIRGIS: We have the problem there of waste of oil or waste of gas. The order that is presented now controls the flaring of gas, and the testimony is designed to show that it prevents any unreasonable waste of gas.

CHAIRMAN DOWNING: Well, I don't think any member of this Commission has any definite idea in his mind as yet what is the proper order; we are just thinking about it.

MR. KIRGIS: Mr. Tarner is available for cross examination now.

CROSS EXAMINATION

BY MR. JERSIN:

Q. Mr. Tarner, are any wells being operated by Phillips being operated at capacity now?

A. I can't answer that exactly. Of course most of our east side wells are. We have pinched in on most of these six wells we have here on the east side, but they are pretty well up on the scale of capacity.

Q. Has Phillips taken any capacity tests lately?

A. I don't think so. I don't think they have except on

those individual wells, the poor wells on the east side.

Q. The wells on the west side, you are not sure how much they have produced?

A. We have been restricted with that gasoline plant limitation of about 124,000 cubic feet per well currently, we have been restricted to that, and I can't answer what the open flow capacity would be. We don't want to take those tests either. We will run the productivity test for you if you wish.

MR. JERSIN: That is all I have.

CHAIRMAN DOWNING: Any other questions?

(Witness excused.)

CHAIRMAN DOWNING: Any other witnesses?

MR. CHURCHILL: I am D. O. Churchill, representing Texas and Union Pacific. We have some testimony we would like to present. I might say at the outset, Mr. Chairman, the order which has been proposed for adoption by the Commission provides, among other things, that any operator or operators shall have the right to conduct a pilot test program for the purpose of evaluating the feasibility of injecting gas into any formation other than the Weber Reservoir. At this time Texas and Union Pacific would like to present evidence in support of that provision of the proposed order. Mr. Mattson will be the only witness we will present.

T. O. H. MATTSON

called as a witness for the Texas-Union Pacific, being first duly sworn according to law, upon his oath testified as follows:

DIRECT EXAMINATION

BY MR. CHURCHILL:

Q. For the record, will you state your full name please.

A. My name is T. O. H. Mattson.

Q. By whom are you employed and in what capacity?

A. I am employed by the Texas Company as Division Petroleum Engineer for the Rocky Mountain Division.

MR. CHURCHILL: Mr. Mattson as you know has testified in numerous previous hearings regarding Rangely, and I assume his qualifications to testify as an expert will be acknowledged?

CHAIRMAN DOWNING: There is no objection, he will be considered as qualified.

Q. Have you prepared a statement for presentation to the Commission on the proposed pilot test program to determine the feasibility of injecting and storing gas in the Entrada formation?

A. I have.

MR. CHURCHILL: I might say this statement is made on behalf of both the Texas Company and Union Pacific.

Q. Will you go ahead and give your prepared statement.

A. I am appearing here in behalf of the Texas Company and in response to the Commission's request for additional testimony on the basis of which it may promulgate rules and regulations to cover the operation of the Weber Reservoir in the Rangely Field. My testimony will cover three items, the first two of which have for some time been under consideration

by the Commission, and the third which has never before been formally presented. The first two are the matters of top oil allowable and the problems attendant to the production and disposition of gas; the third is the storage of gas in the Rangely Field within the Entrada Sandstone Reservoir.

CHAIRMAN DOWNING: Is that the Dakota?

THE WITNESS: No, sir.

CHAIRMAN DOWNING: Is that still another?

THE WITNESS: This is the Entrada, which is below the Dakota. With respect to Item No. 1, a top oil allowable for Weber oil wells, The Texas Company does not want an oil allowable for the Rangely Field. We believe that a reservoir such as the Weber should be permitted to produce at the rate necessary to keep the total field market supplied, and that such a procedure gives each operator ample opportunity to produce his wells in the manner which he believes in his overall picture to be best, taking into account all the circumstances having a bearing on the problem. It is reasonable to assume that each company at Rangely has conducted its operation in a manner which has best fit its own peculiar individual combination of these determining circumstances. We know of no instance in which such operating practices have created waste. In other words, producing rate has no bearing on ultimate primary recovery.

As to Item No. 2, pertaining to the production and disposition of gas from the Weber Reservoir, we have in the past

maintained that the benefits to be derived from injection of gas into the Weber Reservoir are, to say the least, highly speculative, and as to The Texas Company-Union Pacific properties, that injection of gas into the Weber is very undesirable. Nevertheless, we have been forced by order of the Commission to make very substantial investments in gas gathering and injection facilities and as of August 1955 we were injecting approximately 37% of the gas in the field in order to produce approximately 20% of the oil from the field. Having made these investments, we are willing for the time being to keep this equipment in operation and within the limits of these installations to do everything we can to conserve the gas for future use without jeopardizing our oil operations. It has been proposed to the Commission that a top gas allowable of 150,000 cubic feet per day be allowed for each Weber well, whether on production or injection status, any additional gas production being permitted only if it is used as field fuel, plant shrinkage, sale, injection into Weber or other formations, or to test suitability of other formations as storage reservoirs. We have previously objected to such restriction of gas production as being unreasonably limiting. Our view in this respect remains unchanged. However, we will be willing temporarily to accept such a restriction for a period of time, not exceeding the time that we will be able with our present gas gathering and injection facilities, to operate thereunder and maintain our market and



01136283

2-27

pgs 101 - 150

11/21/55

field position. We believe that we will be able to operate under such a limitation, and with only our present compressor installations, for six months or more, possibly until the Pacific Northwest Pipe Line Company is able to start purchasing gas from the Rangely Field, thus providing additional gas disposition relief. It is our present plan to continue operating to capacity all of our present compressor installations; thus, the amount of gas we would flare would be reduced to only a small percentage of the 150,000 cubic feet per well per day contemplated by the proposed order. In our opinion it would be unwise and uneconomical for Texas-U.P. to install additional compressors now or in the foreseeable future.

The Commission is aware of the fact that the Pacific Northwest Pipe Line Company is in the process of constructing a pipe line from the San Juan Basin to the Pacific Northwest, which pipe line goes through the Rangely Field. Pacific North West has indicated its willingness to purchase gas at Rangely. There is, therefore, at this time some incentive to store this gas for future sale. However, it can be shown that gas storage in the Weber reservoir is uneconomical. The Texas-U.P. gas injection costs average 4.2 cents per Mcf. During August, 1955, as shown in Exhibit 1, 43.5 per cent of the gas injected by Texas-U.P. was cycled gas. The other 56.5 per cent was the volume of gas being stored at a cost of 7.4 cents per Mcf for future use, and to eventually join the cycling stream. The

difference of 3.2 cents per Mcf stored represents the August cycling cost required to keep the gas in storage, which cost for that month alone amounted to \$16,000. It can similarly be shown that the unit cost of gas storage in the Weber by the Texas Company-U.P. during February, 1956, will be about 9.6 cents per Mcf stored, the extra cost being due to a substantial increase in cycling. It can therefore be clearly seen that storage of gas in the Weber is fast becoming a most unprofitable operation, and that information should now be gathered to determine whether or not gas produced in excess of gasoline plant needs, field fuel, and pipe line requirements, can be economically stored in some reservoir other than the Weber. Gas storage of this type is commonplace in the industry. We have made a joint study of this problem in conjunction with engineers of Union Pacific and Sharples, and have arrived at the conclusion that the initial experiments of such gas storage at Rangely should be conducted in the Entrada Reservoir which appears to have the characteristics necessary for such a project.

Item No. 3 in my testimony therefore pertains to the storage of gas in the Entrada. Exhibit 2, which has been placed on the board, shows contours drawn on top of the Entrada porosity in the crestal area of the Rangely Field, and therefore pictures the top of the Entrada Reservoir itself. The very uppermost part of the Entrada consists of a variable amount of very tight siltstone; consequently to the extent of

modification resulting from the variation in thickness of the tight upper siltstone, the map represents also the Entrada structure. It will be noted that generally the Entrada structure conforms to the underlying Weber structure.

Exhibit 3, also attached to the board, is a cross-section drawn to show primarily the sequence of formations at the depths under consideration. The uppermost red band shows the top of the Dakota Sandstone; the yellow band at the approximate center of the geologic section shows the Entrada Sandstone Reservoir. Above the Entrada Sandstone is the Curtis Shale; immediately below is the Carmel formation, and below that is the top of the massive Navajo Sandstone. The Entrada has been determined to be water productive by means of various drill stem tests throughout the field. For instance, The California Company's Emerald No. 16 well, located in the northeast northwest, Section 31, recovered fresh water in 21 minutes and thereafter flowed water at the rate of 14 barrels in 15 minutes from an interval of plus 1470 to plus 1442 feet above sea level. This test indicated the reservoir pressure to be approximately 1850 psi. Another drill stem test of the Entrada Sandstone conducted on the Phillips' Levison No. 1 well, which is located in the southeast of the southeast of Section 27, started flowing water in 20 minutes through casing perforations at an interval of plus 1089 to plus 1079 feet above sea level. The average permeability of the reservoir was determined from these tests

to be approximately 400 millidarcies, which permeability compares favorably with laboratory determinations of permeability made on a few Entrada core samples at Rangely and in other nearby fields producing from the Entrada; porosity was determined to be approximately 18% on the basis of a few core analyses at Rangely and at nearby fields.

In summary, therefore, the Entrada Reservoir at Rangely has structural closure and is a water-filled sandstone having a thickness of approximately 140 feet, a permeability of approximately 400 millidarcies, and a porosity of approximately 18%. The reservoir pressure has been determined by drill stem test results to be approximately 1,850 psi, which pressure is sufficient to sustain a column of water some 400 feet above the surface at the Rangely Field.

The Curtis Formation, consisting principally of shales and limy shale and having a thickness of approximately 100 feet, lies immediately above the Entrada Sandstone. It forms, therefore, with the tight siltstone of the upper Entrada, the impermeable cap rock which contains the abnormally high water pressures within the Entrada Reservoir. The fact that there are no known springs or fountains in the Rangely area is the strongest evidence that the various water reservoirs, including the Entrada, are sealed and able to contain water under high pressure and therefore similarly able to contain gas under pressure. The thickness of the sand body and its high porosity and

permeability indicate that it can contain large volumes of gas and that the sand will be able to receive injected gas and produce it again with but nominal changes in pressure. All information available at this time, therefore, indicates that the Entrada will be a satisfactory gas storage reservoir; however, in order to eliminate any question as to the ability of the Entrada to contain gas it is proposed that a pilot gas storage project be started as soon as possible. The Texas Company therefore requests the Commission to approve such a pilot gas storage project, the initial purpose of which will be to determine the rate at which gas can be injected into the Entrada Reservoir and the reservoir pressure behavior attendant to such gas injection. Having determined these initial objectives, it will be necessary to determine by actual injection experience that injected gas will stay in the reservoir and that it will be reproducible therefrom.

Some time ago The Texas-Union Pacific drilled a well, U.P. 70-32, as a deep test in the SW NE NW of Section 32. Ten and three-quarter inch casing was set on top of the Entrada. The well now stands plugged back into the 10-3/4 inch casing and can be easily recompleted as an Entrada injection well. We propose to utilize this well to conduct the initial tests for determining the ability of the Entrada Sand to receive gas. We believe that the injection capacity of the Entrada will be considerably greater than the injection capacity of any Weber well

presently in use in the Rangely Field, meaning that in all probability we will be able to inject in excess of 10 MMCFD into the Entrada Sand through one well. We propose to determine the maximum injection capacity within the limits of our compression facilities and to determine the rate of pressure build-up in the reservoir. In the meantime a close watch will be maintained on offset wells in order to promptly detect any signs of leakage. We anticipate being able to complete these initial tests within a period of one or two months, although it is recognized that the time element will be dependent on the rate at which the gas can be injected, and for this reason we recommend that no limitation be imposed as to injection rate in order that the testing time can be minimized.

The second objective, that of determining whether or not the gas will stay in the Entrada Reservoir, will take more time. A glance at the Entrada structure map will show a dome-like area in the north half of Section 32, the top of which is approximately 50 feet higher than the Texas-U.P. Well 70-32. Mr. S. W. McLaughlin has some time in the past drilled and cased a well to the top of the Dakota in the NW NE of Section 32. This well is ideally located for conducting injection tests of the Entrada whereby the ability of the Entrada to contain gas can be determined. An attempt is now being made to obtain permission to use this well for Entrada gas injection purposes. It has been calculated that the Entrada void space

in this dome-like high area, down to the elevation of Texas-U.P. Well 70-32, may contain approximately four billion cubic feet of injected gas. Contingent upon our ability to utilize this well, we propose to inject something in excess of four billion cubic feet of gas therein, and watch for it to appear at The Texas-U.P. 70-32 Well, which at that time will be utilized as an observation well. If this gas makes its appearance at approximately the time scheduled, we can conclude that there has been no leakage of injected gas from the reservoir and that this second objective of the pilot gas storage project has been successfully completed.

In the event that we are unable to obtain permission to deepen the McLaughlin well to the Entrada for injection purposes, it will be necessary to conduct the storage test utilizing only The Texas-U.P. 70-32 Well. It now appears that the best procedure to follow under these circumstances will be to inject into the well for a period of one month, then leave the well shut in for several days to a week, followed by a short period of back flow to determine whether or not the gas bubble has reached the injection well. By alternating such injection and back flow periods it is believed that a determination can be made as to when the gas bubble will have filled the reservoir to the elevation of the injection well and thereby again make it possible to determine whether or not any gas leakage has taken place.

The third objective will be to determine whether or not this gas can be reproduced. There is but one way known at this time for making such a determination, and that is to actually place a well on production at or near the top of the bubble, and thereby determine whether or not the production of water with the gas would be a serious problem. We do not at this time know what volume of gas production would be required to satisfactorily determine whether or not storage losses would be excessive. It is not believed, however, that it would be necessary to reproduce all of the injected gas in order to make a satisfactory determination. It will be necessary for our engineers to closely follow the progress of this experiment in order to maintain the necessary control. Progress reports will be prepared quarterly by them and furnished to the Commission.

I have mentioned earlier that gas storage of this type is commonplace in the industry. In most instances depleted gas or oil fields have been utilized for gas storage. In a few instances water reservoirs having the necessary characteristics as to closure, permeability, porosity, thickness and pressure have been so utilized, the most outstanding example of which is probably the Herscher Natural Gas Storage Project conducted by the Natural Gas Storage Company of Illinois near the town of Kankakee about 60 miles south of Chicago. In this particular instance the Galesville Sand of Cambrian Age is being

utilized for gas storage purposes. The sand is found at a depth of 1750 feet in the crestal area. It is 100 feet thick, has a porosity of approximately 18 1/2 per cent, a permeability of approximately 1500 millidarcies, and a reservoir pressure of approximately 680 pounds. It has been determined that the gas storage capacity of this formerly water-filled reservoir is 90 billion cubic feet. Storage losses at abandonment have been estimated by Natural Gas Storage Company at about 6%. During 1954, approximately 6.2 billion cubic feet of gas were injected into this reservoir at a maximum rate of 50 to 60 million cubic feet per day and a maximum injection wellhead pressure of 710 pounds. The maximum withdrawal rate during a single 24-hour test was 434.7 million cubic feet per day with a very nominal drop in reservoir pressure. No water has been produced to date.

In many respects the Rangely Entrada Reservoir compares with the Herscher Galesville Reservoir, particularly as to thickness and porosity. Permeability of both sands is high; the reservoir pressure at Rangely is considerably higher than the reservoir pressure at Herscher. There is reason to believe that gas storage performance of the two reservoirs may be comparable. We sincerely feel that a gas storage experiment such as this is needed at this time at Rangely. We respectfully request authorization from the Commission to conduct such a test, in order that we can promptly proceed to make the

necessary arrangements with other parties who may participate in the experiment.

MR. CHURCHILL: We offer in evidence the Exhibits 1, 2, and 3 which were testified to by Mr. Mattson and referred to in his statement.

CHAIRMAN DOWNING: If there is no objection they will be received. I want to compliment the author; I think he puts his position very very clearly.

MR. CHURCHILL: He is available for cross examination.

COMMISSIONER VAN TUYL: Are the Weber wells in this area so completed that there is little chance for escape of the gas from the Entrada Reservoir?

THE WITNESS: I believe that the completion of each well has been accomplished in such a manner that the Weber Reservoir will be protected. We have had available to us only the information on the Texas Company's wells. We have made a detailed check of that information and all of the information on the Texas Company's wells indicate such protection.

COMMISSIONER VAN TUYL: What about the Dakota, isn't there a chance for gas moving into that?

THE WITNESS: We are bordering now in the realm of speculation. It's my personal opinion that the gas will not move into the Dakota, but I don't believe that any final determination can be made on that without a test.

CHAIRMAN DOWNING: Any further questions?

CROSS EXAMINATION

BY MR. SULLIVAN:

Q. Mr. Mattson, I noted several "ifs" in the course of your discourse there. If any one of those fails then your whole plan or your whole scheme will probably fail or will not be successful, is that correct? If, for instance, there is leakage into the Dakota, will that not be a disadvantageous proposition that will lead you to at least reconsider your injection into the Entrada?

Q. If we are able to determine from such an experience as this that there is leakage into the Dakota it would lead us I think to the next step, and that is concluding that Entrada storage is not proper and probably we should try Dakota storage.

Q. Then that would entail another period of experimentation for the Dakota quite similar to this for the Entrada?

A. That is correct.

COMMISSIONER VAN TUYL: Is the lease situation that you can store gas in the Entrada such that you can store gas without becoming involved in litigation?

THE WITNESS: I don't know that I can give you a complete answer as to the lease situation, but I can say that as to the reservoir situation it will be much more simple to conduct a test in the Entrada than in the Dakota for the reason that the Dakota already has some gas in it, and if we were to conduct our initial tests in the Dakota we would be up against

some problems as to ownership of the gas that is there and the manner in which it's mixed with injected gas. That has been the principal reason why we have preferred to recommend the initial testing in the Entrada.

BY MR. EVANS:

Q. The attorney for Phillips Petroleum at the beginning stated there was certain mutuality among certain people. Does that statement go so far as to include your testimony in this statement?

A. I presume that you have in mind my statement that we felt the 150,000 cubic foot top gas allowable to be unreasonably limited, is that correct?

Q. No, what I want to know is do the rest of the other side agree with your statement in all of its particulars?

A. Yes, sir, I think that is correct.

Q. Then as I sum up your statement, if this is a fair statement--

A. Let me add one more bit to that.

Q. Let me ask my next question first. It's a fair statement, is it not, from what you have just read that as far as the Weber formation is concerned that the best way to protect correlative rights and the best conservation is no conservation and no protection for correlative rights?

A. Well, again that depends on definition of correlative rights and conservation I would think.

Q. Well, you have said that you want to produce all you can and you don't want to use the gas back into the Weber?

A. That is correct.

Q. So as to the Weber, the best conservation is no conservation?

A. Well, again I may differ with you in--

Q. Well, isn't that what you said in your statement?

A. I differ with you in my concept of what may not be conservation here.

Q. Well, you are saying that the best conservation for Weber is no conservation.

A. No, sir, I did not say that. I said that I did not recommend a top oil allowable and I didn't agree in principle with the 150,000 cubic feet per day gas allowable.

MR. EVANS: That is all.

BY MR. FREEMAN:

Q. Mr. Mattson, I am reading from page 2 of your statement: "We have in the past maintained that the benefits to be derived from injection of gas into the Weber Reservoir are, to say the least, highly speculative." What do you think the possibilities are, eliminating any other consideration of increased future recovery of oil, with Weber injection program?

A. Continuing it?

Q. Yes, sir.

A. Do I understand you correctly in your question, are

you asking me whether or not I think that the gas injection program is beneficial?

Q. Yes.

A. I do not.

Q. Then is it your statement you don't think that any additional oil in the future will be recovered by continuing the Weber injection program?

A. Not as the result of Weber gas injection, no, sir, and if I may I would like to explain that.

Q. Yes, sir.

A. We have been very consistent in this particular position as to Weber gas injection. Our concept of the manner in which this reservoir is to be properly operated will be to operate it under primary depletion in order that the maximum recovery can be obtained from all of the reservoir rock, including the very low permeability sandstone that exists in very large quantities at Rangely. At some time in the future following that type of operating procedure, we would contemplate that it would be proper to initiate water flooding procedures. It is my firm belief that when the Weber Reservoir at Rangely is finally depleted under that type of a reservoir operating mechanism that the ultimate recovery will be as great, if not greater, than had the intermediate and very expensive step of gas injection been undertaken.

