BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
April 25, 1962

IN THE MATTER OF:

Application of the British American Oil Producing Company for a unit agreement Lea County, New Mexico. Applicant, in the above-styled cause seeks approval of the Jalmat Field-Yates Sand Unit Agreement embracing 2,760 acres, more or less, of State and fee lands in Township 22 South, Range 35 East, Lea County, New Mexico.

CASE 2545

Application of The British American Oil Producing Company for a waterflood project, Lea County, New Mexico. Applicant, in the above-styled cause seeks permission to institute a waterflood project in the Yates formation in the Jalmat Pool in an area underlying its proposed Jalmat Field-Yates Sand Unit Area, comprising 2,760 acres, more or less, in Township 22 South, Range 35 East, Lea County, New Mexico, with injection of water initially to be through 16 wells located within said unit area, the project to be governed by the provisions of Rule 701.

CASE 2546

BEFORE:

Elvis A. Utz, Examiner.

TRANSCRIPT OF HEARING

MR. UTZ: Case 2545.

MR. MORRIS: Application of the British American Oil Producing Company for a unit agreement, Lea County, New Mexico

MR. SPERLING: James E. Sperling, Modrall, Seymour Sperling, Roehl & Harris, Albuquerque, appearing for the applicant. Associated with me is Frank Allen of our office.

MR. UTZ: Mr. Sperling, would you like to consolidate these two cases for purpose of testimony?

MR. SPERLING: Yes, sir, I was going to request that that be done for the purpose of the testimony. There will be testimony relating to both applications. There will be one exhibit which is the unit exhibit or the unit agreement which will be applicable, of course, to 2545. The other exhibits will be applicable to 2546 and have been so marked.

MR. UTZ: For the purposes of testimony, cases 2545 and 2546 will be consolidated. Are there other appearances in this case?

MR. KELLAHIN: Jason Kellahin, Kellahin and Fox, Santa Fe. I would like to enter an appearance in both cases in behalf of Amerada Petroleum Corporation.

MR. UTZ: Are there other appearances? You may proceed.

(Whereupon, Applicant's Exhibit 1 Marked for Identification)

MR. SPERLING: Mr. Examiner, we have three witnesses, George Judd, Mr. L G. Fearing and Glenn Rader.

MR. UTZ: Will you all three stand and be sworn at once?

(Witnesses sworn)

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

DIRECT EXAMINATION

BY MR. SPERLING:

Q Mr. Judd, state your name and your employer, your occupation and your place of residence.

A George B. Judd, The British American Oil Producing Company is my employer; I live in Dallas, Texas.

Q What is your capacity with British American?

A I have the position of Unit expediter.

Q Have you previously testified before this commission?

A I have not.

Q Mr. Judd, would you briefly give a resume of your educational and professional experience and background?

A I was graduated from the University of Minnasota with a Bachlor's Degree in Petroleum Engineering in 1951. I worked for six and a half years with Pan American Petroleum Corporation in Wyoming as a production and reservoir engineer. For the past four years, approximately, I worked with The British American Oil Producing Company as a production and reservoir engineer and the last three of which have been as Unit Expediter.

MR. SPERLING: Are Mr. Judd's qualifications acceptable?

MR. UTZ: Yes, sir, they are.

Q (By Mr. Sperling) Mr. Judd, you are familiar with the application which has been filed in Case 2545, are you not, relating to the unit agreement, proposed unit agreement?

A I am.

Q I will refer you to what has been marked as Exhibit 1 in Case 2545, and ask you if that is the proposed unit agreement for this area as designated in the application?

A Exhibit 1 is the executed draft of the unit agreement. There's been some revisions made to the unit agreement from the agreement that was attached to our application.

Q And the Exhibit marked for identification as Number 1 is the proposed final copy os the unit agreement?

A That's correct.

Q Would you state briefly what those changes are, that is as between the unit agreement submitted with the application and Exhibit 1?

A Changes are located on Page 13, Paragraph 9, Point 1, Point 2; Page 15, Paragraph 12, Point 1; Page 19, Paragraph 18, Point 1; and also on Page 19, Paragraph 18, Point 3.

Q State in substance what language has been added or deleted so far as these changes are concerned.

A The revision of Paragraph 9, Point 1, Point 2, on Page 13, we added language which would require that the Commissioner of Public Lands of the State of New Mexico would approve. I

believe that's expansion or enlargements. I made an error; the addition of Page 13 is to Paragraph 9, Point 3, excuse me, and the actual addition is to require that the Commissioner of Public Lands approve any revised exhibits before they'd become effective. On Page 15, Paragraph 12, Point 1, the revision is to require approval by the Commissioner of Public Lands and the Commission, the Oil Conservation Commission, for enlargement to the unit area. Page 19, this is Paragraph 18, Point 1, which begins on Page 18, the revision is on 19 and it has to do with the extension of time between cessation of unit operations and the automatic termination of the unit agreement from 90 to 180 days. Also on Page 19, Paragraph 18, Point 3, on the execution form, everything after the first sentence has been deleted from the form which was originally submitted with the application.