COMMISSIONER VAN TUYL: Do you have a possible source

of water of that magnitude for water flooding?

THE WITNESS: We have at least three underground reservoirs at Rangely that will flow water to the surface; the first is the Dakota, the second is the Entrada, the third is the Navajo. They have all been tested and they have all been capable of flowing.

COMMISSIONER BRETSCHEIDER: Mr. Mattson, have your plans developed far enough so that you could discuss here who will be entitled to inject gas into these injection wells, and have you gone far enough to know to what degree and in what proportion of other operators in the immediate area would be able to use this injection system into the Entrada?

THE WITNESS: Mr. Bretschneider, our plans have not developed far enough that I would be able to tell you who would participate in this particular project. Certainly the Texas-U.P will participate. I am equally sure that the Sharples would want to participate and possibly Stanolind and Phillips would want to participate and possibly even the California Company, but I don't know. We have taken the position that we wanted to clear the groundwork before we made any real attempt to work up a testing procedure in which the other operators would participate.

COMMISSIONER BRETSCHEIDER: After you approve the practicality of using the Entrada for storage reservoir, you expect some other plan, some more detail, to be injected into

the situation so the area can be used for whatever reasons exist at the time?

THE WITNESS: I think that is correct, sir, yes.

MR. JERSIN: Mr. Mattson, you mentioned the possibility of water flooding. Will you please give us a discussion on how far you have progressed in that type of study.

THE WITNESS: We have made no detailed analysis of the manner in which water flooding would be accomplished at Rangely. I have some opinions though. I think that in all likelihood the initial water flooding experiments will be conducted in areas of low pressure. My present opinion is that fieldwide it would be unwise to start water flooding until the pressure has been dropped substantially below the present level.

CHAIRMAN DOWNING: Where will you start water flooding, in a particular spot?

THE WITNESS: We would probably start out in a pilot area to begin with, a low pressure pilot area, and try to evaluate it there first.

CHAIRMAN DOWNING: I mean right away?

THE WITNESS: I would think that would have to be a little bit in the future. I would be very hesitant to recommend to my management, at least, that we take any portions of our leases at the present time for injection of water, because that is certainly a last step to take in the operation of this field.

CHAIRMAN DOWNING: What do you think would be the percentage of additional recovery by water flooding?

THE WITNESS: Now we are really speculating. Some in this room have speculated that 30 to 80 million barrels of additional oil with gas injection, and I have indicated that I disagree with that completely, but I think that by water flooding either one of those figures are very very small.

BY MR. STAYTON:

Q. Mr. Mattson, I believe you testified, did you not, in the litigation that was attacking the first order?

A. Yes, sir.

Q. I believe you expressed in that litigation the opinion that the injection of gas into the Weber Reservoir, particularly in view of the fact that you didn't have a unitized field, would not increase the ultimate recovery of oil, is that correct?

A. I think that is correct, sir.

Q. At that time of course you didn't have any years of history of gas injection in the Weber Reservoir, did you? I mean you were expressing an opinion primarily based upon pilot projects and which you have been able to learn about the reservoir since that time, is that correct?

A. That is correct.

Q. Now you find yourself today with an extended period of gas injection behind us, isn't that correct?

A. That is correct.

Q. I will ask you to state whether or not based upon what has actually happened out there in that field whether it's still your opinion that gas injection into the Weber Reservoir when it's ununitized will not increase the ultimate recovery of oil.

A. That is still my opinion.

Q. In other words, has what has happened out there in your opinion borne out the opinion that you expressed before it actually did happen?

A. I think so.

Q. Now was one of the dangers that you feared that gas would just be cycled in this reservoir if it was being injected helter-skelter and without unitization?

A. Yes, sir.

Q. In your opinion have those fears been borne out by the events?

A. They certainly have.

Q. Now if the Commission should allow the injection of gas into some other reservoir, that is into the Entrada or into the Dakota, it would eliminate that difficulty in so far as disposing of gas produced by the Weber formation is concerned, is that right?

A. Yes, sir, that is correct.

Q. Now you will remember that the first order, the order that was attacked, provided that all gas should be

injected into the Weber Reservoir. You remember the order that was litigated, Mr. Mattson?

A. Yes, sir.

Q. And the objections that you as a witness made to that order from an engineering standpoint, I am not talking to you about the legal aspects but I am talking about the engineering standpoint, the objections you made were first from a waste prevention standpoint, considering the ultimate recovery of oil that reinjection of that gas wouldn't do any good certainly if you didn't unitize the reservoir. That was one objection, was it not?

A. Yes, sir, that is correct.

Q. And in that connection you called attention and testified to the cycling effect of the gas if the field wasn't unitized and you had a helter-skelter injection, is that right?

A. Yes, sir, I believe that is right.

Q. I believe you also made the point, did you not, that it would cost the operators a great deal of money to inject, and the longer the field would produce the longer it would cost them, is that true?

A. Yes, sir.

Q. And I believe you made the further point if you had this helter-skelter gas injection it would certainly affect the correlative rights of the operators and particularly the people in the gas cap. You remember that testimony?

A. I believe that is correct.

Q. Now there has been some disposition, Mr. Mattson, on the part of some to suggest to the Commission that instead of entering an order that provides that all gas be reinjected into the Weber Reservoir that they enter an order providing some sort of a gas limit, say 150,000 cubic feet of gas a day, and that the Commission not expressly provide in the order that all the gas be injected, that is in excess of that, but that it merely in its operation of the order give credit for injected gas. Do you follow me?

A. Yes, sir.

Q. Now I ask you to state in the first place if the Commission entered any such order as that, would that lead to the injection of great quantities of gas into the Weber just as we have today? In other words, if you are going to have 150,000 cubic feet gas limit and in the operation of the order the Commission gave you credit for gas injected, won't you have most operators injecting gas as you have today?

A. Yes, sir, I think that all operators will continue to inject gas.

Q. All right, if the Commission enters such an order as that which we will call a "net gas-oil ratio order", if the Commission enters such an order as that, from an engineering standpoint couldn't you make exactly the same attack on it as you made on the original order, and that is that you are going

to have cycling of gas; that you are going to have injury to correlative rights; that it's going to cost a great deal of money; in other words every argument that was made in that first suit you can make in any order that sets up 150,000 cubic feet limit on a net ratio basis?

A. You are speaking entirely now of injection into the Weber?

Q. Yes, sir.

A. That is correct.

Q. That is correct, is it not?

A. Yes, sir.

MR. STAYTON: That is all.

BY MR. SULLIVAN:

Q. Mr. Mattson, I think you are to be commended, if for nothing else, for having been probably the outstanding witness throughout the entire proceedings for having taken a consistent stand at least as far as Weber injection is concerned. But now getting down to comparative injection programs, let me ask you this question as long as we have speculated and dealt in hypothetical situations: Would the Texas Company be interested in introducing gas into the Entrada at all if this Commission didn't exist?

A. Yes, I think that we probably would. We have a gas market developing in this particular area that we have been watching with a great deal of interest. We would like, if

economically possible, to save what gas we can for sale to this pipe line. I think that we would be interested in conducting an Entrada gas storage or a Dakota gas storage project on that basis.

Q. Then you prospectively hope that this will be an economical project?

A. We are hoping that it will be.

Q. That is contrary, is it not, to the opinion expressed for instance from spokesmen of Phillips at previous hearings?

A. I think that there have been some that have made some pretty definite statements that they didn't think it would be economical. We don't know yet what price we will be able to get for this gas; we are hoping it will be sufficient to make money.

Q. Do I understand that that opinion of the Phillips spokemen has since been sublimated in this grand composite approach that you people present?

MR. KIRGIS: If the Commission please, I object. If they wish to direct questions to us we will be glad to answer, but I don't think this is hardly the witness for those questions.

MR. SULLIVAN: I will withdraw it.

Q. Now you speak of the speculative advantages of injecting gas into the Weber, although you did say that your own personal opinion is and has always been that it was probably not advantageous and probably disadvantageous, is that correct?

A. That is correct.

Q. But you did say, I believe, that you think that the best that could be said of Weber injection is that its speculative, whether it was advantageous?

A. That is correct.

Q. Now do you believe that this is any less speculative in the injection of gas into the Entrada or the Dakota or the Navajo, are the results any less speculative?

A. To me the results are less speculative in that in my speculation -- let me put it this way -- in my opinion the injection of gas into the Weber can be harmful rather than beneficial. I have used the term "speculative" because there is no one who can determine how much good or how much harm is going to come of gas injection into the Weber.

Q. Is that not also true of injection into the Entrada? Now I asked you a moment ago whether or not it wasn't possible for instance that the Entrada would leak and you would have to abandon that particular zone.

A. Yes.

Q. Perhaps it will leak into the Dakota.

A. Possibly.

Q. Now what led you to think, if it leads into the Dakota, that it wouldn't leak out of the Dakota if you attempt to use that?

A. Mr. Sullivan, we have one bit of information in the

Rangely Field that I think is quite strong evidence that there will not be leakage of injection for storage gas to the surface and that is the fact that we know we have high pressure water in these reservoirs and nowhere has any one seen water springs in the Rangely area.

Q. Could not injection into these other zones, however, result for instance in blowouts if leakage occurs?

A. The pressure in the reservoir would have to be increased over what it is today.

Q. How much of an increase in pressure does it take for instance to get over the critical point between where you don't have a blowout and you do have a blowout?

A. Well, sir, I indicated that the pressure in the Entrada now was sufficient to shoot a column of water 400 feet above the surface at Rangely. That is a pressure, a reservoir pressure, of something on the order of 200 pounds.

Q. But in order to get the gas in there you will have to put it in there at something greater than the reservoir pressure, are you not?

A. Yes, sir, but it will not be a very great amount of pressure, I don't believe, because of the high permeability of the sandstone. I think the gas will go in very well.

Q. But is it not possible that you reach a critical point at which a single pound's pressure makes the difference between let's say a blowout or no blowout?

A. Yes. You are speaking of the straw that broke the camel's back.

Q. That is correct, exactly.

A. I don't know where that straw is.

Q. I don't know either.

A. But I think we will have about 200 pounds of leeway before we are even approaching the point which we might be endangered.

COMMISSIONER BRETSCHEIDER: I would like to ask Mr. Mattson one more question please. Mr. Mattson, have you any idea or an estimate of time involved when the injection of gas into the so-called Weber area will be a thing of the past and all the gas produced from that area or other areas will go into the Entrada and there will be no injection into the Weber?

THE WITNESS: You are assuming Entrada gas storage will be successful?

COMMISSIONER BRETSCHEIDER: Yes, sir.

THE WITNESS: I would think that if storage of gas in the Entrada reservoir can be proven to be successful that there will be many operators and many engineers who will have occasion to very critically analyze the economics of continuing to inject gas into the Weber. If they come up with the same type of conclusion that I have come up with all of the gas will be going into the Entrada just as soon as the necessary agreements can be drawn. This being a water reservoir, I would think

those agreements could be put together pretty fast.

COMMISSIONER BRETSCHNEIDER: And sooner or later there would be no injection into the Weber in the area of the Entrada pool, is that correct?

THE WITNESS: I believe that is what would happen. I believe all operators and engineers would consider the economic disposition of gas in Rangely to be into the Entrada for future sale.

CHAIRMAN DOWNING: What would happen if some of the operators injected in the Entrada and the others in the Weber, what would be the situation?

THE WITNESS: Well, I can't really visualize a situation under competitive operations where there would be that much difference in opinion as to the benefits to be derived from gas storage and gas injection. Under unitization maybe we can get together on something other than Entrada storage, I don't know, but even under unitization my feeling still would be that it should go somewhere else.

COMMISSIONER BRETSCHNEIDER: Do you have any idea or any opinion whether the dry gas or the wet gas will be injected into the Entrada?

THE WITNESS: Well, I think that it would be more proper to inject the dry gas for the reason that by so doing we would be diluting to a lesser extent the gas that the gasoline plant is now having to process.

COMMISSIONER BRETSCHNEIDER: And also you might be able to get a better price for the wet gas that you sold to the Pacific North West Pipe Line?

THE WITNESS: That is correct too.

MR. JERSIN: Mr. Mattson, just as a summary of your statement, about how long do you think it would take the Texas Company to be before the Commission on a change in their pilot injection into another zone other than the Weber if you find your operations are successful, three months?

THE WITNESS: Well, that depends on the rate that we will be able to utilize for injection of gas into the Entrada. If we can inject let's say 10 million feet a day it would take something over a year to get enough gas into the Entrada to test the ability of the Entrada to contain this gas unless it becomes apparent at an earlier date that we have leakage. Personally, I don't think we are going to have any leakage, so I might say that at the rate of 10 million feet a day at least a year will be required. If we can go to 30 million feet a day it would be a third of a year.

CHAIRMAN DOWNING: All right, any more questions?

(Witness excused.)

CHAIRMAN DOWNING: Do the four companies have any more evidence?

MR. KIRGIS: I believe there is some more but I would like to make a brief statement, if I might. Mr. Sullivan, in

what was in part testimony, has made several insinuations regarding Phillips Petroleum Company and I would merely like to set the record straight. First, by questions aimed at another witness he has undertaken to explore the position of the Phillips regarding storage in the Entrada and its economic feasibility. So that Mr. Sullivan may be fully informed and so that the Commission may likewise, let me make this statement. We have had our doubts as to the economic feasibility of storage in the Entrada. We still have those doubts, but having such doubts seems to us to be no reason why we should raise objection to the desire of those who have a legitimate and sincere desire to test it and find out whether it is feasible; and that I think is an adequate explanation of what was indicated to be some tremendous reversal of position.

Secondly, it has been indicated by rather direct implication that we have changed our position, that our engineers have changed their position, on gas storage in the Weber formation. Let me say this: Our engineers took the position at the original hearings that gas reinjection into the Weber formation was something that should be tried and might be worthwhile. We do not and would not now change that position in the same circumstances. As a matter of fact, it would be our position that gas injection in the Weber formation has been of some benefit to the Weber Reservoir as a whole. However, it has also been our position more recently as a result of experience,

and this has been stated in prior hearings also, that the progression of gas injection on a lease basis as distinguished from under a unit plan has created inequities; it has disturbed, and will in the future obviously from present behavior more disturb, the correlative rights of the parties. Our objection is on that ground and not as to the benefit to the field as a whole of injection into the Weber. I wish our position to be understood and our consistency to be understood.

CHAIRMAN DOWNING: Do I understand that well injection would be beneficial but lease injection is not?

MR. KIRGIS: That is correct.

MR. SULLIVAN: Now I withdraw my question, Mr. Downing, but I don't suggest that he withdraw that elegant speech. I think that should remain in the record.

CHAIRMAN DOWNING: All right, any more evidence?

MR. HOLME: Judge Downing, in regard to the various McLaughlin interests, which include a number of royalty owners and who have not participated in terms of producing evidence at these hearings before, we do have some evidence we would like to put on. Now whether you care to go ahead with it at this time or wait until morning we will leave it up to you. We think it might take an hour.

CHAIRMAN DOWNING: Is there anyone else that has something to present?

MR. SULLIVAN: Yes, we have evidence to present.

CHAIRMAN DOWNING: Does Sharples have any?

MR. STAYTON: We have none.

MR. ROBINSON: Mr. Downing, I appear here for Arthur A. Cameron and George Cameron. My name is Kenneth Robinson, I am a lawyer in Denver. My clients are owners of the three-eighths interest in about 1600 acres in this field of the independent owners. We join in the proposals which have been made by the Stanolind Oil and Gas Company, the Phillips, and Texas and Union Pacific. We have no further evidence to offer but we wanted to, as an independent owner, state we did join in those proposals.

CHAIRMAN DOWNING: Thank you. We will take a recess before continuing.

(Whereupon a short recess was taken.)

CHAIRMAN DOWNING: All right, proceed.

MR. HOLME: Judge Downing, my name is Peter Holme, Jr. As I stated before, I am speaking on behalf of the McLaughlin interests and various royalty owners who are involved in these proceedings, not as operators, but as extremely interested parties. Through the previous proceedings, although we have made a statement from time to time, we have not felt that it was our place to put on evidence, and yet it is so apparent here that the evidentiary problems are great that our clients have felt called upon to have investigation made and produce evidence to examine the questions which I will discuss very

briefly. I didn't make an opening statement earlier so I should like to outline the course which our testimony will take so the Commission will be aware of the sequence in which the testimony will appear.

In the first place under the existing order No. 2-26, which is the 300 barrels of oil allowable order, we have had our engineer make an investigation of the performance of the field prior to the enactment of that order, and then to make an analysis of what that order would do in terms of effect on waste and on correlative rights. The order, as the Commission will recall, recited that this oil allowable of 300 barrels would not materially affect the field production. Our evidence will be to show exactly what effect that does have and will, we submit, be a very material effect.

Secondly, an analysis has been made to show the relationship of this 300 barrel oil allowable to the correlative rights of the various leases on the field. Thirdly, we want to bring on a little evidence, perhaps supplementary to much of what has appeared today, to show that the California Company's claim of drainage adverse to its interest cannot be sustained with regard to the three particular single well leases which we will discuss, and that the drainage, as in the case of Stanolind's evidence, is towards California rather than the other way around. Finally, we want to discuss the question of gas injection in the Weber sand which we believe to be an

unsound thing indeed as experience has shown in the absence of unitization, which is the condition we are faced with. That in essence is the subject matter.

CHAIRMAN DOWNING: Who did you say you represented?

MR. HOLME: Stuart McLaughlin, Evelyn Levison, Texas University, those having royalty interest in the Rangely Field.

CHAIRMAN DOWNING: Your property is being operated by the California Company, is it not?

MR. HOLME: By several of the operators in various portions of the field.

CHAIRMAN DOWNING: All right, proceed.

J. HOWARD BARNETT

was thereupon called as a witness, being first duly sworn according to law, upon his oath testified as follows:

DIRECT EXAMINATION

BY MR. HOLME:

Q. Will you state your name please.

A. My name is J. Howard Barnett.

Q. Mr. Barnett, since I don't believe you have testified in earlier hearings in this matter, would you please state very briefly your qualifications as an expert in this field.

CHAIRMAN DOWNING: If there is no objection he will be considered qualified.

MR. HOLME: Sir, I think since perhaps this record may perhaps be read by those not acquainted with Mr. Barnett

it would be well for him to establish briefly his qualifications that will enable him to speak with authority on the Rangely Field.

CHAIRMAN DOWNING: All right, make it brief.

A. I am a Consulting Petroleum Engineer at the present time. I was employed by the Stanolind Oil and Gas Company for about 18 years, and during that period I was Division Engineer part of the time during the development of the Rangely Field. I was Chairman of the Engineering Committee which developed in this green book the oil-in-place figures, the recoverable oil, the possible benefits of unitization, and any ramifications on secondary recovery. I am a licensed engineer in the State of Wyoming, a member of the A.I.M.E. and W.G.A. and Wyoming Engineering Society. I have had numerous occasions to investigate the Rangely Field, not only during the employ of the Stanolind but since I have been out on my private practice.

Q. Now, Mr. Barnett, have you had occasion to become familiar with the Order known as 2-26 which this Commission has now in effect regarding Rangely Field?

A. Yes, sir.

Q. And have you had occasion to make a study of the Rangely Field performance figures for the month of September during which that order was not in effect and to make an analysis of what the effect of that order would be?

A. Yes, sir, I have. We can illustrate that by these

exhibits that I have prepared. The first exhibit is the map of the Rangely Field, bringing particular attention by red arrows to those wells that were producing in excess of 300 barrels per day during the month of September.

CHAIRMAN DOWNING: How many wells are there producing more than 300 barrels?

THE WITNESS: There are 43 wells that were producing in excess of 300 barrels per day during the month of September.

CHAIRMAN DOWNING: Who owns the 43?

THE WITNESS: The wells are divided as follows: The California Company had 15 wells, Phillips Petroleum had 2, Sharples had 1, Stanolind operated 17, and Texas 8, for a total of 43. These 43 wells produced an amount of oil in excess of the 300 barrel per day rate some 4,669 barrels per day. That amount of oil was subject to shut-down. The amount of gas that was produced along with this oil, subject to shut-down, was 4,938,000 cubic feet per day. The gas-oil ratios of the wells that were producing in excess of 300 barrels per day were less than the field average gas-oil ratio.