Q Does that conclude the changes?

A One minor change on the execution papers, the Phillips Petroleum Company has been deleted on Page 21.

Q Were the changes which you have just enumerated suggested largely from the unit division of the office of Commissioner of Public Lands?

A They were.

Q And the revised addition, which is Exhibit Number 1 in 2545, has been submitted to the office of the Commissioner of Public Lands?

A It has.

Q Mr. Judd, there are appended to Exhibit Number 1 two exhibits. Would you refer to those, please, and tell us what they are and what, if any, changes have occurred with reference to the unit area as reflected on the two exhibits referred to?

A Exhibit A to the unit agreement is the tabulation which includes the description of the land within and unit area, the number of acres in each tract or lease, the lessee of record, the State Land Department lease number, and the division of ownership of each lease plus the primary and secondary participation of each unit tract. Changes from Exhibit A or Exhibit 1 from the originally submitted unit agreement are a result of the deletion of the Phillips Petroleum Company lease from the unit area.

Q Where is that tract located?

A The tract is located, or described, or can be described as the South half of the Northeast quarter of Section 10 or 22 South, 35 East.

Q Referring to Exhibit B of the unit agreement, Exhibit 1 in this case, does that designate the unit area and the presently producing wells within the unit area?

A It does.

Q Any other information contained on Exhibit B that should be referred to, is it self explanatory?

A I believe it's self explanatory. The numbers, of

course, refer to the tract numbers as numbered on Exhibit A.

Q Now, it would appear from Exhibit A to the unit agreement that 2,640 acres out of 2,680 acres is land under which the State of New Mexico owns the minerals, is that correct?

A That's correct.

Q And there is only one fee tract which contains forty acres?

A That's correct.

Q What percentage of the royalty interest has been committed to this unit agreement, assuming approval by the Commission, of course?

A The Commissioner of Public Lands has approved the unit agreement as to form and content. Assuming that they will also approve the unit agreement, we can say one hundred percent of the royalty has approved, or will ratify, the unit agreement.

Q Have you been furnished with a letter from the office of the Commissioner of Public Lands indicating their approval as to form and content of the agreement?

A Yes, I have.

Q And you have that in your possession?

A Yes.

Q What percentage of the working interest within the unit area has been committed, and what is the status of

execution?

A Currently 68.2 percent of the working interest on a primary participation basis have ratified the unit agreement and unit operating agreement; on a secondary participation basis the percentage is, 73.6 have ratified for the working interest.

Q What is the status of execution of outstanding working interest?

A There are three outstanding working interest owners who have not ratified, and all of them have indicated that they would in the near future.

Q Has the revised unit agreement been submitted or circulated among these working interest owners?

A It has.

Q And coincident therewith, I assume, operating agreement has been circulated?

A That's correct.

Q Does the operating agreement designate British American Producing Company as the operator?

A Yes.

Q Of the unit area?

A Yes.

MR. SPERLING: That's all the questions I have of this witness at this time.

MR. UTZ: Are there questions of the witness?

MR. MORRIS: Yes, sir, I have a question.

MR. UTZ: Mr. Morris.

CROSS EXAMINATION

BY MR. MORRIS:

Q Mr. Judd, is there any good reason for having taken in only such acreage in this area within the unit as has been done here? I'm particularly concerned with, say, the South half of 13 and all of Section 24 and the Southeast quarter of Section 23.

A The unit area, as shown on Exhibit B to the unit agreement, has been agreed to mutually by all the operators within the field. The operators in the area to which you made reference are in the process now of forming a second unit.

Q I see.

A Does that answer it?

Q Does the acreage within the unit conform in some way to a separate geological structure or --

A From the acreage in Section 24?

Q Yes.

A No, it doesn't; it's the same reservoir.

Q There's no discontinuity along the lines of the unit?

A No, sir.

Q I notice that there is a well up in the Northwest of the Southwest of Section 2, that's immediately adjacent to your unit boundary. Could you tell me whether the owner or that well was given an opportunity to join the unit?

A The owner as yet has not been given an opportunity to join because as stated in Exhibit 1 here, the participation in the unit is based on certain perameters, production and reserves. The operators within the unit have decided to extend to the operator of this well the opportunity to join at such time that we can determine the equity for the well. It's recently been completed and as yet I'm positive that we can't make a realistic reserve determination for it.

Q Who is the operator of that well?

A Ross, William G. Ross; he's in Midland, Texas.

Q Does your unit have the usual provisions with respect to subsequent joinder within the unit area as now defined?

A Yes, sir.

MR. MORRIS: I believe that's all. Thank you.

MR. UTZ: Are there other questions: The witness may be excused.

(Witness excused)

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

DIRECT EXAMINATION

BY MR. SPERLING:

Q State your name, place of residence, employer, and occupation.