Now one thing we would like to emphasize here is the purpose of these exhibits and these tables is to illustrate how the shoe would fit if it were worn during the month of September. Some percentage figures on the amount of oil that would have been shut in is shown in Table 1, which I have given to the Commission. I pointed out in this table the shut-down order

would have reduced the oil rate in the field by some 7%. At the same time it would have reduced the amount of gas produced by 4.43%. I might put those on the board to show them. These figures are significant to illustrate that the order itself would not have reduced the amount of gas in proportion to the amount of oil that was reduced. We further looked at the matter with respect to the gas-oil ratios of wells that were producing at the 300 barrel per day rate, and I have here part of Table 1 which shows some interesting figures on the effect of this order. The total production in September, 1955, was producing at a gas-oil ratio of 1,690 cubic feet per barrel.

Q. That was average for the field?

A. That was average for the field in September of 1955.

Q. And during that period there was no restrictive order in effect, is that correct?

A. There was no restrictive order in effect, that is right. The number of wells, 43 wells subject to shut-down, were producing 1,060 cubic feet per barrel. As you shut these wells down you would reduce the oil take by some 4,669 barrels per day, and the resulting gas-oil ratio of the wells that were then allowed to produce would have been increased to 1,741 cubic feet per barrel. I was surprised to find this out.

Q. What conclusion do you draw from that with regard to the effect in terms of waste of a 300 barrel per well allowable?

A. The 300 barrel per well allowable does not prevent

waste; more likely it encourages waste, it increases the waste.

Q. Are the more efficient or the least efficient wells subject to shut-down under a limitation of that kind?

A. The more efficient wells are subject to shut-down. As an example, we have the three wells of particular interest to the McLaughlins, and I will read these figures of oil rates and gas-oil ratios. The McLaughlin unit "A" was producing at 493 barrels per day at a gas-oil ratio of 352; that is just about the solution rate. The Phillips Mattern, producing at 394, at a gas-oil ratio of 279; again a solution ratio. Stanolind Associated Unit "A", producing at a rate of 464 barrels a day, at a gas-oil ratio of 270; again in solution ratio.

Q. In other words, those three wells which you have used as examples are all producing in excess of 300 barrels before this order but producing at various gas-oil ratios, is that correct, Mr. Barnett?

A. Yes, sir.

Q. Now how about the wells which were not affected by the 300 barrel limit, do you have a figure there that shows what the gas-oil ratio would be on those wells over the whole field?

A. I don't have an exact figure to that extent, but I can tell you this, that it would be considerably higher than 1,741 cubic feet per barrel of those wells that were producing at less than 300 barrels per day.

Q. So the shut-down order of the 300 barrel limit in effect meant that every barrel of oil produced in Rangely was produced at a higher gas-oil ratio than before the shut-down order went in, is that correct?

A. Yes. That illustrates Table 1 and the fact, we believe, that the order as written, 2-26, on the top per well allowable did not accomplish the objective of conservation.

Q. May I ask where you got the figures on which these tables are based and on this map, which should be marked as Exhibit 1?

A. The figures came from the Rangely Engineering Committee reports, available to all operators, and part of their records. The map, of course, is a standard map. I have placed upon this map the colors in which the McLaughlin interests are involved. I have posted opposite the wells the oil rates and the gas-oil ratios of selected wells in the area, and I have placed these red arrows bringing attention to those wells that are producing in excess of 300 barrels per day.

Q. I notice on that map you have certain areas colored light yellow and certain areas a darker yellow. What is the differential?

A. The McLaughlin interest is substantially greater in the heavier areas than they are in the lighter areas.

Q. Is that all you have to say on those exhibits?

A. Yes, that covers the essential features of the No. 1 point.

Q. Now did you make any comparison with regard to reservoir voidage of these three McLaughlin wells you have been discussing and the surrounding offsets?

A. Yes, I did. One thing more I would like to state before I get on to that is the Stanolind exhibit of reservoir performance. You will recall this Exhibit 1 that the Stanolind had this morning showing the gas-oil ratio increasing as it proceeds and showing the drop in reservoir pressure. I wish to clarify a statement that came up about the rate of take of oil from these types of reservoirs. The Stanolind people mentioned, and I want to clarify, that this type of reservoir is not sensitive to rate of production of oil. It is sensitive more to the undue dissipation of gas. The field may ultimately produce 400 million barrels, as an example, if you take that out at 10,000 barrels a day or 60,000 barrels a day or 70,000 or 100,000 barrels a day; the ultimate oil will not be significantly changed.

Q. Is there a difference between a gas drive reservoir and a water drive reservoir with regard to the rate of production and its effect on ultimate recovery?

A. Yes, there is. In a water drive reservoir those wells are more inclined to be rate sensitive like the East Texas Field. Oftentimes if you withdraw the oil or fluids from a well at extreme rates you are liable to by-pass oil in the reservoir by virtue of a water channel reaching the well bore

and thereby establishing itself as a permanent part of fluid flow and you are not able to squeeze it off. So there essentially is a difference between Rangely and East Texas in the fact that this is a gas in solution reservoir, whereas East Texas is water drive.

Q. And it's your testimony that with regard to Rangely the rate at which it is produced will have no appreciable effect on the ultimate recovery, the amount of oil recovered, is that right?

A. The rate of oil produced at efficient rates, produced at efficient gas-oil ratios.

Q. Incidentally, did you have any part in preparing that predicted performance curve which appears on that Stanolind exhibit to which you refer?

A. Yes, sir. This Exhibit 1 of Stanolind's was a part of the Engineering Committee report of February, 1949, previously made mention in the testimony. The Engineering Committee calculated the expected reservoir performance and this is the result of their findings. I was Chairman of that Committee.

Q. Turning now to the next exhibit, did you make a comparison of these three McLaughlin wells versus their offset wells, Mr. Barnett?

A. Yes, sir, I have, and I will pass these out to the Commission as exhibits. Now this Exhibit 2 is a result of my findings in connection with determining reservoir voidage in

the vicinity of these three wells that McLaughlin is interested in. I have looked at the offset production of oil, water, and gas that is produced in excess of the gas-oil ratios of the McLaughlin wells, and I find that there are a number of offset wells that are producing a gas-oil ratio significantly higher than the McLaughlin well, and I find one well which is producing 473 barrels of water per day. That 473 barrels of water voids the reservoir just like 473 barrels of oil; likewise the gas-oil ratio of the well here, say 609, 1042, 648, the amount of gas that is produced along with the oil creates a reservoir voidage much the same as oil creates a reservoir voidage.

Q. What is the effect of this reservoir voidage?

A. As an average, the three McLaughlin wells are voiding the reservoir at a rate of 450 barrels per well per day, compared with the offset wells of 470 barrels per day of reservoir voidage consisting of water, oil, and gas.

Q. Is that per well?

A. That is per well. So as far as the material balance or reservoir balance is concerned, there is not drainage into these; more likely there is drainage away from it because of the fact there is significantly more reservoir voidage on the offset wells than on the McLaughlin wells.

Q. Did you prepare a table relating to these same problems as reservoir voidage?

A. Yes, sir, I have. I don't have copies of this but I

will give you what I have here. This gives you the evidence or the basis upon which I computed the reservoir voidage of the McLaughlin wells and the adjacent wells. I just have the one copy, but I will get you more.

Q. Now there has been quite a little testimony today with relation to the pressure gradients between these various wells around the west end of Rangely. Did you make a comparison of the pressure gradients on these three McLaughlin wells similar to the one which was testified to earlier today by the Stanolind people?

A. Yes, sir. The approach of movement of fluid from the reservoir always has to be resolved down to bottom hole pressure, and this map that I prepared as an exhibit you will recognize as identical in the base of the Stanolind Exhibit 4.

Q. The map to which you have just been referring, does that have an exhibit number?

A. Yes, that has, Exhibit No. 4.

Q. And that is a bottom hole pressure map similar to Stanolind's Exhibit 4, is that correct?

A. Basically these lines are the same.

Q. The contour lines?

A. The contour lines are the same, it's the same map.

Q. Would you locate on the Stanolind exhibit the location of the McLaughlin tracts which you have profiled.

A. They are right there, there, and there.

Q. Now would you go ahead and testify what you found in connection with that check.

A. We have here these bottom hole pressure profiles which I would like to have you look at.

Q. Would you identify those by Exhibit number please.

A. Yes, sir. This is Exhibit No. 5, and it shows a profile, west to east, along cross-section line A-A.

Q. And that cross-section line is marked on Stanolind Exhibit No. 4, is that right?

A. Yes. It covers California Company Well No. 14, A. C. McLaughlin Associated Unit "A" in which the McLaughlin interests are involved, McLaughlin Unit "A", California Company 29, and California 35. The thing we want to point out in this connection is the pressure gradient toward these wells is less than the pressure gradient away from the wells. The two wells in question being here, Stanolind Associated Unit "A" and Stanolind McLaughlin Unit "A", those two wells are the ones in which the McLaughlin interests are concerned; and the gradients in this case is not to the advantage of the McLaughlin wells.

Q. You concur in the earlier opinion to the effect that oil will migrate in the direction of low pressure, don't you?

A. Oh, yes, that is basic.

Q. Now with that in mind, where is the migration of oil with regard to those leases you are talking about?

A. There is some migration of oil this way; there is a

greater migration in that direction.

Q. Do you know who the adjacent property operators are on the east?

A. The California Company are the operators on the east of the A. C. McLaughlin.

Q. So drainage to the extent that it occurs by reason of the pressure differential is in favor of the California Company, is that correct?

A. Yes, sir.

Q. Did you draw any other profiles?

A. Yes, sir, I have profile B-B which I would like to have the Commission look at.

Q. That is Exhibit No. 6?

A. That is Exhibit No. 6. Exhibit No. 6 shows a profile right directly to the south of Exhibit No. 5. It shows the profile from B-B and it covers California 7 A. C. McLaughlin, Magor Unit operated by Phillips, Mattern Unit operated by Phillips in which the McLaughlins are interested, and California 13. In this case Exhibit 6 shows a fairly uniform gradient from the west to the east, and we would say that there is about a stand-off in that situation. The oil moving into the tracts from the west is about equal to the oil moving out of the tracts to the east.

Q. So there is no advantage to the McLaughlin lease by reason of drainage?

A. There is no disruption of correlative rights.

Q. Now the profile that runs north and south, would you describe that one.

A. We have that as C-C.

Q. Exhibit No. 7?

A. Exhibit 7. This profile runs from the south to the north. It covers California 12, the Mattern Unit operated by Phillips in which the McLaughlins are interested, McLaughlin Unit "A", and California 39. Here again a pressure profile shows that the pressure gradient towards the tracts is less than the pressure gradient away from the tract, so there is drainage in a greater degree away from the tract than there is toward the tract. These are all prepared as an investigation to determine if correlative rights are being disturbed, and if by virtue of producing these wells at say 450 barrels per day is resulting in undue drainage. The reverse was actually found to be the case from two approaches; the approach on the profiles we have just gone through, and the approach shown by Exhibit 2 which was a reservoir balance or a reservoir voidage balance.

Q. Now these figures were developed on the basis of unrestricted September production, is that correct?

A. Well, they were based upon the June, 1955, bottom hole pressure survey. The voidage investigation was based upon the September, 1955, production rate from the records.

Q. And therefore even without any top per barrel limitation the migration would be in the same direction, is that right

A. Oh, yes.

Q. Now with regard to the question of injection in the Weber sand, I am looking now for the moment on Stanolind's Exhibit 4 which is in front of us, is there any characteristic of the pressure pattern as shown there which you would relate in your opinion to the injection program?

A. Oh, there definitely is. Stanolind has pointed out the injection wells were these distinguished yellow arrows, and you will notice in all cases that the high pressure areas immediately surround the injection wells. This particular pattern has been pronounced in the last few months and it has been aggravated by the injection of gas, and I think it has unquestionably disrupted the normal pattern that would have taken place had there been no injection of gas and had the field been operated in a normal manner on a primary basis. That exhibit also shows the same thing, except it's in relief, but the injection wells are all right there.

Q. Now do you have a map which shows the pressure pattern in the field prior to the gas injection program?

A. Well, we have two exhibits here, this is the same map as that.

Q. What do you have reference to?

A. Exhibit 4, and that is the June, 1955, survey and we

compare that with our Exhibit No. 8, which shows the same isobar bottom hole pressure map drawn on a minus 900 foot datum during the pressure survey of October, 1950, before gas injection was started, and I think it's obvious that the pattern has been disrupted by the injection of gas. The pressure isobars in this particular case are fairly uniform, decreasing in a northerly direction in the 1950 survey; whereas in the 1955 survey we have large hills and points of very high pressure, obviously brought on by the injection of gas. This is a man-made situation and obviously you are aggravating a movement of reservoir fluids by creating these abnormally high pressures; and the dispersed gas drive as you now have, why, a number of these high points will occur in the reservoir and aggravate the situation of movement of reservoir fluids.

Q. In other words, the present day pressure map as of June, 1955, is entirely different in your opinion from what it would have been in the absence of gas injection, is that right?

A. Yes, I would have expected the pressure pattern to remain as reflected by the 1950 survey. The only difference would have been there would have been a gradually lowering of pressures between the '50 survey and the 1955 survey.

Q. Throughout the field?

A. That is right.

Q. Can you point to any specific instances on those two maps where a change has occurred that you would attribute to

gas injection?

A. Well, yes, there are several of them. There is one right here in the northeast corner of 19 around these two injection wells close by. There is a 2200 pound pressure contour. Compare that to the pressure during October of 1950 of 1700 pounds, and there was no particular irregularity in the pressure pattern in that vicinity.

Q. Instead of the normal lowering of that 1700 figure we have had a reversal which has brought it up over 2,000 into the 2200 bracket, is that right?

A. At that particular point, yes.

Q. Has that happened elsewhere in the field where there has been a reversal of normal performance?

A. Yes, sir.

Q. What effect does that have on oil in place between the various leases in the field?

A. It tends to push oil from the high pressure area to the low pressure area.

Q. In other words in every one of those gas injection wells it increases the pressure underneath it, will push oil away from that area, is that correct?

A. Yes, sir.

Q. Into an area where there is no gas injection well?

A. Yes, sir.

Q. Is it your opinion that the gas injection program as

presently is in effect or as it would be carried on along the same basis would aid in any degree in ultimate recovery from the field of oil?

A. As the gas injection program is now being carried on in the helter-skelter sort of pattern, I would say is an inadvisable method to operate a secondary recovery program. The most advisable way, if you are going to have gas injection, would be under a unitized operation, and obviously if you did that the operators would inject the gas into the gas cap.

Q. Where is the gas cap?

A. The gas cap, as I pointed out previously, is around this area here north of 32, Sharples property.

Q. Proper injection practices would call for injection into the gas cap then, is that right?

A. Yes, under unitized plan of operation.

Q. And under this plan how many injection wells are located in the gas cap?

A. Well, there is one, and this one down here is close to the gas cap, the Sharples 35 might be classified as a well into the gas cap, and the injection well on southwest of 32 is near the gas cap area.

Q. Now how many injection wells are located outside of the gas cap area?

A. All the remainder.

Q. And how many are there altogether?

A. Sixteen.

Q. Sixteen which are away from the area where proper practice would call for injection, is that right?

A. That is right.

Q. Now referring to the changes in these pressure patterns that have been occasioned by the gas injection, will that effect be increased or decreased if further injection is carried on in this manner?

A. Oh, you could reasonably expect this to be increased and aggravated more by gas injection.

Q. In other words, the longer this program continues the more pronounced these disparities will become, is that right?

A. Oh, yes.

Q. What effect does continued gas injection have upon the gas-oil ratios of the wells in the future?

A. Well, the gas-oil ratios of the wells adjacent to injection wells, as we have observed in recent performance, shows a decided increase. Naturally these areas have been prematurely gasified by the injection of gas, and the wells surrounding the injection wells show an increasing tendency of gas-oil ratios. These areas are being gasified by the injection of gas.

Q. Now did you prepare an exhibit relating to the production history of these wells?

A. We looked at the possibilities of gains from gas injection on the Sharples lease, described as the 11-well lease

lying in the north part of Section 33 and the south half of the southwest of 28, and have prepared Exhibit No. 9 showing the history of this lease. I have extra copies of this exhibit which I would like to pass out to the Commission.

Q. Now would you relate what this exhibit shows.

A. This exhibit shows the production history from the year 1945 through September of 1955 on the Sharples "C" lease covering 11 wells in the Rangely Field. It shows by green line the average daily oil production for those years covered in the investigation. It shows by yellow line the actual gas produced from those wells along with the oil. In red line I have shown the gas injection history. Gas injection was started in July of 1953 and has continued since that time. The particular significance of these curves are first that the oil rate showed a decided decline starting in 1952.

Q. Was that oil rate interrupted or brought upwards by the initiation of gas injection?

A. No, there hasn't been any arresting of the decline of oil rate, and didn't expect it. The gas production shown by this yellow line has been aggravated by the injection of gas. It is believed that the injection has resulted in a terrific amount of recycling of gas in this particular part of the reservoir. At the same time, we haven't seen any benefits to oil production. I don't say that injection of gas in any one of these wells is going to harm oil production down-structure,



2-27
11/21/55

pgs 151-200

but it could harm oil production for up-structure wells by virtue of the fact that it would prematurely gasify them.

Q. Do you have any comments, Mr. Barnett, with regard to the feasibility of injection into the Entrada?

A. Well, certainly we don't know. I realize that it has to be experimented with, we will have to find out if it will take the gas and hold it and certainly if the gas can then be produced. I don't see that there is any serious objection to trying it. We can't tell these things unless we experiment with them. There are so many forces of nature that you can't exactly predict until you undertake an experimental operation in the field. I think it's an admirable thing that the people are concerned with conservation of the gas to put it to more beneficial use later either through sale or through recycling through the Weber Reservoir, if, as, and when the field may be unitized.

Q. Is it your opinion that this continuance of injection into the Weber sand would be a better protection of correlative rights and would reduce waste more than continuance of gas injection in the Weber?

A. Well, I think discontinuance of gas into the Weber would be inclined to protect correlative rights more rather than the continuation.

Q. Is it your opinion that there should be an oil allowable per well under the Commission's order?

A. Oh, no. The oil allowable, we have investigated how it might work in September of 1955, and any oil allowable would defeat your purposes of conservation of gas. There shouldn't be a top oil well allowable.

CHAIRMAN DOWNING: Has that been true in Texas?

THE WITNESS: The Texas Railroad Commission of course sets producing rates in connection with market demand, and in some fields in Texas where you have an active water drive I can see where the reduction of rate of take from an individual oil well will certainly be a conservation measure.

Q. But that is in a water drive field, is that right?

A. Yes, in a water drive field.

COMMISSIONER VAN TUYL: What is the amount of water production from this field per day?

THE WITNESS: The water production from this field is relatively small. I don't have the exact figures but it's less than 10% I am sure.

COMMISSIONER BRETSCHNEIDER: Is that 10% currently?

THE WITNESS: I don't know what the figures are.

MR. HEGGLUND: It has been in the area of 1500 barrels a day as compared to 65,000 barrels of oil.

COMMISSIONER VAN TUYL: I had the figure of 15,000.

MR. HEGGLUND: No, sir.

THE WITNESS: Some of the wells inside of Arabia produce at 5,000 barrels per day that California operate.

Q. Mr. Barnett, do you know who the operators of the various properties in which the McLaughlins have an interest are

A. Well, yes, I think I can recite them. The light colored yellow lease is the A. C. McLaughlin lease, 38 wells operated by the California Company; the Associated Unit "A" in which McLaughlins have a working interest, operated by Stanolind; McLaughlin Unit "A" operated by Stanolind, working interest; Phillips Mattern operated by Phillips, McLaughlins have a working interest; McLaughlin Unit "B", operated by Stanolind; Rigby Units 1 and 2, operated by Phillips.

Q. To shorten this up a little, Mr. Barnett, is it correct that all of the operators present, with the exception of Texas-U.P. operate some properties in which the McLaughlins have an interest?

A. Yes, sir.

MR. HOLME: You may cross examine.

CROSS EXAMINATION

BY MR. SULLIVAN:

Q. Now, Mr. Barnett, it's a distinct pleasure to see you back in our little throng again and may I welcome you once more, but to refresh my memory about the statements that you made while you were qualifying, I understand you are no longer employed by Stanolind despite the testimony that you just gave?

A. That is right.

Q. And they are not paying any part of your fee in this case?

A. Absolutely not.

Q. Thank you, I wanted to make that clear. Now you are acquainted, are you not, with a gentleman by the name of Sidney B. Richards who is in the employ or was in the employ of Stanolind Oil and Gas?

A. Yes, sir.

Q. In 1951 and 1952 what were your relative positions in that organization?

A. I was Division Engineer and he was Assistant Division Engineer.

Q. In other words he was directly under you, wasn't he?

A. Yes, sir.

Q. Now let's go back and see what Mr. Richards said about Dakota injection for instance in May 22, 1952, and I read from the record of the hearing in this cause on that date from page 448: "Stanolind representatives did not feel, prior to the April 15 hearing, that Texas and U.P. were actually serious in their previous suggestions regarding Dakota gas storage and had not anticipated that they would present a recommendation at the April 15 hearing for Dakota gas storage. Since that hearing Stanolind engineers have made a thorough study of the proposition to store Weber gas in the Dakota sand and the economics involved, and it is the purpose of this statement to briefly report to the Commission the results of this study." Now do you recall what the results of that study were?

A. No, sir, I don't.

Q. May I refresh your memory without having to read at length from the record that the results of that study were extremely negative.

A. They may have been.

Q. Does that help refresh your memory?

A. They may have been.

Q. Did Mr. Richards take that position at that time with your knowledge and condonation and probably at your direction?

A. He obviously did.

Q. Then you have radically changed your position, have you not, Mr. Barnett?

A. I have looked at this to suggest the trial of injection into the Entrada might be an advisable thing at this time. We have reached a state of impasse, and in the spirit of cooperation to conserve the gas I think that is about the only avenue left open to us to see if it works.

Q. But did I not detect in the examination of you on direct that you now no longer felt that Weber injection was advantageous?

A. We are talking about Dakota injection?

Q. In the manner in which it is presently being done, wasn't that the proper gist to be drawn from your testimony with regard to continued Weber injection?

A. It's a dangerous thing.

Q. I see, but in 1951 you didn't consider it such or at least through the words of Mr. Richards?

A. Mr. Richards testified to that extent that the saving of gas by injection into the Weber might be an advisable thing.

Q. Now let me read you another quotation from Mr. Richards taken from November 29, 1951, the record of that hearing. This is with regard to allowables, and I quote: "Mr. Richards: I simply want to affirm our previous stand that we think with a limitation of 150,000 cubic feet of gas per day for each well in the field a more uniform distribution of withdrawals throughout the field will be maintained. We feel there is a danger without that limitation on each well having a high concentration of oil withdrawals in certain small restricted areas to the extent that the reservoir pressure would be drawn down in that area and tend to cause waste in the reservoir. We think it is the fairest way to distribute the use of reservoir energy throughout the reservoir." That was from page 147 of that record. Now on page 149, Mr. Richards again: "You will be in effect restricting production, which is in effect proration, and if you do that then I think that you have the duty" -- he is speaking to the Commission -- "to see that that is prorated in a fair and equitable manner so that each producer will have an opportunity to use his just and equitable share of reservoir energy and to produce his just and equitable

share of oil." Now do I take it, Mr. Barnett, that you think that the just and equitable way for each operator today to get his just and equitable share of the oil is to depart from that principle and let everybody produce wide open?

A. I don't believe you ought to have a top oil allowable.

Q. Mr. Barnett, you have been in this business a long time; you testified you worked for Stanolind for 18 years?

A. Yes, sir.

Q. And since that time you have been a consultant?

A. Yes.

Q. How long have you been a consultant?

A. About three years.

Q. That is 21 years at least that you have been in this business. Have you ever before in your long experience in this kind of thing seen a demonstration where people asked for their correlative rights to be protected by continuing the continuation of the law of capture?

A. I don't know whether I have.

Q. Do you know what the law of capture is?

A. Well, I presume you might tell us what you think it is and I think I would agree with you, whatever you thought it was.

Q. Well, if we are in agreement there is no need to discuss it.

A. I guess not.

Q. Isn't this an abnormal phenomenon in this type of

hearing to find people who claim they are being drained and that the answer to it is to permit on the part of the Commission, empowered with the authority to limit production, to permit the continuation of disproportionate, unratable, unequal withdrawals from the reservoir in the same areas?

A. It's a very surprising thing to have the question of abuse of correlative rights being brought up by one party and a detailed investigation of the matter has resulted in an opinion directly to the opposite.

Q. Despite the disparities in production rates of those operators?

A. Taking into account gas, oil, water, pressures and everything, I am really surprised to see that the California Company wells are draining the others in view of the fact that you first got up and said the other thing. This is an amazing development.

Q. It is, it's astonishing, isn't it?

A. Yes, sir.

Q. And think of the position that it puts this Commission in.

A. Yes, it is.

Q. Now you testified there was a well located on a McLaughlin lease that was producing 473 barrels per day of water. Would you show that well please.

A. That is Well No. 39, California Well 39, in the southeast southeast of 12. It shows 25 barrels of oil, 190

gas-oil ratio, and 473 barrels of water per day.

Q. Per day?

A. Yes.

Q. Where did you get that figure?

A. From the September, 1955, Rangely Engineering Committee records.

MR. SULLIVAN: I am through, thank you very much.

REDIRECT EXAMINATION

BY MR. HOLME:

Q. One other question, Mr. Barnett. Has there been any information made available to the people interested in the Rangely Field available now after two years of injection which was not available prior to the experimental injection program?

A. Oh, yes. As an example, this chart, Exhibit No. 9, certainly is information that is new and it must be appraised and evaluated. I know there will be similar information of other areas where gas injection has been going on. Obviously as time goes on you get a vast amount of information and your ideas and opinions are subject to change in the light of new information.

Q. Does the information which has been gained confirm or strengthen your opinion as to the unwisdom of gas injection into the Weber sand?

A. Well, these pressure patterns confirm my opinion that gas injection is a dangerous thing. Dispersed gas drive in the

absence of unitization is a dangerous thing.

MR. HOLME: That is all, thank you.

(Witness excused.)

CHAIRMAN DOWNING: Now what is coming further?

Mr. Sullivan, you want to introduce some testimony?

MR. SULLIVAN: Yes, sir, we do.

CHAIRMAN DOWNING: Now is there any other testimony that the four companies or the four operators wish to present? All right, hearing none then we will close this hearing as to the case by the four operators, and when we meet again we will take up first the case of the California Company.

COMMISSIONER BRETSCHEIDER: Pardon me, I think that Mr. Robinson wants to make an address.

MR. ROBBINSON: When all the evidence is in in this case.

MR. STAYTON: You are not closing all statements, are you, just evidence?

CHAIRMAN DOWNING: After the evidence is in we would like to hear a little bit from the attorneys here or somebody from each company. Now how long, Mr. Sullivan, do you think your testimony will take?

MR. SULLIVAN: Well, with our customary zeal, Mr. Downing, we will attempt to be as brief as possible but it's difficult to estimate how long it's going to take us.

CHAIRMAN DOWNING: All I want to know is can we finish tonight?

MR. SULLIVAN: I think without any question we can finish our presentation of evidence at a relatively early hour.

CHAIRMAN DOWNING: We will now take a recess until 7:30 this evening.

(Whereupon, a two-hour recess was taken.)

NIGHT SESSION

CHAIRMAN DOWNING: Mr. Sullivan, are you ready to proceed?

MR. SULLIVAN: Yes, sir

CHAIRMAN DOWNING: Maybe you could make your opening statement. I want to say to you, Mr. Sullivan, we would like you to be as brief as possible but remember the four companies had about five hours and I don't want you to curtail your case without presenting it fully.

MR. SULLIVAN: Thank you, sir, I will try to abide by that.

CHAIRMAN DOWNING: All right, proceed if you will and make your opening statement.

MR. SULLIVAN: At your suggestion, and one with which I am in complete agreement, Mr. Downing, we will try to abbreviate this every place that we possibly can in view of the length of the proceedings that have gone on so far. However, I do think that some general comment may be called for in the light of what has transpired since July 14, 1955, and in particular what has transpired here today. Now this drainage proposition

was first presented to this Commission in what we felt was a concrete and well-exemplified manner of the hearing on July 14 to indicate that the California Company had a legitimate complaint under the new Act to which recourse to this Commission should be sought, and that was that we were being drained by virtue of the disproportionate withdrawals in the western part of the field. Now we do not depart from that position despite the evidence to the contrary which has here been presented, which we have already sought to discredit or to diminish on cross examination and which we will further seek to either discredit or diminish on our direct examination of our own witness.

Now as a position side of our presentation this evening we are also going to emphasize and build up the aspect of physical waste that accompanies uninhibited withdrawals from the reservoir. We did not emphasize it but we did mention it at the 14th of July hearing. So to that end, I think that we might just as well proceed to our first witness and our only witness, Mr. E. N. Dunlap, who is familiar to the Commission, and if there is no objection I would like to have him accepted as a qualified expert witness.

CHAIRMAN DOWNING: May I ask what do you think our order should be, it's probably repetitious?

MR. SULLIVAN: Yes, sir, it is.

CHAIRMAN DOWNING: But they have given us a very definite proposition. What is yours?

MR. SULLIVAN: We are still of the opinion and we are working for at this time, as we did at the 14th of July hearing and every subsequent hearing that transpired between that date and today, we are working for an oil allowable that will be applicable to every well in the field and some reasonable limitation on the net GOR that is permitted in the field. Now our original suggestion was 200 barrels of oil per day and 750 gas-oil ratio and we still believe that that figure is certainly one that is reasonable, one that is defensible under the law and one which affords us the relief which we think the situation demands. Is that satisfactory?

E. N. DUNLAP

called as a witness for the California Company, being first duly sworn according to law, upon his oath testified as follows:

DIRECT EXAMINATION

BY MR. SULLIVAN:

Q. Please turn to our first exhibit there, Mr. Dunlap. Now this is a schematic representation which I am going to ask you to explain to the Commission. Will you please demonstrate to the Commission what we have tried to exhibit on our California Company Exhibit No. 1.

A. Exhibit No. 1 symbolically indicates what the problem at Rangely is. It shows the crux or the nutshell of the problem that the Commission has at Rangely. The Commission has the duty to prevent waste and to protect correlative rights and

also must not unreasonably restrict oil or gas production. Somewhere this area represents waste, danger zone, red. The area in this portion of the diagram represents unreasonable restriction. Somewhere in between there is reasonable conservation. The clear area means that that is the area that is reasonable conservation. Around the fringes is unsteady ground, doubtful. I believe that is essentially Exhibit No. 1.

Q. It's simply a graphic representation, Mr. Dunlap, of the dilemma that the Commission must undoubtedly find itself in, on the one hand an order that will unreasonably restrict the production of the field, on the other extreme an order that may result in extremely wasteful practice?

A. I should mention here that the two variables plotted are two important criteria in the operation of the field such as Rangely. As we will point out later, rate is an important consideration, oil rate, as well as net produced gas-oil ratio; both very important as far as physical waste is concerned.

MR. SULLIVAN: Incidentally, for the record, I would also like to enter the appearance of Mr. John W. Woolfolk, New Orleans, Louisiana. I ask California Exhibit No. 1 be admitted in evidence, if there is no objection.

Q. Let us refer to this chart as California Company Exhibit No. 2. Now, Mr. Dunlap, please explain to the Commission what this exhibit is and what it demonstrates.

A. Exhibit No. 2 is an excerpt from the Rangely

Engineering Committee Bottom Hole Pressure Survey Report for the Month of June, 1955. The two curves that I will speak about are those that are colored. The green curve is plotted recovery factor in barrels per pound decline times 1000, plotted against cumulative oil production in millions of barrels. The definition of recovery factor is simply the number of barrels produced between any two pressure survey periods. These dots represent the times or the cumulative production of which the field pressure survey was made, so that the recovery factor that I am talking about is simply the number of barrels produced between these two points divided by the change in reservoir pressure between these two points. Barrels per pound of reservoir pressure decline is this recovery factor which is plotted in green. In red is plotted the average daily Weber production in barrels times 1000.

I would like very much to call your attention to the fact that after the field development was completed about this time when production was being taken out all over the field in a well-scattered pattern and there were no transient effects, there was no instance as the field production rate was reduced the recovery factor increased. You have heard testimony that the Rangely Field was not rate sensitive. I submit that in every instance -- and these are facts, this is not speculation -- in every instance when the field production rate was reduced the recovery factor increased. My conclusion on the basis of

this graph is that the lower production rate would result in a higher recovery factor, the field pressure will be higher at a given cumulative production, which means to me that there is additional oil remaining in the reservoir since the pressure is higher; conversely, at the higher production rate, the lower productivity factors, the recovery to a certain pressure will be less, hence less ultimate recovery.

Q. Now both sides of that are equally true, are they not, as demonstrated by that graph? In other words, the lower the production rate the higher the recovery factor; the higher the production rate the lower the recovery factor, is that right?

A. That is correct.

Q. Now is your recovery factor an index to, let us say, an index to ultimate recovery?

A. I believe it is, yes. As I indicated, the higher recovery factors the ultimate recovery should be higher and that is only obtained at lower production rates.

Q. On the contrary would a lessening of the recovery factor indicate poorer production practices or wasteful production practice?

A. Yes. The higher the production rate would represent a wasteful practice.

Q. Then basically is your conclusion from the facts presented on this graph to the effect that this is a rate sensitive reservoir?

A. That is my conclusion, yes.

Q. Do you have any other comments that you would like to make on that particular chart?

A. No, I think that merely illustrates the point I made on the first exhibit.

Q. Before you turn it over, let us clear up once and for all for the purposes of this hearing how the Rangely Engineering Committee functions with regard to the data that go into the making of these charts and the reports as we have used them heretofore today. Will you explain briefly how the data gets into the Rangely Engineering Committee reports?

A. The basic data up to and including the pressure figure for each individual well, the datum pressure for each individual well, is computed by the operator who owns that well. The Rangely Engineering Committee takes that data on the pressure on each individual well and constructs pressure maps, such as you have seen in the previous testimony, and also computes from the isobaric map that is constructed on the basis of this raw data the field average pressure, which you see plotted here. The Rangely Engineering Committee does not attempt to compute the pressures of individual wells nor the gradient to be used for the individual wells; they accept the companies' pressure figures as turned in to the committee.

Q. Is it the normal function of that committee to attempt to correct basic data furnished them by the various operators?

A. I can't answer that question.

COMMISSIONER BRETSCHNEIDER: Before you turn to the next page, Mr. Dunlap, would you please explain what happened to the recovery factor line in between 140 and 150 million barrels. It goes way up.

THE WITNESS: Yes, that is true.

COMMISSIONER BRETSCHNEIDER: You say that when the average daily oil production declines your recovery factor rises, and you mention particularly the rise in that curve at 60 million barrels; whereas over between 140 and 150 you have a very marked rise in the green line or recovery factor line that I don't understand how what you said explains that.

THE WITNESS: One explanation of that is gas injection was started at that time, in between these two points, which caused the recovery factor and the efficiency to go up.

CHAIRMAN DOWNING: Are these reports of the Engineering Committee unanimous or is there a divided vote?

THE WITNESS: I don't know just how the committee operates in that particular instance. I think, to my knowledge, usually everybody is happy before the report leaves the committee.

COMMISSIONER BRETSCHNEIDER: Will you please explain again what is meant by your recovery factor.

THE WITNESS: Recovery factor is simply the number of barrels produced over a given period of time, divided by

the decline in reservoir pressure during that period of time.

CHAIRMAN DOWNING: Production today is about 160 million, isn't it, or 158 million?

THE WITNESS: Something in excess of 170 million.

CHAIRMAN DOWNING: Where is the 170?

THE WITNESS: Right here.

MR. JERSIN: Mr. Dunlap, in order to clarify the recovery factor to the Commission, will you please give two simple examples in terms of hypothetical figures, pressure and oil figures.

THE WITNESS: Well, just assume production something in the order of 7 1/2 million barrels were produced and the pressure decline was in the order of 40 pounds, so that 7 1/2 million divided by 40 -- let's round it off to 8 million divided by 40 -- would be 200,000 barrels per pound. The recovery factor, 200,000 barrels per pound.

MR. JERSIN: In other words, for every 200,000 barrels of oil produced you lose 1 pound of pressure in your reservoir?

THE WITNESS: That is correct.

Q. Several references have been made throughout the day indicating that there was considerable doubt as to the advantages or the merits of Weber gas injection. In your opinion, Mr. Dunlap, does this chart indicate to you that there are merits to Weber gas injection?

A. It most certainly does indicate that. It simply reiterates the application or statement I made before, it has resulted in an increase in the recovery factor. When the recovery factor is increased, obviously it means that per given cumulative production the pressure is going to be higher at the time that production is recovered, leaving you more pressure to get out more oil.

COMMISSIONER EAMES: May I ask why the sudden decrease there at 140?

THE WITNESS: There is some decrease in production.

Q. You mean increase in production, don't you?

A. Increase, excuse me.

Q. Increase in oil production?

A. That is right, increase in oil production. Possibly this is exaggerated slightly because the pressure drop over that period was so small and it's more difficult to determine the recovery factor accurately when the pressure falls off so little, but generally speaking it just simply confirms what is shown in every instance and is entirely consistent throughout, the production rate increased causing this to fall off.

CHAIRMAN DOWNING: Will you explain why reinjection increased gas pressure brings about greater ultimate recovery. What are the underground factors that cause that?

THE WITNESS: Well, one is you have more pressure decline available to you to produce the oil, and if you have

more pressure decline available before you reach the depletion point it's logical you will get more oil out. Does that answer your question?

CHAIRMAN DOWNING: Well, I was just wondering about the fluid part of the oil.

THE WITNESS: It will increase this mobility or the fluidity of the oil as long as the pressure is maintained higher. That is also a factor that will aid recovery.

Q. Now the next chart. Now, Mr. Dunlap, this is the Exhibit I that we introduced at the July 14, 1955, hearing, and I would like to emphasize that we re-introduce it here for purposes of showing that as early as that hearing we did indicate that the rate of production was related to physical waste.

MR. SULLIVAN: Incidentally, I would like to submit our California Company Exhibit No. 2 into evidence, if there is no objection.

A. Do you want to identify it as Exhibit 3 now for this hearing?

Q. It has already been introduced, but we can re-introduce it here as California Company Exhibit No. 3, although it was California Company Exhibit I in the previous hearing on July 14.

CHAIRMAN DOWNING: If there is no objection it will be received.

Q. Now just very briefly run through what that chart

demonstrates, Mr. Dunlap.

A. I don't believe there is any need for me to go over again the definition of production efficiency. I believe that was presented quite in detail in the first hearing. I will only say that it is an indication again of physical waste, the abscissa is the gas-oil ratio limit, and we will take 600 cubic feet per barrel. If the top well allowable is 300 barrels of oil per day per well, the production efficiency will be 43%; if the top per well allowable is 200 barrels a day the production efficiency will be 20% higher if the top per well allowable is 200 instead of 300 barrels a day.

Q. Does this demonstrate that the daily oil production rate per well is directly or let's say inversely related to ultimate recovery?

A. I believe you can draw that conclusion at any given gas-oil ratio since the production efficiency is greater at the lower top oil limit; the physical waste is less and the ultimate recovery will be greater.

MR. SULLIVAN: We submit that for re-introduction into evidence at this time.

Q. The next chart will be referred to as California Company Exhibit No. 4. Now, Mr. Dunlap, please demonstrate to the Commission what this exhibit shows.

A. This exhibit is a map of the Rangely Field, a structure map of the Rangely Field, on which is plotted the average

production rate per well averaged on a battery basis for the month of September, 1955. This information was taken from the Rangely Engineering Committee report for that month. This is to bring the Commission up to date on the distribution of withdrawals that has occurred or to show any differences that has occurred since the presentation of the testimony on July 14. That map was based on April production.

Q. Now that was Exhibit C at that hearing, was it not, California Company Exhibit C?

A. I believe that is right, yes. This exhibit again shows flagrant disproportionate withdrawals, comparing 360 barrels a day on Phillips Mattern lease with 272 barrels a day from the McLaughlin "A" battery. Also McLaughlin Unit "A" produced 490 barrels a day. Another instance, Stanolind M. B. Larson "B" 558 barrels a day compared to California Company A. C. McLaughlin "B" battery of 222 barrels a day. I don't believe that I need to go further. It is quite evident. My conclusion, as it was before, is that there is being migration of fluids from the areas of low withdrawal to the areas of high withdrawal, resulting in drainage to the California Company.