A My name is Louis G. Fearing. I live in Midland,

Texas and am employed by British American Oil Producing Company as a geologist.

Q Have you testified before the Commission on previous occasions?

A No, sir.

Q Would you give us a brief resume of your educational and professional experience, Mr. Fearing?

A I was graduated with a B. S. in geology from the University of Oklahoma in 1950 and spent nine years with Pan American which five years was spent in Oklahoma as a geophysicist and four years in West Texas and central Texas as a geologist. At that time I took a job with British American, I have been with them almost three years working New Mexico exclusively.

Q In the course of the performance of your duties with British American, have you had occasion to make a geological study of the area designated as the Jalmat Field in Lea County, New Mexico?

A Yes, and in addition to that, I have studied areas similar to it, relative to the Capitan Reef facies.

(Whereupon, Applicant's Exhibits 2 and 3 marked for identification)

Q I want to call your attention to the exhibit which has been marked Exhibit 2 in this matter, and ask you to explain to the Commission, by reference to the exhibit on the

wall, if you choose to do so, what information is shown thereon and what information is pertinent from the standpoint of the geology of the unit area and the surrounding area with which we are concerned in this case.

A Well, Exhibit Number 2 is a structure map which is contoured on top of the first Yates Sand member of which we are dealing with. The contour interval is fifty feet. The unit area is the hashered line right here. As far as dip is concerned, there is one area in which the dip may exceed three hundred feet per mile, but in most --

Q Excuse me, Mr. Fearing, for interrupting, but before we get into your analysis of the geological features of this particular area, would you refer to the legend and indicate what information is shown thereon and its relevancy so far as this matter is concerned?

A All right. According to the legend within the unit we have proposed injection wells, and proposed injection wells in the future, both of these will be discussed by the engineer subsequently. Also, on this map we have designated wells which are producing from the Jalmat, Yates, Seven Rivers, and wells in purple producing from the Seven Rivers, Queen. Then the orange lines are the east-west structural cross section and a north-south stratigraphic cross section through the unit.

Q If I may interrupt you again, I assume that the lines of cross section that you have indicated on Exhibit 2 are the

cross sections which appear as Exhibit 3 which has been so marked and which we have distributed?

A That is correct. The east-west structural cross section is the bottom half of Exhibit Number 3 and the north-south stratigraphic section is the upper half of Exhibit Number 3.

Q Now, the information, that is the wells indicated on Exhibit Number 2, show the location of wells producing from all formations within a radius in excess of two miles from the unit area, is that correct?

A That is correct, and the interpretation has been extended to that point also.

Q Continue, Mr. Fearing, with your geological explanation of your findings as a result of the study that you have made.

A The reservoirs that we're dealing with are the various Yates Sand members of that formation which is upper Guadalupe in age. In order to explain the contours of these sand members I would like to refer you to this small diagram down at the bottom in the enclousure in Exhibit Number 3 which is a simplified schematic diagram of how these formations were deposited. Briefly, as the Capitan Reef, which is well known in geological circles here in New Mexico, as the Capitan Reef built to a certain level, it's my interpretation that a

Lagunal area shoreward was built behind this reef and there was subsequent sorting of these sandstones into a suitable reservoir type sand, and as we approached the Capitan Reef proper, these sands are slightly more dolomitic and consequently less permeable, and as we approach this shelf area, or we'll say the pinch out zone on the east side of the field, the sands become tight by virtue of the cementing material within the sand grain such as red clay and so forth. This is a cyclic thing. At the termination of any one sand body there came a deposition of dense impermeable dolomite and then the cycle was repeated over and over again until we have the various sand bodies laid down. Then the entire system was tilted such that we have this structural configuration now tight, and in doing so we have trapping of hydrocarbons up to this point, which I have shown as the purple line on Exhibit Number 2. It is there that the oil and gas of these Yates Sand members have been trapped and that is why this line is shown such as it is.

Now, if you will refer to Exhibit Number 3, which is the north-south stratigraphic section through the unit, this was constructed to demonstrate the good continuity between each of the sand members of the Yates formation and also shows the continuity of the dolomite beds which are tight and very impermeable between the sand bodies. It is this reason that I think that each of the sand bodies must be treated separately

in this waterflood system. The bottom half of Exhibit Number 3, as has been stated before, is the structural cross section and it shows also the continuity in the other dimension of the sand bodies and the intervening dolomite beds and also shows the deterioration in reservoir properties as we move towards the East and to this Skelly dry hole which sits right ere.

Q What other information did you have available, beside the logs that are shown in cross section north and south and east and west, for the purpose of correlation of these logs?