Q. And do you persist in that conclusion despite all of the testimony of all the other experts?

A. I heard the whole story and that is still my opinion.

Q. You don't think you are in any danger of being dropped out of the A.I.E.C. for so saying, do you?

A. I don't believe so.

Q. Turn to the next chart please. Now, Mr. Dunlap, you have just said that you have heard all of the witnesses here today who have testified about the drainage that the California Company is guilty of committing. One witness, as I remember, said that it was a basic law of physics. Now this we will refer to as California Company's Exhibit No. 5, and will you as quickly as you can, still with some degree of thoroughness, explain what you have done on this exhibit.

A. This exhibit shows in my opinion the net drainage that the California Company is suffering in the west area, and we took the fundamental law of petroleum engineering.

Q. Now is this the same basic law of physics that was referred to this morning?

A. It's the general law of physics applied to the specific case of an oil reservoir, yes.

Q. And what is that commonly called in the industry?

A. Called the Darcy Law.

Q. Now go ahead.

A. That law simply says, when reduced to field terms, that the barrels of oil per day is equal to conversion factor, times the oil permeability, which is the degree in which rock will conduct fluids. It's also directly related to the cross-section area through which the oil moves. The barrels of oil per day of drainage is also related to the pressure drop along

the length of the path of the flow of the oil, and inversely related to the oil viscosity or thickness you might call it. It's also inversely related to the formation volume factor, which is a measure of the oil shrinkage, so to speak, from the reservoir volume to stock tank volume; and it's also inversely proportional to the distance over which you are applying that pressure differential. The values of the physical quantities, rock and fluids, are put into this formula for Rangely. The formula can be simplified to say that the barrels of oil per day of drainage is equal to 1.06 times Delta P, and that Delta P simply means that is the pressure difference along the line of flow or pressure between the wells in this instance to adjoining wells straddling a property line.

Q. Now, Mr. Dunlap, in the interest of time, because it is getting late in the evening, let's assume that the Commission, and I think rightfully so, is familiar with the operation of Darcy's Law. Now will you tell me what your conclusion was as to the application of Darcy's Law to the California Company properties individually in the west area. State the conclusion first and then I will ask you to substantiate with detailed data.

A. This formula was applied to 75 different lease boundaries in the west area common to the California Company.

Q. What do you mean common to the California Company? Common to us and some other operator?

A. That was all lease boundaries.

Q. It was every lease boundary?

A. Yes, every lease boundary in the west area.

Q. That we had in common with some other operator?

A. That is right.

Q. In other words, it was a boundary across which the flow of oil would constitute drainage regardless of which way it went?

A. Yes, sir.

Q. Very well, proceed.

A. We took 75 California Company lease boundaries in the west area and summarized those algebraically and it totaled 2349 pounds per square inch in the direction of drainage from the California Company to the other operators. This is a minus 2349 pounds per square inch. It's a negative pressure indicating drainage away from the California Company. If that algebraic sum of pressure differentials is applied to this equation or this equation is applied to that difference, you come up with the amount of drainage off of California Company currently based on the accurate data on the June, 1955, pressure survey of 2480 barrels of oil per day.

Q. Now all day long we have heard generalizations about areas; we have heard generalizations about lease averages; we have heard generalizations on generalizations. Now, Mr. Dunlap, in order to tie this down to the individual lease boundaries, will you please read individually the results of your study of

the difference in pressure for each of the 75 lease boundaries that went into the cumulative sum that you have arrived at at the bottom of that graph.

A. All right. I will read off the name of the well and the pressure difference between the wells.

Q. Do this rapidly because time is wasting, but do it so that everyone makes certain that we are not talking in generalities. These are specific lease boundaries, 40-acre tract boundaries.

A. I will name the wells, then I will read off the pressure difference, and when I say "plus" it will indicate a drainage to the California Company. In other words when the California Company will have the lower pressure of the two, when it's negative, will be drainage away from the California Company. All right, Stanolind M.C. Hagood "A", 7; Calco McLaughlin, 34; plus 35. Stanolind M. C. Hagood "A", 3; Calco McLaughlin, 36; plus 30. Stanolind M. C. Hagood "A", 6; Calco McLaughlin, 31; zero balance. Stanolind M.C. Hagood "A", 5; Calco McLaughlin, 37; minus 32. Stanolind M. B. Larson A-C, 2; Calco McLaughlin, 26; minus 60. Stanolind M. B. Larson "B", 1; Calco McLaughlin, 26; minus 60. Stanolind M. B. Larson "B", 1; Calco McLaughlin, 24; minus 110. Phillips Beezley, 1; Calco McLaughlin, 8; minus 80. Stanolind M. B. Larson "C", 1; Calco McLaughlin, 23; minus 20. Stanolind M. B. Larson "C", 2; Calco McLaughlin, 28; minus 280. Stanolind C. R. Stover "B", 1; Calco McLaughlin,

28; plus 50. Stanolind C. R. Stover "B", 1; Calco Emerald, 12;
minus 262. Phillips M. B. Larson "A", 1; Calco Emerald, 15;
minus 215. Stanolind C. R. Stover "A", 3; Calco Emerald, 15;
minus 250. Stanolind C. R. Stover "A", 1; Calco Emerald, 9;
minus 200. Stanolind C. R. Stover "A", 1; Calco Emerald, 8;
minus 228. Stanolind C. R. Stover "A", 2; Calco Emerald, 17;
minus 220. Phillips M. B. Larson "A", 1; Calco Emerald, 17;
minus 230. Phillips M. B. Larson "A", 1; Calco Emerald, 25;
minus 147. Calco Gray "B", 6; Stanolind S. A. Guiberson "A",
2; minus 70. Calco Gray "B", 3; Stanolind Guiberson "A", 1;
minus 70. Calco Gray "B", 17; Stanolind Guiberson "A", 1;
minus 140. Calco Fee, 24; Stanolind Fairfield "A", 1; minus
136. Calco Fee, 37; Stanolind Fairfield "A", 2; minus 274.
Calco Fee, 49; Stanolind Fairfield "A", 3; minus 120. Calco
Fee, 49; Texas-UP, 39; minus 187. Calco Fee, 31; Texas-U.P.,
55; minus 350. Calco Fee, 56; Texas-U.P., 27; minus 304.
Calco Fee, 23; Texas-U.P., 41; minus 250. Calco Fee, 23;
Texas-U.P., 44; minus 184. Calco Fee, 55; Texas-U.P., 14;
minus 307. Calco Fee, 4; Texas-U.P., 51; minus 400. Calco Fee,
7; Texas-U.P., 51; minus 200. Calco Fee, 51; Texas-U.P., 8;
minus 142. Calco Fee, 52; Texas-U.P., 8; plus 90. Calco Fee,
52; Texas-U.P., 20; minus 124. Calco Fee, 3; Texas-U.P., 52;
minus 35. Calco Fee, 50; Texas-U.P., 7; plus 78. Calco Fee,
50; Texas-U.P., 4; plus 118. Calco Fee, 54; Texas-U.P., 7;
minus 30. Calco Fee, 44; Texas-U.P., 26; minus 40. Calco Raven,

2; Texas-U.P., 26; minus 80. Calco Raven, 4; Texas-U.P., 60; plus 240. Calco Fee, 48; Texas-U.P., 34; plus 300. Calco Fee, 70; Texas-U.P., 63; plus 70. Calco McLaughlin, 10; Stanolind Lacy, 4; plus 230. Calco McLaughlin, 3; Stanolind L. N. Hagood "A", 3; plus 170. Calco McLaughlin, 16; Stanolind L. N. Hagood "A", 7; plus 120. Calco McLaughlin, 15; Stanolind L.N. Hagood "A", 7; plus 80. Calco McLaughlin, 2; Stanolind L. N. Hagood "A", 2; plus 170. Calco McLaughlin, 5; Stanolind L. N. Hagood "A", 4; plus 199. Calco McLaughlin, 11; Stanolind L. N. Hagood, 8; plus 210. Calco Emerald, 11; Stanolind L. N. Hagood, 8; plus 90. Calco Emerald, 10; Stanolind L. A. Hagood, 6; plus 309. Calco Emerald, 5; Stanolind S. B. Lacy, 3; plus 187. Calco Neal, 3; Phillips Rigby "A", 2; minus 70. Calco Neal, 2; Phillips Rigby, 1; minus 189. Calco Gray "A", 8; Phillips Rigby, 1; plus 324. Calco Gray "A", 9; Stanolind Associated "A", 2; plus 150. Calco McLaughlin, 4; Stanolind Associated "A", 2; plus 82. Calco McLaughlin, 1; Stanolind Associated "A", 1; plus 100. Calco McLaughlin, 1; Stanolind S. B. Lacy, 1; plus 150. Calco McLaughlin, 9; Stanolind S. B. Lacy; plus 150. Calco McLaughlin, 39; Stanolind Associated Unit "C"; minus 130. Calco McLaughlin, 39; Stanolind McLaughlin Unit "A", 1; plus 50. Calco McLaughlin, 25; Stanolind Associated Unit "A", 1; plus 157. Calco McLaughlin, 14; Stanolind Associated Unit "A", 1; minus 50. Calco McLaughlin, 7; Phillips Magor, 1; minus 121. Calco McLaughlin, 6; Phillips Magor "A", 1; minus 30.

Calco McLaughlin, 12; Phillips Mattern, 1; minus 150. Calco McLaughlin, 13; Phillips Mattern, 1; plus 100. Calco McLaughlin, 29; Stanolind McLaughlin Unit "A", 1; plus 182. Calco McLaughlin, 29; Stanolind Associated Unit "C", 1; plus 2. Calco McLaughlin, 35; Stanolind McLaughlin Unit "B", 1; zero balance. Calco Gray "B", 17; Stanolind McLaughlin Unit "B", 1; plus 5.

Q. And the cumulative or algebraic total of all those plus and minus figures then gave you the result that you stated at the bottom of that chart, is that correct?

A. That is the way that result was arrived at.

Q. And do you consider that general argument or particular argument?

A. I consider it a very particular specific argument.

Q. Is it a fact or conjecture?

A. It's a fact.

MR. SULLIVAN: If there is no objection I request the admission into evidence of California Company Exhibit 5.

CHAIRMAN DOWNING: If there is no objection it will be admitted.

Q. This chart you will refer to as California Company Exhibit No. 6. Now, Mr. Dunlap, in view of the rather exorbitant amount of time we took in pointing out that last batch of information, I request that you explain this as briefly as possible, but what does this chart demonstrate?

A. This chart shows the effect of oil proration or

curtailment of top oil allowable in correcting non-uniform, disproportionate, unratable and excessive withdrawals. The two upper curves show the effect on prorated wells, which is obvious. The average number of wells subject to curtailment under 300 barrels top allowable before applying that top limit have an average of 400 barrels per day. They will be curtailed approximately 100 barrels, leaving still a disparity of some 180 barrels between these wells and the other wells; whereas--

Q. Now wait a minute, by other wells what do you mean?

A. Wells which are not affected by the top oil allowable.

Q. In other words, wells which are not producing in excess of 300 barrels?

A. That is correct. It shows that the average well which will be affected by a limit of 200 barrels produces about 320 barrels a day, which would be reduced 120 barrels to 200 barrels average, leaving the disparity between the wells affected by the top oil allowable by those not affected by the top oil allowable by 120 barrels rather than 180 barrels, or about half the disparity. That demonstrates simply that the 200 barrel a day top allowable would be more effective in correcting non-uniform, disproportionate withdrawals. The blue line shows the percent of total wells at Rangely which would be affected, would come under the effect of different top oil allowables. As you can see only 9% of the wells would be affected if the top allowable was 300 barrels a day. That is almost no curtailment.

CHAIRMAN DOWNING: How many?

THE WITNESS: Nine per cent of the wells would be affected if 300 barrels a day top oil limit was instituted as compared to 23% of the wells.

CHAIRMAN DOWNING: On a lease basis?

THE WITNESS: This is per well, individual per well basis.

Q. Now it has previously been stated by Mr. Barnett, I believe, that that would amount to 43 wells. Is that correct or approximately so?

A. Yes, sir.

Q. Or 9% of the wells in the field?

A. Yes, that is correct. Also comparing the effect of the 200 barrels top allowable with the 300, the percentage of wells affected by 200 top allowable would be 23%, or more than twice as many wells.

Q. In other words, is it your conclusion that the lower oil allowable would result in a more effective allowable rate in that it would help eliminate the disproportionate, the unratability, or the excessiveness of withdrawals in the field?

A. Yes, in my opinion it would help correct the glaring disproportionate withdrawals that is demonstrated on previous exhibits.

Q. And in addition do you or can you draw the conclusion from this chart relating back to our earlier exhibit where you

indicated that the rate of production per day was related to physical waste, does this also demonstrate that a lower allowable would also result in less physical waste?

A. Well, it obviously follows if the wells affected are reduced to a lower oil rate and the deficient wells are reduced also it will reduce the total field production, and the reduction in total field production will result in increased ultimate recovery.

MR. SULLIVAN: I request the admission of California Company Exhibit No. 6 into evidence.

CHAIRMAN DOWNING: No objection, this will be admitted in evidence.

Q. Let us refer now to this as California Company Exhibit No. 7. Before I ask you a question on that, Mr. Dunlap, I remind you and I remind the others on the Commission that we have heard from time to time allusions made about how the field production would be cut, total field production would be cut, by the imposition of various oil allowables. Now, Mr. Dunlap, what is this chart designed to do?

A. This chart shows the estimated total field production rates under various and maximum oil allowables and the net produced gas-oil ratio of 600 cubic feet per barrel. This is the maximum field production rate, again maximum oil allowable, and in the insert is shown the 5-year production history for the Weber Reservoir. In my opinion this shows that the proposal

by the California Company, the proposed order of 200 barrel a day top per well allowable combined with 600 cubic feet per barrel net GOR limit, would result in a field production rate in the order of 62,000 barrels of oil per day, which corresponds very well with the historical field average production rate at Rangely and would leave the historical production rate unchanged.

Q. Now that would be the maximum permissible production under those rates as you estimate?

A. That is correct.

MR. SULLIVAN: I request the admission of California Company Exhibit No. 7 in evidence please.

MR. JERSIN: Mr. Dunlap, on this exhibit, before you turn it over please, you used the production figures as the wells are producing?

THE WITNESS: I will get to that on the next exhibit and I believe that will answer your question.

CHAIRMAN DOWNING: If there is no objection we will admit that in evidence.

Q. Let us refer to this tabulation as California Company Exhibit No. 8. Will you please explain this tabulation to the Commission.

A. This exhibit explains and supplements the previous exhibit. It shows the procedure that was used to arrive at the previous exhibit and it's really a demonstration of the same

thing, and by tabular form estimated total field production rates under various maximum oil allowables and net produced gas-oil ratio of 600 cubic feet per barrel. As you will note we took four different maximum oil allowable rates, and started off with September total field production rate as a starting point. All of our calculations start and progress from this point. I will go through that very briefly; it's quite straightforward and I don't believe it will take much time. The second column is the total cutback of wells producing over the oil allowable in barrels per day. I believe this figure under 300 barrel top per well allowable agrees very well with the figure Mr. Barnett quoted to you this afternoon. It shows what will happen, the amount of oil cutback that will result under these different maximum oil allowables. The next figure to enter the calculation, the total increase due to allowable credit for injection wells, in barrels per day. Each injection well was allowed a credit under each instance, depending on the top oil allowable, and applied to that lease providing the lease was able to produce it from the other wells.

The fourth row is total increase due to gas allowable of 600 cubic feet per barrel, which is in barrels per day again. This is the result of being able to produce additional oil by taking an average of the additional net gas production, which would be allowed over that which was actually taken advantage of in September. In other words, September we didn't use our

600 cubic feet per barrel. This shows what would have happened had it been used. The fifth column is the algebraic sum of each of these individual figures, which is our estimated total maximum field production under different top oil allowables. The last column shows the net change that would result from the September rate, and as you can see the difference here that corresponds with the black point on the previous exhibit.

Q. Now let me ask one question there. Your figure 61,485 which appears under the column, "200 Barrels Per Day Per Well", how does that compare with the historic daily production of the field?

A. That is in line very well with the historical production rate over the past four or five years.

Q. Even though it is considerably less than the 65,891?

A. Oh, yes. This figure is actually the highest rate the field had produced up to that time I believe.

MR. SULLIVAN: May we have Exhibit 8 admitted into evidence at this time?

CHAIRMAN DOWNING: Yes, sir, if there is no objection it will be introduced.

Q. Now do you recall Mr. Barnett's testimony regarding the four 40-acre tracts in the northwestern part of the field which were designated Stanolind Associated Unit "A", Stanolind McLaughlin Unit "A", the Phillips Mattern, and the Phillips Magor? I believe, however, he only talked about three. I don't

recall which one he didn't talk about, but I believe he omitted the Phillips Magor. Will you please explain your conclusions regarding the figures on this chart and what they demonstrate in the distinction or in contradiction of Mr. Barnett's conclusions.

A. This refers to the four leases that Mr. Barnett spent some time discussing.

Q. Now didn't he conclude that those leases were being drained by California Company properties?

A. I would have to refer to the testimony on that, but at least he didn't testify it was in the direction in which the California Company suffered.

Q. Very well, proceed. The record will show what his conclusions were with regard to those tracts even if we have gotten them erroneously.

A. We will refer to this upper left hand lease, Stanolind Associated Unit "A", based on the Rangely Working Interest Engineering Committee Report. The recovery stock tank oil by primary recovery above the cutoff point of 5 millidarcies is estimated to be 693,839 barrels. This information was compiled by the same committee of which Mr. Barnett was chairman.

Q. And at that same time I believe according to his testimony, is that correct, 1949, or 1950?

A. Yes. You will note that the cumulative production through September, 1955, of 736,626 barrels already exceeds the

estimated ultimate recovery from under that tract. I don't believe that I have to spend the time explaining why I conclude that this lease has drained the California Company.

Q. Well, it has more than drained itself according to the original estimate in other words?

A. That is correct. It has produced more than the estimated ultimate recoverable oil.

Q. Will you proceed with the next one and cover them rather rapidly.

A. Stanolind McLaughlin Unit "A", estimated ultimate recovery, 553,160 barrels; actual cumulative production, 716,681 barrels. Phillips Mattern, 774,052 barrels compared to actual cumulative production through September of 804,193 barrels. The Phillips Magor, although not having yet recovered its estimated ultimate recovery, is some 200,000 barrels less yet in the current rate of production in that well but it will only be a matter of months before it has recovered the ultimate recovery of oil. My conclusion is that these figures show that those four leases have been draining the leases surrounding those which are operated by the California Company.

MR. SULLIVAN: If there is no objection, we ask that this be admitted into evidence.

CHAIRMAN DOWNING: If there is no objection, it will be admitted.

Q. Now at the conclusion then, Mr. Dunlap, of this

formal part of the presentation, your present conclusions that California Company properties in the west end of the field are being drained, which was your conclusion at the July 14 hearing still stands?

A. Very definitely.

Q. Now you heard the colloquy that went on between me and Mr. Giles today in my cross examination of that witness concerning how they arrived at bottom hole pressures that they had used in making up the various charts that they used in their presentation, did you not?

A. Yes, I heard the whole story.

Q. Mr. Dunlap, what led us to believe that an error had been made in Stanolind's calculations, do you recall, when we first saw that survey?

A. When we first studied the pressure map it did appear that we were draining the other operators. That we couldn't understand because we knew of the disproportionate withdrawals and it made us wonder if there was something wrong. We also made material balance calculations and that too indicated that there was some reason to suspect the pressure measurements as reported through the R. E. C. The discrepancy in the withdrawals compared to the pressure map made us quite concerned that the pressure map was correct as far as accuracy was concerned; that is the reason we checked it.

Q. And what conclusion did we arrive at with regard to

the bottom hole pressure survey data as presented in this 1955 report? Or let's put it this way: What conclusion did you arrive at, Mr. Dunlap?

A. The obvious conclusion after examining the information was that the gradients were obviously increased for Stanolind. Whether it was intentional or not, I do not know. The point was that the gradients used for the June, 1955, survey were high, which resulted in higher pressures on Stanolind's leases.