A As far as understanding the rock characteristics within this unit British American has cored 16 wells. These are not exhibits which I persent, but I have with me samples of detailed core description plotted against the gamma ray neutron logs and that is the way we determined exactly what each one of these kicks, as we say in logging, what it actually means. We went from this type of study on to the cross sections and interpreted, of course, in areas which we did not log, what the formation would be. As far as the rock characteristics go, we are dealing with a grain sandstone in each one of these sand bodies. The first two zones have permeabilities which are not outstanding and probably are the cause of low primary recovery. The third sand member has fair to good permeabilities, but the type sand we're dealing with is practically the same in each sand body. Now this is what I see in summarizing this thing. The sand bodies have good continuity

over the proposed unit. I can see no reason why an effective waterflood cannot be accomplished in this area.

Q Do you have anything else to add, Mr. Fearing?

A Well, I would like to know if there are any questions.

Q Yes, we'll get to that. You may resume your seat and I will ask you if exhibit 2 and 3 were prepared by your or under your supervision?

A They were prepared by me.

MR. SPERLING: That's all I have at this time.

MR. UTZ: Are there questions of Mr. Fearing?

MR. MORRIS: Yes, sir.

MR. UTZ: Mr. Morris.

CROSS EXAMINATION

BY MR. MORRIS:

Q First I would like to make sure I have your name right, Fearing?

A F-e-a-r-i-n-g.

Q Mr. Fearing, I believe that you said in this waterflood project each of these sand bodies should be treated separately. Do you mean by that as sort of a separate waterflood project in its own sense?

A No, sir. In fact I think that this explanation should be left up to our engineer. Let me explain what I mean in geologic terms. There is nothing we can do to one sand

body that would influence the other because we have intervening tight zones between them.

Q Do you have the information with respect to the porosities and permeabilities of each of these zones or does your engineering witness have those too?

A He has that.

MR. MORRIS: I believe that's all I have. Thank you.

BY MR. UTZ:

Q Mr. Fearing, am I to understand that the water injection in these proposed injection wells will be only in the sand members of the Yates formation?

A Yes, sir.

Q And that all production to the Northeast from the wells shown on your Exhibit Number 2 are producing from members lower than the Yates-Seven Rivers, for example?

A The wells which are colored yellow, to the right of that purple line, I interpret to be producing from the Seven-Rivers formation and from zones which are lower than those which are proposed to be flooded. The reason, I believe that if you will look to the West of those wells, you'll notice that Carper and Skelly and Roach and others have drilled dry holes between that production, and in talking to these people and getting information from them, the Yates formation was thinning in those zones, and also the character of the rock was such that that is what created the trap, they were

becoming red and shaley and tight. I believe that is fair evidence that there is separation between the wells which are colored yellow on the right side of the purple line and also on the left side.

Q I presume your engineering witness will testify as to the exact zones of injection?

A Yes, sir.

MR. UTZ: Are there other questions? The witness may be excused.

(Witness excused)

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

DIRECT EXAMINATION

BY MR. SPERLING:

Q State your name, place of residence, by whom employed and in what capacity.

A L. Glenn Rader, Junior. Reside in Midland, employed by British American Oil Producing Company as district engineer.

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

A R-a-d-e-r.

Q Have you previously testified before the Commission?

A No, I have not.

Q Would you give us a resume of your educational and experience background, professionally?

A I have a B. S. Degree in petroleum engineering and

mechanical engineering from Texas A and M. I was employed for five years in Colorado, Wyoming, Nebraska, with British American in various engineering capacities; two years in South Louisiana and;I have been in the present capacity for the past two years in Midland.

Q In your capacity as district engineer forBritish American Oil Producing Company, have you had occasion to do a study of the Jalmat Yates Field in Lea County, New Mexico?

A Yes, sir, I have.

Q And that is the area which is depicted in Exhibit Number 2 which you have before you and to which you are referring?

A That is correct.

(Whereupon, Applicant's Exhibit 4 Marked for Identification.)

Q From the standpoint of reservoir characteristics, which you have found to be present in this field, I would like to refer you to Exhibit Number 4 and ask you to explain the information which is contained on that exhibit and expand upon it in those areas where you feel it necessary and with relation to the area as shown on Exhibit 2.

A The Yates Sand in this area has an average thickness of approximately forty feet with an average porosity of 21½ percent, an average permeability of 18 percent, as determined by core analysis. Permeabilities ranging from 1/10 of a

millidarcy up to and greater than 200 millidarcies. This variation in permeability is more of a variation between the various sand members rather than a wide variation within any given sand member. However, it should be pointed out that there certainly are variations within each sand member. The original bottom hole pressure of this reservoir was 1400 PSI, the current bottom hole pressure is estimated to be approximately 500 PSI. This reservoir is in the advanced stripper stage of completion, it's a solution gas-drive reservoir. The average production from the 45 wells within the unit area is 10.7 barrels per day, accumulative production to April 1, '62 is one million five hundred seventy thousand barrels. It's estimated from decline curve analysis that ultimate primary recovery from this reservoir will be 1.9 million barrels, or remaining primary reserves of four hundred thousand barrels. It is planned that we will inject water into the upper two sand members simultaneously, be isolated from the water injected into the lower sand member. The water source is yet to be determined, but from the geologic control in the general area, as well as the Capitan Reef section encountered in the Hall State D 1, in Section 23, it is believed that the 1600 feet of Capitan Reef section will be more than adequate to meet out water needs.

(Whereupon, Applicant's Exhibit 5 marked for identification)

Q Before we get to Exhibit Number 5, Mr. Rader, referring now to Exhibit Number 2, would you point out that initially the area of injection appears to be in the, what we might call the Northwestern section of the unit area, and possibly into the middle section?

A That is correct. The purpose of this, of course, is to prevent migration and drainage by the wells to the Southeast. The presently proposed, or the initial injection wells are shown in solid triangle on Exhibit Number 2, and the future injection wells are shown in a dashed triangle on the same exhibit. At such time as the operators to the southeast commence a waterflood project of their own, it is anticipated that we will expand our injection system to the southeast and form some type of cooperative agreement with these operators.

Q Now, Mr. Rader, is there any further explanation you want to make at this time of the data contained on Exhibit Number 4 with reference to the proposed injection plan?

A Well, as shown on Exhibit Number 2, we are proposing an 80 acre five spot pattern and it is anticipated that the initial injection rates will be 350 barrels per day per well, and that the increased ultimate recovery from this reservoir, as a result of this waterflood, will be approximately two million barrels.

Q I assume that the 350 barrels per day initial water

injection rate will be divided between the first and second member and the third member, is that correct?

A That is correct.

Q In what proportion?

A Approximately equally.

Q Before I interrupted you, you were talking about the source of water supply for injection purposes. I will ask you now to refer to Exhibit Number 5 and ask you to explain the information contained on that exhibit.

A That is a schematic diagram of a typical water supply well. To date we have not drilled a water supply well although we anticipate commencing the well in the near future to test the Capitan Reef in our unit area. We plan to set 24 inch conductor pipe approximately thirty feet, cement it to the surface, 13 and 38 inch casing at 21 hundred feet, cement it to the surface and have 8 and 5/8 liner run from the top of the reef into the 13 and 3/8 casing. It is anticipated that due to the bottom hole pressure of the Capitan Reef in this area, we'll have a high working fluid level and that we should be able to obtain an adequate source somewhere in the range of 700 to a thousand feet.

Q What is the location of your proposed water supply well?

A OUr proposed location would be in the center of the West half of the Northeast of the Northwest of Section 14

which is on our Merchant's Livestock Lease. This well will be approximately 660 feet from our Merchant's Livestock Company Number 1 well.

Q I believe you made reference previously to the Hall State 1 Well --

A That is correct.

Q -- as indicative of the sufficiency of water supply?

A That is correct. We do not have an exhibit present --

Q Would you identify that well specifically, please?

A That well is located on the Northeast, Northeast of Section 23.

Q And your conclusions are based upon the electric logs run on that well as to that of water source?

A That is correct, as well as subsurface control of other wells in the general area.

Q Do you wish to add anything else with reference to Exhibit 5?

A No, I don't believe so.

(Whereupon, Applicant's Exhibit 6 marked for identification)

Q I will direct your attention now to Exhibit Number 6, and ask you to explain the information shown thereon and what it is.

A This is a schematic diagram of a typical producing well. This shows that we have approximately 350 feet of

8 and 5/8 surface casing cemented to the surface, and that casing has been set through the Yates Sand in all cases and the cement has been circulated up to above the rustler section.

Q Is the rustler a salt section?

A It has some salt in it.

Q Is this exhibit typical of the casing program which has been followed on all of the wells in the proposed unit

A This is typical. This exhibit shows five and a half casing, however, some wells do have four and ahalf casing, but other than that it is typical of well in the unit area.

Q Does any other significant information appear on this exhibit, other than already touched on by you?

A No, sir.

(Whereupon, Applicant's Exhibit 7 marked for identification)

Q I will refer you, Mr. Rader, to Exhibit Number 7, and ask you to explain what that is and what information is contained on it.

A This is a typical injection well. At this time I want to point out, of course, that we do not anticipate drilling any injection wells, but currently producing wells will be converted to injection wells in this project and this is a schematic diagram of a typical installation after conversion from a producing well to an injection well. This diagram shows that water will be injected down two inch tubing below

a packer into the third sand member. The packer being set between the upper two zones and the lower zone. Water will be injected into the annulus between the tubing and the casing into the upper two zones, and the water measured into each.

Q As indicated, I assume that this diagram will be typical of the procedure to be followed on all of the wells to be converted to injection wells?

A That is correct.

(Whereupon, Applicant's Exhibit 8 marked for identification)

Q While on the subject of injection wells, Mr. Rader, I will refer you to what's been marked as Exhibit Number 8, and ask you to state what that is.