Q. Now, Mr. Dunlap, can you demonstrate why we think that an error was made in arriving at those gradient factors of .373 in each of those cases? Will you demonstrate what you think the proper gradient would be with the available data that you have in the customary manner used in the industry to arrive at a proper gradient for those wells, or demonstrate as you wish why it doesn't appear to be accurate on its fact. Use the blackboard if you like.

A. One obvious discrepancy was the fact that, as I mentioned, the wells in 1954, the Stanolind wells' gradient was used as .345, and in 1955 the gradient of .373. As indicated by the Stanolind witness, apparently the Stanolind engineers used the oil gravity. Now if the oil gravity of 34 degrees which Stanolind shows is used, that is stock tank gravity at 60 degrees is used, you come up with a gradient of .370. Now obviously if that oil exists down the hole where there is a higher temperature, the oil expands and the actual

observed gravity is going to become considerably less, so on the very face of it there was an error in using the gradient corresponding to stock tank gravity at 60 degrees, and that is not just a negligible quantity.

Q. Suppose you pick out L. N. Hagood No. 5, I believe it was, which we discussed at some length this morning and show what you think the proper gradient should be in that tabulation for that particular well and how you arrive at it, in contradistinction I might add to the text book gradient which appears in the list.

A. This gradient I consider to be the highest gradient I could assign this well. Actually it's based on the expansibility of the oil and the expansion of the oil in solution gas. If you use stock tank oil of 34 degrees, which has a gradient of .370 PSI per foot and correct that to the average temperature existing in that oil column, you will come up with a correction factor due to temperature alone of .958, which will give a gradient of .3585, and if a further correction is made for the effect of solution gas, the correction of .015, your gradient becomes .343. This is a correction due to temperature. This is the correction due to solution gas, and that is the very highest gradient that I could reasonably assign to that well. Yet Stanolind has actually used a gradient of .373, and that results in the 70 some odd pounds error that was demonstrated this afternoon.

Q. Now the .3435 that you derived there on the board is virtually the same figure that they used in 1954 to arrive at their survey of pressures, is it not?

A. That is correct, and in that survey we did look at that survey and it does not give the same appearances of drainage when we are using that lower gradient as the June, 1955, map does.

Q. Now with the resultant error that would come about by this sort of a miscalculation in each of their exhibits which is based upon the variations in pressure would have some degree of error in them, would they not?

A. They most certainly would.

MR. SULLIVAN: I tender the witness for cross examination.

CHAIRMAN DOWNING: There is one thing I would like to clear up that the Commission is concerned about. I notice that the four companies in their statement states that each operator in the Rangely Field has agreed to utilize the present equipment to capacity in the future, at least the future for a time. Does the California Company subscribe to that same doctrine?

MR. SULLIVAN: No, sir. We made our position clear, as clear as I could, at the hearing I believe it was on October 25, and that was that we felt no commitment of any kind to continue the injection of gas in the absence of an oil allowable order, and an oil allowable order that would be proper to

correct the features that we were complaining of in the west end of the field; and in the absence of that we cannot so agree.

CHAIRMAN DOWNING: At the July meeting didn't each operator agree to use present equipment indefinitely to its capacity, the present injection equipment?

MR. SULLIVAN: We did not so agree, no. As I explained previously, I think it was again at the October 25 hearing, the longest commitment we ever undertook of that nature was during that interim period of about 60 days following the July hearing, during which time we did agree to use our injection equipment to its present capacity, but beyond that we have no commitments and we are not undertaking any.

CHAIRMAN DOWNING: Let me ask this further question: If it happens that the Commission adopted the order presented by the four companies, what would you do with your present equipment?

MR. SULLIVAN: Well, in that case--

CHAIRMAN DOWNING: If you don't want to make a commitment, what would be your expectation?

MR. SULLIVAN: Well, if you adopted the order without the agreement of ourselves -- well, I don't know, let the promoters of that order explain that.

CHAIRMAN DOWNING: I think they have already agreed, at least they have stated here in their proposition that they will agree to use present equipment to capacity as long as the

order remains. Now I am just asking, and I assume that applies to any order that we may make, if not I would like to be corrected, and I also would be very much disappointed if the California Company wouldn't agree to the same thing.

MR. SULLIVAN: Well, Mr. Downing, we cannot be expected to agree to an order that has been designed over here in complete opposition to the position that we have taken ever since the 14th of July. We had no part in its construction. They knew at the time that they concocted it that we wouldn't agree to it. We were never consulted; we had no opportunity to even examine it except until we arrived here today. In fact it would aggravate in our opinion the abuses of drainage that exist in the west end of the field. Now our entire testimony has been directed to that end. Now we made an offer at the October 25 hearing, signed by the responsible official of our company, that under certain circumstances we would agree voluntarily to inject a proportion of the gas that otherwise we would be permitted to flare under the order that was then under consideration; but beyond that we have agreed to nothing and I don't think should be expected to agree. I mean why should we agree to something that is not only going to perpetuate but aggravate the very situation that we have complained about for four or five months.

CHAIRMAN DOWNING: Of course you understand that this Commission is greatly concerned on the flaring of gas, the

waste of gas, and on what order we will make we have never discussed, I have no idea what sort of an order the Commission will make here, but we do want to make an order that will minimize to the lowest possible degree the flaring of gas. As I understand the testimony of the four companies, the order that they request would result in the flaring of not over 7 million feet a day at this time. Now the question is, under the present law we probably have more power than we had under the old law, and I want to know whether we should, in our order, undertake in some manner to compel the beneficial use of this gas and prevent absolute waste. Flaring is waste. Reinjecting it into another sand may not be waste, selling it obviously is not waste; so under those conditions I am asking the question so that we may be guided properly in our order. I can't imagine the California Company under any circumstances would flare gas which they could inject, but it's for you to answer.

MR. SULLIVAN: Well, let's just put it this way, Mr. Downing. On July 14 we proposed an order and on October 25 we suggested another order to you. Now if you can get the other four to agree to that order then we will carry out our proposition of voluntarily injecting the major portion of the gas that we will be permitted to flare. We still produce 50% of the oil and gas in the field, roughly, and just because there happens to be 5 or 6 or 14 operators over here representing the other part still doesn't make their position any more

righteous on its face. They might just as well agree to our order as us to agree to theirs.

CHAIRMAN DOWNING: We are not asking you or anyone to agree to any order. Obviously we couldn't get these warring factions to agree on anything. I don't believe you would agree that the sun is not shining at the present time. This has nothing to do with your proposition or their proposition, but we want to be guided in our order as to whether we are up against a flare proposition or not.

MR. SULLIVAN: Well, sir, I suggest you review the letter written to the Commission on behalf of the California Company which was handed to you at the October 25 hearing.

CHAIRMAN DOWNING: It came originally by wire, as I remember.

MR. SULLIVAN: No, this was the letter that was presented to you as a corroboration of the position that I stated orally at that hearing.

CROSS EXAMINATION

BY MR. ROBBINSON:

Q. Mr. Dunlap, I assume you would agree with me that water won't run up hill?

A. I think that is a correct assumption.

Q. And that fluids in the reservoir will not move from an area of low pressure to an area of high pressure?

A. Yes, I think that would be a fair statement.

Q. And that when you looked at the pressure survey map prepared by the Engineering Committee that it indicated to you that drainage was occurring off of Stanolind's properties and towards California's properties?

A. Would you repeat that.

Q. When you looked at the pressure survey map prepared by the Engineering Committee you came to the conclusion that it indicated that drainage was occurring towards Stanolind's leases instead of toward the California's leases?

A. My conclusion was drainage was occurring away from the California Company leases, yes.

Q. You say that the pressure map indicated to you that it was occurring away from the California Company's leases?

A. Yes, sir.

Q. I misunderstood you, sir, I thought you said when you looked at that map you observed that you thought it indicated drainage to be in the wrong direction according to your prior calculations.

A. Yes, in the first glance at the R. E. C. official map you might say that is correct.

Q. It indicated to you that drainage was in which direction?

A. That the drainage was in the direction toward the California Company.

Q. Toward the California Company leases?

A. That is right.

Q. So unless that engineering data is wrong, the drainage is occurring in the direction of your company's leases.

A. That is exactly what I said, yes, sir.

Q. And the only way that you can challenge that correctness is to challenge the correctness of the Engineering Committee's figures?

A. It's a logical conclusion for us to suspect the information if it is contrary to the distribution withdrawals, yes, and which we did.

Q. And are you aware of the fact that key wells out there are tested with bombs to confirm the picture which is derived by this computed bottom hole pressure?

A. I am aware that some key wells are measured with bombs and also there have been separate determinations of fluid gradients.

Q. Are you aware of where those tests were made?

A. I am aware of some of them.

Q. You would not challenge the accuracy of those tests, would you, Mr. Dunlap?

A. I might.

Q. I see. Would you challenge it in order that it might be established that there is drainage towards California Company properties?

A. I would challenge if I thought the physical conditions were such as to leave doubt as to the accuracy of the information, yes, sir.

Q. Now then if your conclusion is not correct that the whole thing is just so inaccurate that it destroys the basis for it, your only other piece of testimony which I understood you to introduce which has anything directly related to the directional flow of fluids in the reservoir is your Exhibit 5, is that correct?

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

Q. Well, didn't all the rest of your exhibits have to do with words such as "low withdrawals" and "high withdrawals"?

A. I think there were two exhibits pertaining to--

Q. Pressure?

A. Drainage withdrawals.

Q. How many exhibits did you introduce in which had been computed using pressure as the basic information?

A. I believe the one.

Q. Just Exhibit 5?

A. Using pressures, I believe that is correct.

Q. You previously testified in this hearing, did you not?

A. I did.

Q. In this exhibit which you introduced I understood that you have made a well-to-well computation, Exhibit No. 5?

A. Yes, that is right, between wells straddling a common lease line in the west unit.

Q. And what you did was to take the pressure differential which existed between one well and the pressure differential toward the offset well?

A. Yes, sir.

Q. Just on a well-to-well basis?

A. That is correct.

Q. Do you recall this question asked you at the last hearing by your counsel: "Now, Mr. Dunlap, is the inference necessarily to be drawn that a single well adjoining a property producing at a comparable rate with the single well on the adjoining lease will necessarily offset all of the drainage caused by a disparity in the production rates with a higher rate on the single well lease? That is perhaps badly worded. Let's put it this way: Can drainage in this field be figured on a well-to-well basis?" Do you remember that you answered: "It is my opinion that it cannot. This field is not producing wide open and it's my opinion that on a field producing its wide open capacity the proper way of comparing the properties so far as drainage is on a comparison on an area basis, not on a well for well direct offset basis." Is that your words?

A. Those are exactly my words, yes, sir, and if you will read also the introductory remarks I believe the question was in regard to comparing production rates, was it not?

Q. It was on the question of comparing drainage; it's on page 78 of the record.

A. I am sure in my own mind we were referring to production rates, of that I have no doubt.

Q. May I ask you is it a fair way to compare the question



01136285

2-27

11/21/55

pgs 201-251

of drainage on an acreage basis?

A. Sir, I am sorry, I will have to elaborate on my answer to your question if you will permit me to. I cannot answer yes or no.

Q. You can't answer that directly?

A. I would like to answer it in this way: that if we compare production rate withdrawals on an area basis we get a reasonable picture of drainage.

Q. Sir, may I interrupt you. Will you tell me in what manner withdrawals can be used in computing lease like drainage?

A. I don't believe I referred to withdrawals in computing lease line drainage, I am speaking of drainage in general

Q. Well, is there any difference?

A. Well, physically I believe there is. When you use pressures, the difference in pressures, we are talking about drainage across a boundary line, and the comparison has to be between the nearest points of measurement, which happens to be wells. We computed the drainage along a 1320-acre boundary. We knew the thickness, we knew the permeability, the character of the fluids, and the physical setup required that we consider the pressure differences across lease lines of individual wells, but that physical requirement does not apply in my opinion to comparison of withdrawals between areas.

Q. Sir, whether it be an area or a well, if property east of that line produces three times as much oil as the one

west of the line but is still at a higher pressure, in which direction is the drainage as between those wells or tracts?

A. I could answer that if you would give me the amount of gas influx and water influx, or the amount of water or gas entering and leaving each property.

Q. You are going to say then that you are going to distinguish between the fluids in the reservoir, is that correct

A. Well, pressures are reflection of the fluid withdrawal

Q. Now you are not going to tell me whatever fluid exists in that reservoir, whether it be gasses or oils or oil and gas in combination or combination of water, oil, and gas, that the movement of those fluids is not going to be from the high pressure to the low pressure, are you?

A. Yes, sir, it will be from the high pressure regardless of what fluid.

Q. Regardless of what kind of fluid it is?

A. That is correct.

Q. All right, then if one side, if east of that line is still at a higher pressure than west of that line, in which direction is going to be the drainage regardless of the withdrawals?

A. The drainage will be from the point of high pressure to low pressure.

Q. Let's talk about waste. As I understand it you propose now, although that as I read the record is a change in

position, that there ought to be a 300-barrel limit on the wells in this field for the purpose of preventing waste. Is that what you now propose?

A. That is right, yes, sir, limited to 200, rather.

Q. Two hundred barrels?

A. That is right.

Q. Now if you even set it at 300 barrels -- was it testified that there were 47 wells in the field that were producing in excess of that rate?

A. Close to that.

Q. Forty-three?

A. Forty-three I think is the correct answer.

Q. The statement was made that those wells are producing at a lower gas-oil ratio than the average of the field. Would you agree with that?

A. I think that may be true, I haven't had a chance to check the record.

Q. If you would cut back the production on those 43 wells to 300 barrels a day, you would reduce the take from the field by some 4700 barrels, is that correct?

A. Yes, sir, that is correct.

Q. 4700 barrels per day and that 4700 barrels would be oil that would have been produced at a low ratio?

A. That is correct.

Q. Would not that very fact--

A. If your assumption of lower ratio averages is correct.

Q. . It's not my assumption, sir, it was testified to here
Do you challenge it?

A. No, sir.

Q. All right, if that is the fact then, would not that
automatically increase the field gas-oil ratio?

A. Yes.

Q. Is that consistent with your views that such a limit
would prevent waste?

A. I think that might temporarily exist in that particu-
lar instance.

Q. Did that table here take into consideration the
actual capacity of the wells to produce the amount you indi-
cated on that table?

A. As best we knew it.

Q. For example, if there is a well in that field that
is currently producing 10 barrels of oil per day, as was
testified to I think by Stanolind, we will use Stanolind's
10-barrel a day well, that well would not enter into your
calculations there in any manner, would it?

A. It would enter in the effect that well was con-
tributing to the production of the starting point.

Q. It would only be 10 barrels?

A. That is correct.

Q. So your assumption would have to be that you computed
in making changes only those wells which would produce over

200 barrels of oil per day, is that correct?

A. Not necessarily, no.

Q. Then tell me how you could make any changes.

A. The wells that were somewhat higher ratio that would be allowed to produce a little bit more, if the operator took advantage of this, might be opened up to produce some of the oil that was cut back by cutting back these top individual wells

Q. So the basis on which you have made your computation is that the higher ratio wells might make up the cutback in those which are lower ratio wells?

A. That is correct.

Q. So what you are proposing is that you put a limit there so that you could increase the allowable of these high ratio wells and decrease the limit of the low ratio wells?

A. The limit is put on to correct the flaring of withdrawals.

Q. Sir, that is actually the basis on which you want the limit imposed and not waste, isn't it?

A. I believe that we have amply demonstrated waste.

Q. Could you answer that question? Isn't that actually the reason that you want a limit placed on?

A. That is an important reason.

Q. Isn't that actually the reason?

A. I believe that physical waste certainly should be considered and we have considered it.

Q. Can you tell me how it's going to stop physical waste to cut back the allowable of the low gas-oil ratio wells and increase the allowable of the high gas-oil ratio wells?

A. Yes, sir, I think that could be shown. If the reservoir volume withdrawals are reduced as a result of that change, it follows, based on the exhibit showing rate sensitivity, that the ultimate recovery will be increased.

Q. Then wouldn't it be even better to reduce the reservoir withdrawals a substantially greater amount by just cutting back all the high ratio wells?

A. I don't think it necessarily follows, no, sir.

MR. ROBBINSON: I give up, that is all.

BY MR. FREEMAN:

Q. Mr. Dunlap, on this question of ultimate recovery of oil, we have had two distinctly divergent statements. I believe it was the Texas Company which stated that if the field is eventually water flooded that the same amount of oil would be produced as would be produced if there was gas injection now. Your statement was that if there is gas injection now there would be a greater ultimate recovery of oil. Are you taking into consideration in that statement eventual secondary recovery methods, such as water drive, water flooding?

A. Yes, sir, I believe the injection of gas will assist in increasing the ultimate recovery by water drive over what would be recovered without the previous use of gas injection. Does that answer your question?

Q. Yes. Now of the wells that you read off in your list, if the California Company was to increase production in those offset wells, just on the offset wells that you complain of, would you avoid this drainage that you speak of?

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

MR. FREEMAN: That is all I have.

COMMISSIONER BRETSCHNEIDER: Why?

THE WITNESS: Because as I indicated before, I think that drainage is indicated by withdrawal distribution, and a prorated or curtailed field has to be determined on an area basis and not just on a well-for-well basis.

COMMISSIONER BRETSCHNEIDER: You could increase the offset well production in areas, could you not, to a degree?

THE WITNESS: Yes, if the second and third wells increase so there would be an area comparison of withdrawals, yes, I would go along with that.

COMMISSIONER BRETSCHNEIDER: You can't do that though for other reasons?

THE WITNESS: No.

CHAIRMAN DOWNING: There was testimony here I think that in this field if it was wide open, that is no oil limit, the ultimate recovery would be the same and would not be affected at all whether there is a top oil allowable or not. Do you agree with that?

THE WITNESS: No, sir. I believe that the institution

of a top oil allowable will increase the ultimate recovery from the field.

CHAIRMAN DOWNING: Any other questions?

BY MR. KIRGIS:

Q. Mr. Dunlap, may I ask first in aid of understanding of the California Company proposal, as I understand it you propose a 200 barrel per well per day top oil allowable?

A. Yes, sir.

Q. Would that be administered on an individual well basis or would it be administered on a battery or lease or some other basis?

A. Well, it would be administered on a per well basis as it is in some of the other states. It would be administered by prorating back to the wells the battery production on the basis of individual well tests is what we propose.

Q. I am not sure I understand that and perhaps I should. Let us look at your McLaughlin Consolidated; that is a lease with a number of wells?

A. Yes, sir.

Q. It includes some edge wells, does it not, at the north edge of the field?

A. Yes.

Q. Some of those wells I think may be less than 100 barrels per day, are they not?

A. There may be.

Q. How would those wells be treated under your proposal?

A. Those wells would, if this net gas-oil ratio is less than 600, be produced without restriction.

Q. Would they be assigned 200 barrels which then could be transferred to another well on the same lease or on the same battery?

A. No, that is not our intention.

Q. Do you recall offhand or do you have access to the information as to the production from your No. 13 well in that McLaughlin Consolidated lease?

A. No.

Q. I believe that for September it was 421. Does that sound approximately right to you?

A. It may be; I won't argue on that.

Q. Would that well be cut back to 200 barrels under your proposal?

A. It would, yes.

Q. It would have no transfers to it from any other well which might make less than 200 barrels, is that correct?

A. Only with this exception, Mr. Kirgis, the transfer of credit for the injection well, we do have one injection well, No. 38, and some of that credit might be assigned to this particular well.

Q. That is a good well, isn't it, one of your good wells? You do know that of your own knowledge, don't you?

A. No, I can't say whether that is one of the best wells or not.

Q. I didn't ask if it was one of your best, I asked if it was a good one?

A. Yes, sir, excuse me.

Q. Is that a direct offset to the Phillips Mattern No. 1?

A. Yes.

Q. It is a direct offset to the Phillips Mattern No. 1, isn't that correct.

A. Yes, sir.

Q. Is that a one-well lease that Phillips has there?

A. That is right.

Q. Do you know what the production is from that lease?

A. No, I believe it's something over 300 barrels a day, but I couldn't give it to you exactly.

Q. Does 381 sound about right to you perhaps?

A. 420 in April so I would go along with that, yes, sir.

Q. Do you know or do you have available to you there the reference to the pressure differential between that Phillips Mattern No. 1 and the California McLaughlin No. 13, the direct offset?

A. I have the interpolated pressure. Roughly that is 100 pounds.

Q. Which way?

A. The higher pressure is on the Phillips property.

Q. And the movement then would be from the Phillips

property to the California property, is that correct?