A This is a log of our new M B Number 5 Well which is the log of a typical injection well in the proposed unit area. This indicates the first, second and third sand members and the fact that they are isolated by the dolomite zone between as well as indicating the perforation therein.

Q There is information contained on these logs, that is, that has been supplied other than the log information itself, isn't that right?

A That is correct.

Q As to perforations and designation of zones?

A That is correct.

(Whereupon, Applicant's Exhibit 9 marked for identification)

Q Mr. Rader, I want you to refer to what's been marked as Exhibit Number 9 which appears to be completion and production data, and explain to the Examiner the information as contained thereon, and make such enlarged explanation sufficiently to be appropriate.

A This is nothing more than a tabulation of statistical information relative to each individual well in the proposed unit area. This lists the completion date and the overall zone which has been perforated in each well. It should be pointed out that the individual perforations in each well are not listed but that each well has been selectively perforated within the interval indicated. The initial potential for each well listed on a daily rate as well as the monthly production during March of 1962. It may be readily seen that the reservoirs in an advanced stripper stage of depletion by comparing the two.

MR. UTZ: This is actually on a monthly rate, isn't it?

A The initial potentials are on daily rates, but the March '62 production is a monthly rate as shown.

Q Have you made a, possibly you testified to this before, but have you made a computation of the average daily production of the wells within the unit area?

A That is correct. It is 10.7 barrels per day currently

or during March of '62.

Q Have the list, or wells listed on Exhibit 9, with the intervals of perforation indicated thereon been uniformly perforated in all three members into which you propose to inject?

A In the majority of the cases they have been, however, there are certain isolated wells in the unit area which have not been perforated in all three members. It is our intention that all wells will be perforated, in all three members, prior to commencement of this project.

Q Will it be necessary to treat these formations again, that is by fracture?

A It is possible thatit will be necessary.

Q And you are prepared to do that?

A If necessary.

Q Do you care to make any further explanation of Exhibit 9?

A No, sir, I don't believe any further explanation is necessary.

MR. SPERLING: That's all I have at this time.

MR. UTZ: Any questions of the witness?

MR. MORRIS: Yes, sir.

MR. UTZ: Mr. Morris.

CROSS EXAMINATION

BY MR. MORRIS:

Q Mr. Rader, what considerations lead you to selectively inject and install a packer to separate your two injection zones in the injection wells?

A Due to the permeability varation between the lower member and upper two members. It was felt that the majority of the primary production has been obtained from the lower sand member, or the third zone, and that a more effective flood could be obtained, without premature watering out, but selectively injecting.

Q The information that you have given us with respect to permeabilities have not been broken down between the three zones; do you have any information that you could present with respect to, say, an average permeability for each of the three zones?

A I'm not prepared to give you an average permeability for the three zones; however, the average porosity for the upper zones is 21 percent and the lower zone is 22.4 percent. An engineering committee proposed, or composed or operators, representatives of all operators in the unit area prepared a detailed study of the possibilities of water flooding the subject area and the Commission has been previously furnished a copy of this report.

Q Do I understand, though, that there is a substantial

difference in the permeabilities between the first and second zones, on the one hand, and the third zone on the other?

A Yes, there is a variation.

Q And the permeabilities in the first and second zones are less than in the third zone?

A That is correct. We feel that the first and second zones will probably contribute larger units of secondary oil than the lower zone will.

Q Now, Mr. Rader, were you present in the room this morning when Mr. Ralph Gray testified in Case 2536?

A Which was Case 2536?

Q That was the application of Hudson and Hudson for a secondary --

A No, I was not.

Q Are you familiar, Mr. R[A]der, with some of the problems that might be involved in setting a packer and injecting in two separate areas with respect to the inability to back flow the well and clean the face of the sand into which the water is being injected?

A Would you elaborate on that? I'm not sure I understand what you are trying to get at.

Q I'm not sure I am either. I understand that one objection to setting a packer in an injection well is because the operator may want to clean the face of the sand into which

the water is being injected by injecting water down the annulus and back up through the tubing and bring it back up from the tubing, from time to time to clean the well out.

A No, I don't agree with you there. That's not our intention at all.

Q I know it's not your intention.

A As pointed out by the geological witness, these various sand members are isolated by dense dolomite zones between , and they are not connected outside of the well bore. It is not anticipated that we will inject in the upper zone and circulate it through the casing and up through the tubing.

Q It will be impossible with the situation that you have here with the packer there?

A Right.

Q At least with respect to that particular problem you don't think that the installation of a packer is going to cause you any particular problem?

A No, we do not.

MR. MORRIS: I believe that's all.

BY MR. UTZ:

Q With respect to Mr. Morris' question do you anticipate that any foreign materials will get into your injection water in such quantities that they will cause certain blockage in the cace of the formation or the well bore?

A No, sir, we do not.

Q Necessitating cleaning?

A We do not anticipate that from the analysis we have available on the Capitan Reef water, some forty miles to the southwest. We are not really in a position to say definitely that this will not be a factor as the water source is yet to be determined.

Q Referring to your Exhibit Number 9, in scanning your March production, I notice that there's probably only one well that is capable of producing much, if any, over twenty barrels per day and that happens to be your Hall State F Number 5. Would you locate that well on Exhibit Number 2 for me?

A Hall State F Number 5 is located in the Southeast quarter of the Southwest quarter of Section 11.

Q That will be an injection well?

A That will be an injection well. There is another well which is capable of producing allowable which is Merchant's Livestock Number 1, which is a south offset to this well which is a producing well.

Q Oh, yes. Can you say that those two wells are in the stripper stage?

A I think that we can say that this portion of the reservoir, which is within our proposed unit area, on an average basis is in the stripper stages.

Q In other words, your contention is that the other wells are probably below 20 barrels a day and these two wells

are anomalies?

A I'm sorry, I didn't understand your last question.

Q I say, your contention is, in other words, that all the other wells can produce only approximately 20 barrels per day and these two wells are probably anomalies?

A Right, that is correct, however, I would say rather than twenty barrels a day, it's much lower than that.

Q Well, there are quite a number that produce twenty barrels, are there not?

A Right.

Q In regard to your 16 injection wells, and I believe you are just requesting 16 wells at this time --

A Yes, sir, we are.

Q -- to serve as injection wells. Are there any of those injection wells completed any lower than the third zone in the Yates?

A There are some wells on Gulf's tracts which have been completed in the fourth zone, on Gulf's Janda K. Lease.

Q What do you propose to do about those wells?

A We propose to inject water into those wells. There will be, four of the six wells on that lease will be injection wells.

Q Into the fourth zone also?

A Yes, sir.

Q That fourth zone is a zone in the Yates formation?

A Yes, sir.

Q Is the Yates formation in this area a part of the horizontal limits of the Jalmat gas pool?

A Would our geological witness care to answer that?

MR. JUDD: I'll try. What do we define as the Jalmat Yates Pool?

MR. UTZ: Well, we have a Jalmat gas pool. My question is, is this unit a part or wholly within the limits of that pool, if you know?

MR. JUDD: I feel that there can be as many as five Yates sand members to the south and west of the purple line. I'm trying to lead up to a conclusion here. The fifth zone has never shown any producing capabilities and the fourth only at the Gulf Janda location. We have never seen wells of producing capabilities in the fourth zone in other wells that were drilled. However, I feel that all five of these zones are fairly continuous. Let me say it this way. I think that the sand zones themselves are continuous, whether or not they have reservoir properties I cannot say for sure. All five zones are present up to the purple line there. Does that answer the question?

MR. UTZ: No, sir. I'm referring to the Jalmat gas pool. Perhaps I can get at it this way. Are there any gas wells within the confines of this unit that you are requesting?

A No, sir, there are none.

MR. JUDD: No, sir.

Q (By Mr. Utz) So if there are any wells in the horizontal limits of the Jalmat gas pool, they would be oil wells in the Jalmat gas pool?

A Right.

Q In regard to the producing wells, within this unit, are there any of those wells that's completed lower than the third member or the lower member of the Yates?

A As I previously mentioned, there are several wells on Gulf's Janda K wells.

Q That's all the Gulf wells on the Janda K lease?

A Yes.

Q Are they completed any lower than the fourth member?

A No, sir.

Q With reference to your Exhibit 4, are all the data on this exhibit calculated on the basis of, well, I'll say within the li its of the unit requested here?

A Yes, sir.

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

MR. IRBY: Yes, sir.

MR. UTZ: Mr. Irby.

MR. IRBY: Frank Irby, State Engineers Office.

BY MR. IRBY:

Q Your Exhibit Number 5, Mr. Rader, may I see it, please?

A Yes, sir.

Q This shows 13 and 3/8 casing set at 2,100, with the cement circulated, correct?

A Yes, sir.

Q You stated that this water supply well would be in the center of the West half of the Northeast, Northwest, Section 14, is that correct?

A Yes, sir.

Q What Township and Range?

A 22 South, 35 East.

Q On your Exhibit 7, if I may see it please?

A Yes.

Q Thank you. You call this a typical injection well?

A Yes, sir.

Q You have twelve and a quarter surface casing?

A No, sir. That's the surface hole.

Q 8 and 5/8?

A Right.

Q Cemented at 350 feet. I presume that's circulated?

A Yes, sir.

Q Then your next string of casing goes all the way to the bottom of the hole, is that correct?

A Yes, sir.

Q What is that T. D.?

A T. D. is approximately 4,000 feet.

Q What's the cement behind that string?

A The cement is up above the Rustler, above the top of the Rustler, somewhere between 700 and 1500 feet in various wells in the proposed area.

Q Is there an anhydrite bed just above the Rustler in this area? Let me put the question this way, in what formation is the top of your cement?