A. Yes, sir.

Q. And at the same time that California well is actually producing more than the Phillips wells, is that correct?

A. That may be.

Q. What is the pressure differential between that Phillips Mattern No. 1 and the California No. 29 in the same lease, Mr. Dunlap?

A. That would be in the order of 200 pounds.

Q. In favor of the California Company, I mean so that drainage would be to the California Company?

A. That is a diagonal offset and we didn't compute it diagonally, but that would be in the direction, yes.

Q. Am I correct then that in the various figures that you gave in which you undertook to show a balance of pressures away from the California Company that you did not take into account diagonal offsets?

A. No, sir, I don't believe it is.

Q. That is true then, is it, as to all of your testimony, I believe it was in connection with Exhibit No. 5, where you ran rapidly through a list of wells comparing one well with another along your lease boundary lines, is that correct?

A. Yes, sir.

Q. In all instances you did not take into account diagonal offsets?

A. I believe that is correct.

Q. Could that make a material difference to your calculations?

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

Q. Why not?

A. The drainage is calculated to cross the boundary line which is normal to the direction of the pressure gradient, and I believe that is the most accurate way to determine the flow, is the pressure gradient perpendicular to the boundary line.

Q. If the Phillips Mattern No. 1 has a pressure of 1250, which is approximately correct I think, and your McLaughlin Consolidated No. 13, which is a direct offset and has a lower pressure, which is correct as you testified a moment ago, and if your No. 29 has a lower pressure which was also testified to by you a moment ago, what reason is there to believe that there is not drainage from the Phillips Mattern No. 1 to both of those California Company wells?

A. Our calculations were made in the most direct way possible.

Q. Does that mean the easiest way?

A. Most direct. As I indicated, the Darcy Law applies. The pressure gradient should be applied along the path of flow, perpendicular along the cross-section of the line of flow.

Q. Is there no path of flow that can go northeast instead of east?

A. That would be diagonal to the property line and the

most direct flow calculated would be perpendicular to the property line.

Q. That might be the most direct, but does that eliminate the possibility of drainage in a northeast direction instead of an east direction?

A. No, sir.

Q. In other words that drainage not only could exist but does exist, is that right?

A. It may exist.

Q. And that is not taken into account in your calculations, am I right on that?

A. That indicates the pressure may exist from the vicinity of the Mattern well in the direction of McLaughlin 29. I don't know that that McLaughlin 29 necessarily drains oil from the Mattern lease.

Q. I didn't say that, but you concede that it will drain from the Mattern lease?

A. The drain from the Mattern lease may be taking place in the direction of that well.

Q. And then still worrying about our poor one-well Mattern lease, isn't the same thing true of your No. 19 well which is the diagonal offset to the southeast?

A. To a very minor extent that would be possible.

Q. In other words, am I correct in this, that you would say in this instance that the preponderant drainage from the Mattern was to your No. 13 well, is that right?

A. That is right.

Q. But that there would also be some drainage in an amount which you did not specify to your Nos. 29 and 19 wells?

A. In that direction, yes, sir.

Q. And that same thing would be true throughout the field wherever you have a pertinent diagonal offset problem, would it not?

A. That is correct.

Q. You also referred in connection with your Exhibit No. 9, if I got the number down correctly, to the Magor and Mattern leases of Phillips?

A. Yes, sir.

Q. And as to the amount of oil which is recovered?

A. Yes.

Q. And you made a comparison between the amount actually recovered and the original estimate of oil in place, and I believe you said the original estimate of the oil in place was based on a cutoff at 5 millidarcies. Am I right on that?

A. Yes, sir.

Q. Isn't that proof that the 5 millidarcies isn't a very good figure to use?

A. No, sir.

Q. Why not?

A. We used 3 millidarcies and we come out with the same result.

Q. The same lease we have been talking about where the

pressure gradients all go in your favor, are they not?

A. No, sir, I don't believe that is correct.

Q. I believe we were just talking about the same lease, weren't we, a moment ago?

A. You said all the pressure gradients and I don't believe we covered them all.

Q. We didn't cover them all but we covered the three to the east, did we not?

A. That is correct.

Q. Are there any others that you wish to mention? I don't want to preclude that opportunity.

A. I think it has been brought out in previous testimony this afternoon there is a pressure gradient across that area, which means there is also drainage into it as well as out of it

Q. We have established pressure gradients which caused drainage to three of your wells in varying degree to the east of the Mattern, have we not?

A. Toward those wells, yes, sir.

Q. Is there a pressure gradient from the north to the Mattern or away from it?

A. It would be away from it.

Q. Is there a pressure gradient from the south to it or away from it?

A. It would be to it.

Q. Is that then going to move from south to east or is it going to go across from south to north?

A. That I don't know.

Q. Isn't it then a fair conclusion that the fact that more oil has been taken from the Mattern than you thought was there must be from the fact that the 5 millidarcies is not a correct cutoff?

A. No, sir.

Q. Why?

A. The pressure map reflects the direction of drainage at the time the pressures were measured. The exhibit which I showed you was the cumulative result of several years of production.

Q. Total production, wasn't it?

A. That is right.

Q. Has there been a change in those pressure gradients over those various years of production of significance in determining drainage?

A. I would have to check the records, I can't answer.

Q. Then you just don't know one way or the other, isn't that correct?

A. That is right.

MR. KIRGIS: That is all.

CHAIRMAN DOWNING: This witness has been cross examined by the two principal attorneys for the four companies. I hope that this is all of the cross examination.

MR. KIRGIS: No, sir, I was cross examining for my client, Phillips Petroleum Company.

CHAIRMAN DOWNING: We can't stay here all night and listen to cross examination which is largely argument. Do you want to cross examine?

MR. HOLME: Yes, sir.

CHAIRMAN DOWNING: On what exhibits?

MR. HOLME: I can't tell, your Honor, until we have an opportunity to go into it. Do I understand you want to cut off cross examination because of the time of night?

CHAIRMAN DOWNING: I don't want to deny anyone the right, but I do think we have had ample cross examination. If you still want to insist on cross examination and make it brief we won't deny you the right.

MR. HOLME: We don't insist on anything the Commission doesn't want; on the other hand we don't feel this witness has been fully cross examined, and that might take quite awhile.

CHAIRMAN DOWNING: Does anyone else here want to cross examine this witness? All right, if you will proceed and ask as few questions as possible because I think we understand the issues pretty well.

BY MR. HOLME:

Q. I have one or two questions first with regard to this Exhibit No. 5. That is the one in which you listed a number of leases and gave the plus or minus figures, is that right?

A. Yes, I believe that is right.

Q. Were those leases all located in the west Rangely unit?

A. Yes.

Q. The Texas Company wells which you referred to?

A. That would be along the boundary of the west unit.

Q. Which side of the boundary?

A. It straddles the boundary.

Q. We have a definite boundary line, as I understand it.

Now is it on the east or the west side of that boundary?

A. The pairs of wells straddle the boundary.

Q. Right on the boundary line?

A. Yes.

Q. And there are no leases which you mentioned that were not on the west side, is that correct?

A. I believe that is right.

Q. Did you make allowances in your various computations for free gas and for water?

A. Yes, we did.

Q. Now you were here all day today, were you not?

A. That is correct.

Q. And you saw the exhibits relating to the relative pressure patterns as of 1950 and of 1955, is that right?

A. That is right.

Q. Do you dispute the accuracy of the exhibit which showed the pressure map of 1950?

A. I can't say without examining it whether I would or not

Q. Have you ever seen that before?

A. Yes, sir.

Q. In your studies of the Rangely Field have you seen a

number of these pressure maps?

A. That is correct.

Q. Have you ever had occasion to challenge the accuracy of one of them before?

A. There have been occasions, yes.

Q. When?

A. After one or two surveys there were wells that looked completely out of line in regard to their production and I believe in one or two cases those wells were resurveyed.

Q. Was that enough to change the general pattern of the pressure lines as shown?

A. In the localities of the wells in question in one or two cases it was.

Q. Do you recall whether or not the challenges you refer to related to this 1950 map?

A. I cannot recall but I don't believe it did.

Q. Is it your belief based on your general familiarity with the way these things are handled that that 1950 map is at least approximately accurate?

A. Yes, sir.

Q. Now your company is represented on the Rangely Engineering Committee, is it not?

A. That is correct.

Q. Do you know of any occasion since June or in the preparation of the June, 1955, map when the accuracy of that map was challenged until tonight?

A. Of course we doubted the validity of the pressures; however, that has not been carried through to the Rangely Engineering Committee. Does that answer your question?

Q. You never mentioned it to them?

A. No.

Q. Now even if we assume there are some inaccuracies on the 1955 map, is it your opinion that that map reflects in the field generally the pressure patterns that are presently there?

A. I would say generally in the east end. I would not go that far on the west end.

Q. Well, taking the east end, if that is approximately correct do you see any relationship between the gas injection program and the change in the pressure map as between 1950 and 1955?

A. Yes, I believe that there is an expected relationship between the change of the pressure map of 1950 and '55 and the gas injection program.

Q. And what is that relationship?

A. It is one that the pressures have been increased in the vicinity of the injection wells rather than a decline.

Q. Pretty much as shown in the earlier testimony and in reference to the exhibits, the Stanolind Exhibit 4 for example; that illustrates that point, does it not, that a high pressure area builds up around an injection well?

A. That is right.

Q. Is it also your opinion that based upon that change in relationship a migration of oil will occur?

A. Yes, sir.

Q. And in which direction?

A. The oil movement will occur as intended by the injection of gas. The oil will proceed from the high pressure to the area of lower pressure.

Q. And whom does that benefit?

A. Benefits everybody in the field.

Q. Does it benefit the man around the injection well if that is his only lease?

A. It may.

Q. How?

A. For the same reason it benefits anyone else in the field, it would tend to maintain a higher pressure for given cumulative recovery and also maintain the oil more fluid, which will result in increased ultimate recovery.

Q. For the man on the injection well site or for his surrounding neighbors?

A. You asked me about the lease with the injection well on it, did you not?

Q. Yes, sir.

A. That is right.

Q. And that man is going to have more oil than he would have had in the absence of the injection program, is that your testimony?

A. Yes, sir.

Q. Despite the migration of oil out from under his tract, is that right?

A. I didn't admit any migration of oil out from under his tract.

Q. I misunderstood, I thought you said the increase in pressure would occasion a movement of oil away from the injection well, isn't that right?

A. Yes.

MR. HOLME: Like Mr. Robbinson, I give up.

MR. BARNETT: May I ask one question? On that chart where you have the figures on the Darcy Law, would you show that to me just for my edification. Where are the gas and water symbols?

THE WITNESS: It's all taken into account on the oil permeability. That is specific permeability corrected for the effect of water and gas.

CHAIRMAN DOWNING: All right, then the cross examination is closed. Now at this time I want to propound here another question, particularly to the four operating companies that joined in this statement and the proposed order. You say that each operator in the Rangely Field has agreed. Now apparently they haven't agreed, at least California hasn't. You say that each operator in the Rangely Field has agreed with the Commission that it will utilize its present compression

equipment to full capacity during the time this order is in effect. Now does that still stand notwithstanding the failure of the California Company to agree?

MR. ROBBINSON: I could answer that, Judge. That paragraph would have to be rewritten to say everybody but California Company agreed.

CHAIRMAN DOWNING: Now in view of that, Mr. Sullivan, I have here the letter that you referred to and it is signed by your company by Mr. Lamar. We thought it a very pleasing letter. I would like to take the time to read it. I will omit the first part of it which is not important. "...If it was subject to attack it was only because it would stand or fall on whether the Supreme Court of Colorado would construe 30,000 cubic feet per day per well flair limit to be reasonable. Our proposal is that you re-issue Order 2-24", which by the way had 275 oil limit and also a gas-oil ratio that I don't remember.

MR. SULLIVAN: That was the 30,000.

CHAIRMAN DOWNING: "But that you raise the flair limit to 150,000 cubic feet per day per well, a level which is reasonable to the point that we estimate that no one would venture to attack it. If someone were so bold we are confident your Commission would be sustained. The total possible field flair under such an order would approximate 46 million cubic feet per day, an amount which we are sure you would frown upon, and to which we would share your feeling. The California Company, therefore, offers to minimize its share of approximately

one-half of this total possible field flare to the extent that it is possible by the full utilization of all our compressor and injection facilities. We might add that our company is now in the process of installing three additional compressors for injection purposes. We estimate that we would flair no more than 6 million cubic feet per day, and possibly materially less. Now in view of that very fine statement, would your company still be a stand-out on this question of using equipment and is your present position consistent with that?

MR. SULLIVAN: Oh, yes, sir. This whole offer is based upon the re-issuance of Order 2-24, one of the primary features of which was the 275 barrel a day oil allowable. Now we are not interested in an order that doesn't have an oil allowable in it.

CHAIRMAN DOWNING: But this letter does not tie your offer or suggestion of utilizing your reinjecting equipment to what may happen to Order 2-24.

MR. SULLIVAN: Well, it was intended to do so.

CHAIRMAN DOWNING: I don't think it does.

MR. SULLIVAN: It says our proposal is that you re-issue Order 2-24.

CHAIRMAN DOWNING: That is one thing. After saying that then you say, "In view of the fact that flaring should be curtailed as much as possible, the California Company therefore offers to minimize its share, " and so forth. Does that

still stand that you would like to eliminate the flare as much as possible?

MR. SULLIVAN: Yes, sir, that is true, but if that letter is open to the misconstruction that we are willing to do as it says we will do in the absence of an oil allowable order, then I here go on the record as saying that that is the way it is to be construed and no other way, and I take the liberty of speaking for my superiors in that respect because I full well know that was the only intention of the letter.

CHAIRMAN DOWNING: If there is any difference of opinion between you and the company as to the meaning of this letter, which controls, the letter or what you now say?

MR. SULLIVAN: I am controlled by my superiors, but I am quite certain that you will find there is no difference in our intention as I stated here and the intention of the letter at the time that it was delivered to you.

CHAIRMAN DOWNING: Without ruling on it at all it does occur to me that there is a very substantial reason to say that this no-flare order or really your offer to cooperate with this Commission in eliminating or restricting flare will have your support.

MR. SULLIVAN: Yes, I think that is so. You know we have constantly argued against the flaring of gas or any disposition.

CHAIRMAN DOWNING: The reason I asked it was because

I always assumed the California Company and all the other companies are anxious to cooperate with this Commission in as little flare as possible and the greatest utilization and beneficial use of all the products of that field, and I would hate to see the California Company a stand-out.

MR. SULLIVAN: Well, we are apparently alone, Judge, in several respects. We still think it ought to go back into the Weber too.

CHAIRMAN DOWNING: All right, do you have any more evidence?

MR. SULLIVAN: I don't give up easily, but I will.

CHAIRMAN DOWNING: Now we come to the question of some argument. How many lawyers or anybody else want to present an argument to this Commission? We would appreciate a statement or argument as briefly as possible on both sides of this question. I want to find out how many there are so we can determine how much time we can allow. I presume you want to talk, Mr. Robinson.

MR. ROBBINSON: Not for long, Judge, it was earlier in the day when I said that.

CHAIRMAN DOWNING: Mr. Kirgis?

MR. KIRGIS: I think not.

CHAIRMAN DOWNING: Do you want to talk, Mr. Sullivan?

MR. SULLIVAN: I don't think so, Judge.

CHAIRMAN DOWNING: We would like to hear the principals

tell us their viewpoint of what we ought to do. We are a little all of us confused by this conflict in testimony.

MR. WESTFALL: I have a short statement I would like to make.

COMMISSIONER BRETSCHEIDER: May I have a moment please. I would like to make the suggestion that someone cover the point that we have been trying to accomplish since last May. I think at one of the last meetings, on October 25, Mr. Sullivan made an observation that we have been working on this order since last May and we haven't arrived at a conclusion yet because the Commission itself has not been able to make up its mind just how to prepare an order. We know, and I think every operator believes, that we perhaps cannot force the operators to inject gas either directly or indirectly, but there ought to be some method by which the operators should agree among themselves. I think the statute provides an operating agreement paragraph that there can be and should be an operative agreement in the field. I believe you could make a very simple agreement which will provide only that, "We, the operators, will use our equipment to the fullest extent to inject the gas into the Weber". Then you can modify it if you like, or some other reservoir as this proposed order says. If we can get an agreement among the operators to use the equipment to inject gas, maybe we will be able to find a solution. If we can't, then I don't know how we are going to find one. I hope someone will

dig into that to our edification.

CHAIRMAN DOWNING: I want to compliment all companies here having made a splendid presentation of the facts and I think you made it clear from your standpoint. Although we may be somewhat confused, I hope your statements you will now make will tend to clarify the issue so that we will understand it better and in particular satisfy us on the point that Mr. Bretschneider has raised.

MR. ROBBINSON: May it please this Commission: The field of Rangely is quite an oil field. Basically it is a gas drive field, but the operators have not been able to agree upon a plan of unitization, and that is indeed a pity. That which has been done under the suggestion and request of the Commission by the operators in the use of compression facilities to reinject gas in that field has caused, and may increasingly cause, some question as to the protection of the correlative rights of the various owners along those injection wells.

Now I think that all would agree that that which could be done to preserve the pressures in this field would be in the interest of ultimate conservation. There are those who don't quite see it that way, but they go upon the fact that there will ultimately be a water injection program in this field and therefore it does not make too much difference how much is recovered during the pressure depletion stage of production from this reservoir. It's obvious that pressure injection which this

Commission has requested the operators to engage in is causing individual problems on the various leases which will over the period of time be multiplied, and I know of no way that that can be worked out except through unitization. I want in the first place to assure this Commission that I personally have raised my small voice to my clients suggesting that they go along with unitization. Now that didn't speed them up any because I know they realized that before I said anything to them. But you are faced here with a problem at this point of facts which exist in the production of oil from this reservoir. Now it isn't East Texas with water drive where the control of production is going to have anything to do with how much oil you are going to get through pressure depletion. The only thing you will have to go on under your pressure depletion methods is to use the gas as best you can.

Now in the light of the Colorado Law you are going to have to accept the promise of these operators to continue to reinject their gas and to hold the pressures there, although it may in instances be causing so much difficulties and so much disparity of pressures that eventually that promise will have to be abandoned without unitization. Unless you can get it unitized you may have to abandon this matter of reinjecting the gas into the reservoir. As I see it, there are only two bases on which you could regulate the production of oil. You can't do it certainly through any question of market. You can't do it

certainly on any question of pipeline facilities because that hasn't been injected into this lawsuit at all. Nobody has come here and complained. If you are going to have a top oil allowable on this field you are going to have to do it to prevent waste or to protect correlative rights as they are defined by the Colorado Law. I have carefully read this record, that is the part of it which was made prior to the time I got into this thing, and I can't find any indication or any statement by anybody in that record to the effect that a regulation or restriction of the oil allowable on these low ratio wells from which the big production is coming that will aid in the ultimate recovery of this reservoir, and I don't think there is any record here which would support you in fixing an oil allowable on the basis of waste.

Now can you do it on the basis of correlative rights? The California Company, the accuser in the first instance wound up being the accused after they dug into the record, and I don't think that based on the testimony which is now before the Commission that you would come to any conclusion that the California Company is getting hurt. But if they are, if they are getting hurt, they say they have got the capacity to produce with their offset neighbors; they said a number of times that we have the capacity to produce equal to our neighbors. Now then there is no reason for me to re-read the definition of correlative rights to the Commission. It says that everybody

in the field that has an equal opportunity to produce the oil is fully protected. That is all correlative rights mean in your statute because that is what it says it means. Now if it's only that they must have an equal opportunity to produce oil from this reservoir, and they themselves say they have it, why should you impose a top oil allowable on it for that basis?

Now we agree with them that it ought not just be, as the gesture has been made, wide open. We say that it should not be wide open. So what type of an order have these operators who are in agreement brought to this Commission to suggest for adoption, something which would prevent this wide open business and something which would tend, which would lean, which would incline in the interest of prevention of waste; and that is the conservation of gas into the reservoir? Unfortunately, as I say, that is not being ideally accomplished and cannot be ideally accomplished in the absence of unitization, and I think nearly everybody in this room realizes that, and I think most of the folks in this room are working in the direction of unitization; but whether it's ideally accomplished or not, it inclines certainly in the direction of the prevention of waste by limiting the gas. Not only does it limit the gas in respect to its utilization of using the oil, but that order would tend to limit the actual wasting of the gas.

The testimony here is that the amount of gas which might be wasted under the terms of the order which we suggest

to the Commission for this adoption is 7 million presently, which is a very small percentage. I have forgotten what the chart showed, some 5%, of the gas which is being produced from that field, and in six months, by June of 1956, it will only be 15% of the gas which is being produced from that field. Now the Commission knows that in the absence of unitization in the light of your statute, in the light of what the Supreme Court says, that gas even if its actually wasted, if it's cremated and not buried as the gentleman says, that so long as it has performed its function in producing oil, if that is a reasonable amount then your Honors would have to go along with it.

In Texas where they pride themselves on their conservation of gas, I dare say every one of you heard General Thompson make at least two speeches or read two of his papers in which he has prided himself on the manner in which Texas has controlled the wasting of gas, and yet down in Texas they are wasting right now, if you wish to call it waste, we would have to say its unavoidably lost and not wasted, in the production of oil there is about 15% of the gas which in normal operation is unavoidably lost. Now that is all that that could project for you back into June of 1956.

Now that order doesn't say that it has to be reinjected, but the order puts a top limit on the amount of gas which one well may take from the reservoir and thereby brings it in line with your statute, brings it in line with the

decision; and certainly, based on the evidence which is before this Commission, there is no bases on which you could make a finding that it's necessary either for the prevention of waste or to protect the correlative rights of the false accuser, the California Company, to put a top oil allowable on it. The field will not be wide open. The order will be in line with that which you are directed to do by the Statute.

Now regardless of what might be said about it, what they are proposing is to reduce the total market of oil from that field, and that the Legislature said you shall not do, and you can't read that legislative intent out of that Act by reading some other part of it. They just said you shall not reduce. Now personally I would have thought it would have been just as good an Act if they put a limitation of market demand in it, but it's not there; and I can well understand Colorado in elbowing their way into this market might not have wished to put any market demand limitation on it. I strongly suspect that the day will come when you will, but right now the legislative direction to this Board is do not cut the allowable in any field in this state, except only for the prevention of waste and the protection of correlative rights. Under this evidence, where can you find any evidence in this record, where can you find any evidence which would support a top oil allowable for either purpose? We think that the order which has been suggested to your Honors is as good an order as could be drawn

under the physical circumstances which exist in the field at this time, under the law under which you operate, and that in toto it will provide the operators time to get away from what apparently is developing to be a very awkward situation in that field by reason of this dispersed gas injection.

CHAIRMAN DOWNING: Might I call your attention to one or two things. One is that we had an amendment of our statute since the Supreme Court decision; that is, I believe it was probably before the decision but it was after the record. I also want to call your attention to this: that our 1951 statute particular allowed or stated that the use of gas to produce oil was accepted in the definition of waste. Now that was amended, that part was stricken out. Now does that indicate anything in reference to legislative intent about your contention that gas should be used to produce oil?

MR. ROBBINSON: Well, sir, I could be entirely wrong but the way I read that decision it says in substance that you cannot require the operators to reinject the gas. I don't find any language in the amendment which says you do have the right under the new law to require the operators to inject the gas.

CHAIRMAN DOWNING: One thing I would like to call your attention to, if I am correct, in East Texas the Commission there with powers not materially different from ours have established a system of bonuses of some sort, rewarding those who reinject without requiring it. Is something like that

possible or feasible in Colorado, if I am correct in my statement?

MR. ROBBINSON: Well, I would be placing myself in the position of your Supreme Court if I gave you an answer to that, but I think it's very doubtful. I think it's very doubtful. I do not believe it can be said with certainty that you have that authority under this Act.

COMMISSIONER BRETSCHNEIDER: By that you mean we could not provide a net gas-oil ratio in an order?

MR. ROBBINSON: I doubt it, sir, I doubt it.

COMMISSIONER BRETSCHNEIDER: I doubt it too, but I think we ought to get a consent of operators to use their injection equipment.

MR. ROBBINSON: I think the operators had in mind some of the limitations of the law when they brought to you here this order of an agreement among themselves to use their injection facilities.

COMMISSIONER BRETSCHNEIDER: Do you think an order such as we are talking about now would have any effect on improving the situation concerning possibly fieldwide unit operation?

MR. ROBBINSON: Well, I think it would have this effect on it, that it would provide a reasonable manner of operating this field which in itself will tend to emphasize the need for unitization.

COMMISSIONER BRETSCHNEIDER: Of course that has been very well emphasized in the past because since May we haven't had an order that anybody would agree that was good.

MR. ROBBINSON: You can't enter an order of unitization

COMMISSIONER BRETSCHNEIDER: Oh, no, we can't do that.

MR. ROBBINSON: And so it's going to have to be up to the operators, and whatever you can do to encourage the operators to unitize would be in the direction of unitization and that is as far as you can go, and I think this order does that, yes, sir.

COMMISSIONER BRETSCHNEIDER: That is what I wanted you to say.

CHAIRMAN DOWNING: Let me ask one other question. Didn't the Commission in Texas order a field shut down completely until the operators did agree upon unitization?

MR. ROBBINSON: That is not exactly what they did. They just entered an order down there in Texas in substance that was a net gas-oil ratio order of zero, and the Court struck that down in Texas.

CHAIRMAN DOWNING: Thank you very much, Mr. Robinson. Now, Mr. Kirgis, do you want to say something?

MR. KIRGIS: No, I feel Mr. Robinson has covered all that I might say in addition to what I have already said during the course of the hearing.

CHAIRMAN DOWNING: Mr. Stayton.

MR. STAYTON: Judge, I am going to speak very briefly

because Mr. Bretschneider made my speech for me.

COMMISSIONER BRETSCHNEIDER: If I have done that I would like to have you expand and elaborate on it.

MR. STAYTON: All right, Mr. Bretschneider, I will do my best. If the Commission please, in the brief remarks that I am going to make I am going to make the assumption first that the primary interest of the Commission is eliminating as much of the flare at Rangely as they can possibly eliminate, and secondly that they want an order that is going to stand up; that is either an order that won't be attacked or an order that is a valid order if it is attacked. Now that is the basic assumption I am making in these remarks.

Now I don't think that you will ever come out with that kind of an order, and I say this with absolute candor, until you recognize what Mr. Bretschneider said just a minute ago, which is that as much as you would like to have the power to do something else that you can not directly or indirectly compel the injection of gas into the Weber formation; and I submit in utmost seriousness of which I am capable that you are never going to get to the bottom of this problem until you accept that. That has got to be the basis for your thinking when you confer about this order, because the Supreme Court of Colorado, if you enter an order that does indirectly what the Court held you couldn't do directly, when you get back up there to defend it and tell them that you now call it a horse instead

of a donkey, you changed the labels on it, that Court isn't going to accept that and you are going back just where you are today; so you have to accept the fundamental premise that you can't compel injection directly or indirectly into the Weber formation.

CHAIRMAN DOWNING: Maybe that is one reason why we would like to have you agree on it.

MR. STAYTON: Now I represent the Sharples, Judge, and they can't agree to it. Those people are being wiped out through injection of gas into the Weber formation, and the longer it continues the more they suffer and finally they will get to the economic limit when you can't inject gas into the Weber and protect their interest in this field; and if you enter an order that attempts to coerce them to do so they have no alternative but to fight. They have nothing to lose and everything to gain. They will lose their property if they don't, so they can't accept an order that requires injection of gas into the Weber formation. That is the physical facts; they are being gassed out now. They can't handle all the gas they have let alone all the other operators putting back gas that is migrating over to their property; so they can't get along on any order that compels directly or indirectly the injection of gas into the Weber formation.

But Sharples is willing to go along with the Commission on an order that will put this gas somewhere else. Sharples

is willing to spend money, and it has spent money, in attempting to determine whether or not some of these other formations will take the gas. They believe that it will and they are willing to try it, and certainly the Commission has everything to gain as I see it and nothing to lose by letting them try it. What skin is that off of your nose? It's going to be their money and not the Commission's, and if they do find out that it is a reservoir that will receive this gas and give it up they will have made a discovery that is very important in so far as the regulation of this field is concerned, so if you enter an order that allows the injection of gas into any formation, Sharples, at least until it's proved that that can't be done, will go along with it. You have nothing to fear then from an attack on the order in so far as the injection of gas is concerned. You have an order that these parties have all agreed they will accept and the California Company couldn't knock out if they attack it because the only ground would be they would say you ought to require them to put all gas back into the Weber instead of putting some part of it in the Weber formation. I will be happy to defend that. I think that is one a high school student could defend. No Court is going to tell you that you have to limit gas injection into the Weber formation. So you would have a perfect defense against any suit that made that attack on your order in so far as the injection phase is concerned.

CHAIRMAN DOWNING: Your company is considering the

possibility of injecting into the Dakota?

MR. STAYTON: No, into the Entrada. They have joined and they have cooperated in this effort and they are willing to cooperate further and spend 20 or 30 thousand dollars fairly quickly and try to find out whether this can be done.

Now the only other feature of a possible order that you are confronted with is should there be some sort of an oil limit or shouldn't there. Now in all frankness in so far as Sharples' individual position is concerned, whether you put an oil limit or don't put an oil limit I don't think is going to affect them one way or the other. You have already permitted them to be gassed out to the point they can't make 300 barrels a day out of any well, so it's a matter of no consequence to them in so far as they are personally concerned. But I will say this, that if you do enter an order that doesn't provide any oil limit, the only way that could be successfully attacked as I see it is by someone that comes in and says that order fails to protect my correlative rights; and I will say in that connection, in my limited experience before commissions, I have never seen a case with respect to alleged drainage that disappeared quite as fast as the California Company case did today. They just didn't prove any drainage, they just didn't show it, it's just not there; but I am not going to go into that any further.

CHAIRMAN DOWNING: Will you be here tomorrow at ten

o'clock?

MR. STAYTON: No, sir.

CHAIRMAN DOWNING: I would like to have you here and have you talk to us on an amendment to our present law which we are considering.

MR. STAYTON: You are going to get me in hot water now. I am leaving on the one o'clock plane. That is all I have to say, but in all seriousness, Judge, please recognize you just don't have the power to compel gas injection back into the Weber. If you don't accept that we will be in trouble for six years.

COMMISSIONER BRETSCHEIDER: I think we know that, Mr. Stayton.

MR. STAYTON: I think you do, Mr. Bretschneider, and I think once you recognize that the only alternative is putting it somewhere else with some cooperation.

COMMISSIONER BRETSCHEIDER: I think we are willing to do that, but we have to have the cooperation of the operators.

MR. STAYTON: Well, at least four of them are willing to go ahead and do everything possible; and I will express this opinion too, whether California Company is willing to let you say in that order that they agree to use their compressor capacity or not, my personal opinion is that they will keep on using it.

CHAIRMAN DOWNING: Thank you very much.

MR. WESTFALL: Judge, I represent the Huskey Oil Company. The Stanolind operates all the properties in which we have an interest. However, currently our production is about 3.6% of the total field production. We feel although it's not large, it's larger than some of the operators and nearly as large as others; therefore we feel like we would like to make a statement.

We would like to urge the adoption of the order that has been introduced by Phillips and Stanolind. We feel it's reasonable and although it does not embody all of the principles that each operator would like to have, we believe that in general it is reasonable and protects the correlative rights of the big majority of the operators and royalty interests. Now I have noticed here that the royalty interests have been neglected in a good bit of this argument, and that is one reason why I brought that out. It is to be admitted that gas injection into the Weber Reservoir may help the overall reservoir, it may be very beneficial if we had a fieldwide unit, but under the dispersed gas injection and the competitive operation, certainly certain operators and royalty owners are being hurt.

However, that doesn't alter the fact that gas is a commodity. Therefore, it has value and should be conserved. We have tried to conserve it in the past by injecting into the Weber Reservoir, and there are certain objections to that. Therefore, we think it reasonable that we investigate the

possibility or the feasibility of injecting it into another horizon. We have no opinion one way or the other as to the feasibility of it, but certainly we won't enter an objection to some field test to determine the feasibility of it. This proposed order would provide for that in that it would give those operators that wished to do so the right to conduct field experiments, if you will, in injecting into the Entrada sandstone. In this matter of applying a top oil allowable, we do not believe that it can be substantiated in the absence of a statute which would permit market demand proration. In the absence of such a statute there are only two premises under which you could limit oil production; one to prevent physical waste, two, to protect correlative rights. We don't believe that there has been any evidence introduced today that would prove that physical waste exists. Actually I think that to us Stanolind's exhibits and the testimony of their witnesses proved just the contrary, that no physical waste exists.

I would just like to emphasize one point that we have probably gone over a half dozen times, and that is a solution gas reservoir is not rate sensitive, unless I went to the wrong engineering school. Now Mr. Dunlap apparently has some question about that, but at any rate that was the way I learned it. The other point, the protection of correlative rights, it is our feeling that the summation of all of the evidence today is that the imposition of a top oil allowable

would only aggravate what minimum drainage across lease lines that may now exist rather than correcting that situation.

In view of these few short remarks, we would respectfully urge the Commission to adopt the order as proposed by the Stanolind and Phillips and so forth. Thank you.

CHAIRMAN DOWNING: Might I ask a question. Our order had a top allowable of I think 275 barrels of oil a day. The Commission thought that was a fair compromise between 200 which was recommended I think by the California Company and 350 recommended by Stanolind. Suppose we did reaffirm that but added to it a provision that this should only apply until you have an opportunity to consider or determine the value of injection in some other reservoir. Would that be satisfactory?

MR. WESTFALL: I don't believe so, Judge, for the reason that I don't believe that has any bearing on the right to limit oil production. Actually this conservation of gas by injecting into another reservoir is for sale or what have you, all that is attempting to do is to conserve gas. Now that is a commodity. It has value not only in dollars and cents as a salable value, but also has a value for the energy that it can impart to the oil in the reservoir. Now it's not out of the realm of my thinking that should we next year or the year after next effect fieldwide unitization in the Rangely Field that we may want to pick up this gas that we have injected into the Entrada or the Dakota or where have you and put it back into

the Weber, because I think that when you have a unitized field, if we ever do, that you have got a horse of a different color as regards gas injection. Now I might just go on there a little bit. Actually the only thing that determines whether gas injection is beneficial to a reservoir is the cost of the number of cubic feet or number of thousand of cubic feet of gas that has to be injected for each barrel of increased oil recovery. Any time it exceeds the value of that barrel of oil, then to me it's not successful. Now somebody that is purely in engineering that doesn't have to look at the dollars and cents side of the thing, maybe they would consider it successful because it does get one more barrel of oil out of there, but in my part of the thing we have got to look at dollars and cents. Certainly there are operators like Sharples, I don't think there is any question but what they are being hurt by this dispersed gas injection. I don't know whether there is any other operator particularly but there are certainly tracts that are being hurt where the royalty owners and operators of those tracts are being hurt. I can't conceive of a circumstance under which we would favor a top oil allowable under present circumstances. Certainly if the Legislature passes a market demand proration law, you would have the power to do it and we would accept it, but under the present law I don't see under any circumstance how we could favor it.

CHAIRMAN DOWNING: Does anyone else on the side of

the four companies want to say something?

MR. HOLME: We think the record should reflect that the royalty owners for whom we speak also go along with the order proposed by the four companies and are perfectly willing to see that experiment tried.

CHAIRMAN DOWNING: Have we concluded the arguments of those on the four companies' side? If so, we will now hear from the California Company.

MR. SULLIVAN: I feel a little bit like this weatherman feels that comes on about ten o'clock every evening and he follows the \$64,000 Question over here and the Ford Theater over here, it's a rare privilege indeed for a young man of my experience and my age to follow two such noted and elegant gentlemen in the field of conservation as these two fellows and I am just sorry that I don't agree with them, but maybe with age and maturity that will come about, and I dare say we will still be arguing the Rangely question when I reach that maturity.

I want to say one thing about Mr. Robinson's reference to this equal opportunity to produce constituting my correlative rights under our new act in this state. If it means what he says it means, then I have the equal opportunity by the mere existence of the wells themselves, and all I have to do to protect myself, my equal opportunity is there simply because the wells exist, and all I have to do is take advantage of any natural circumstances that are there without regard to anything

else. Now, Judge, I submit to you all, that if that is all that statute means, we didn't need to amend that law of 1951 in 1955 to add protection of correlative rights. If all it means is that if I own a well, I thereby automatically can protect myself against the piracy that can go on arising out of a multitude and myriad of circumstances beyond my control, then that law is meaningless, it's futile, and it never should have been passed. In other words, you have got no more authority under the correlative rights features of our new act than you had before. It's an astonishing conclusion.

Now let me also say this with regard to this proposed order: I think that if nothing else that the California Company can be commended for the fact that we have consistently espoused (1) the conservation of gas in the Rangely Field, and any other practices which we sincerely believe would lead to the furthering of ultimate recovery; and to that end we, as you remember, went down the line and supported you. We lost, but we have consistently supported the proposition that gas in the Rangely Field, if it is to be produced and is not to be flared into the air, must go back into the Weber Reservoir in order to serve its real conservation purpose. I submit to you that the only reason that Stanolind has departed from its initial position and that Phillips has departed from it is because of the fact that they have found that finally in unity there is strength and they think they can overwhelm the position of the

California Company on its lone insistence on an oil allowable in the field, against which all the others have been aligned and it has resulted not in anything other than what I would like to refer to, since we have been called a "false accuser", I would like to refer to this as an "Unholy Alliance" because I think it is based on something that is not wholesome; it is not consistent with their previous position and it will not serve conservation. You are not helping the Weber Reservoir of that field one whit more by putting that gas into the Dakota or the Entrada than you are by flaring it. Now, Judge, that suggestion is simply a sop to the desire of the Commission not to see that gas go into the air. I want to commend the Commission too upon the admirable patience that you have shown with all of us.

CHAIRMAN DOWNING: Anyone else?

MR. EVANS: I would like to make a statement for Equity, Weber, and Utah Southern. We hope the Commission has not forgotten that there was a prior hearing and that there was substantial evidence produced at that time. We happen to believe that the facts and the figures that are shown by the California Company which indicate that there is a loss to the California Company of some 2400 barrels of oil is true.

CHAIRMAN DOWNING: You represent Equity, don't you?

MR. EVANS: Yes, sir. We can't pick our operators, we are stuck with California. So this order that has been

introduced to my way of thinking is not honest, I will say, because I think that in strategy the thing that you try to depreciate most is what you are afraid of most, and that is an oil allowable. That is the only thing that can be substantiated. Phillips is not arguing about it because they say, "We have an even break, you are stealing from us about what we are stealing from you." Sharples, they are in the same situation. Stanolind is getting a little more than anybody else is getting from them. On their testimony they tried to indicate that their leases were being drained all over, but Phillips even admits with Stanolind there is a crossing of the lines as between their leases, and that on cross examination they admitted that the oil was traveling in their leases in about four other respects and it's not in its proper perspective.

In another instance, you have been served notice that if you grant this order you are going to get clobbered, to put it roughly. What they are doing is like the three boys in the alley, one of them is putting the chips on the one guys shoulder and the other is getting ready to paste him in the jaw, because I get that from the inference that any injection into the Weber directly or indirectly you can't substantiate. That should be enough. There wasn't one of them that testified that they wanted injection into the Weber. Texas said, "We don't like it but we will go along for the purposes of this order." They are not afraid of that; they can upset you on that, they

think. Now just one other little remark. There has been some reference here that this kind of order would assist in unitization. Well, it won't assist unitization as far as my client goes because he has some very specific notions on a fieldwide unit. So the veiled idea that this kind of thing will do that is erroneous. Furthermore, we don't agree to any agreements that California might make to reinject without an oil allowable, because if they do, we are going to shoot them. That is all I have.

CHAIRMAN DOWNING: That then, I guess, concludes the hearing.

(Whereupon the hearing in Cause No. 2 adjourned at 10:30 o'clock p.m., November 21, 1955.)

* * * * *

C E R T I F I C A T E

I, Donald E. Weimer, Certified Shorthand Reporter, hereby certify that I personally recorded in shorthand the proceedings in the foregoing matter in the first instance and that I later transcribed the same and that the foregoing record is true and correct to the best of my knowledge and belief.

Done at Denver, Colorado, the 6th day of
December, 1955.

Ronald E. Weimer

Certified Shorthand Reporter
2027 Newport Street
Denver 7, Colorado

Phone
FR7-0358