MR. JUDD: In making the study, Mr. Irby, I confined my investigation from the top of the Rustler anhydrite on down. I'm not prepared to testify as to the continuity of any anhydrite bed up above.

A Well, the cement is in the red beds. The top of the cement is in the red bed.

MR. JUDD: I think his question was, is there an anhydrite bed above the top of the Rustler.

Q I'm sure the water isn't going to penetrate the anhydrite bed if it is continous. If your cement is up at the top and it is continous at the top of the Rustler, then I'm satisfied with your cement program.

MR. JUDD: Yes, sir.

A I think there is one continous throughout the area.

Q The thought alone is not going to satisfy me, Mr. Rader.

A All right, I'm not prepared to testify conclusively on that, Mr. Irby.

MR. UTZ: Mr. Rader, can you make this determination and send the information to Mr. Irby at the Engineers Office with a copy to us?

A Yes, sir, we certainly can.

Q (By Mr. Irby) Thank you. You stated that your source of water is the Capitan Reef?

A Yes, sir.

Q In these injection wells, is the casing fairly new and in good condition?

A Yes, sir.

Q The ones that will be converted to injection wells?

A Yes, sir, I'd say there is no casing in the area in excess of, well casing was new when the wells were drilled and the first well was drilled in our proposed unit area in April of '55. We feel that the casing is in very good condition.

Q Do you have an analysis of the water in the Capitan Reef at this location, or near this location?

A No, sir, we do not have any near. The only analysis we have was obtained from Pure Oil Company on one of their source wells to be used in their Dollar Hyde Unit, approximately forty miles to the South.

Q You no doubt will analyze prior to use?

A Yes, sir.

Q Will you furnish me with a copy of that analysis, please?

A Yes, sir.

MR. IRBY: That's all the questions I have, thank you. Mr. Sperling, if I may, I would like to copy these two exhibits, 5 and 7, and I would like also to have copies of Exhibit B of the unit agreement and Exhibit 2.

MR. SPERLING: Yes, sir.

MR. IRBY: Exhibit 2 is the first one on the wall.

MR. SPERLING: Mr. Rader will furnish them to you at the conclusion of the hearing.

MR. IRBY: Thank you.

MR. UTZ: Mr. Irby, the information you wanted was reference to the formation above the cement job?

MR. IRBY: Yes, sir, at the top of the cement job on the production string.

MR. MORRIS: One further question, Mr. Examiner.

MR. UTZ: Mr. Morris.

BY MR. MORRIS:

Q Mr. Rader, do you see any reason why you cannot live and operate within the allowable provision of Rule 701 in carrying out this waterflood project?

A No, sir, I do not.

MR. MORRIS: That's all thank you.

MR. URZ: Mr. Rader, I don't believe that you have furnished us with a list of the names, locations, either by units or by footage, of the section line of the sixteen proposed injedtion wells.

A No, sir, we have not, other than designated on Exhibit Number 2.

MR. UTZ: Does Exhibit Number 9 include all sixteen of those wells?

A Yes, it does.

MR. UTZ: You may, if you care to, put that information on Exhibit 9 and send us a copy of it.

A All right, we certainly will.

MR. UTZ: Are there other questions of the witness? The witness may be excused.

(Witness excused)

Are there any statements in this case?

MR. MORRIS: Mr. Examiner, the Commission has received two telegrams, one from the Atlantic Refining Company, the other from Gulf Oil Corporation, both concurring in British American in their application these two cases.

MR. KELLAHIN: Mr. Examiner, Amerada Petroleum Corporation, the owner and operator of properties both within and offsetting the unit, and they concur in the application of

British American in the unit application and the waterflood project.

MR. UTZ: Are there other statements?

MR. STORM: L. O Storm, representing J. R. Cohen, independent operator of Lubbock, Texas. Mr. Cohen has been furnished all of the information presented here. We are in essential concurrence with the applications under his tutelage we are attempting to form a unit adjacent to the British American unit as proposed to you. We would prefer at this time to leave those as separate activities. We hope that we will reach a stage soon enough in our operations that we can in proper time execute barrier agreements with the British American unit so that the wells that they present on their exhibits in dashed form, the injections wells can be included in their system, but until that time, we would request the Commission to restrict the injection wells as they request them at this time to protect the common area from movement of oil.

MR. UTZ: Your proposed unit will be immediately to the Southeast of this unit?

MR. STORM: Immediately to the Southeast.

MR. UTZ: Are there other statements? This case will be taken under advisement.

MR. MORRIS: Mr. Examiner, I move that we re-open Case 2545 and 2546.

MR. UTZ: Without objections Case 2545 and 2546 will be re-opened.

MR. MORRIS: Mr. Examiner, on behalf of Mr. Sperling, and attorney for the applicant, those those two cases, I wish to offer the exhibits in both of those cases into evidence.

MR. UTZ: Without objection the Exhibit in Cases 2545 and 2546 will be entered into the record of those cases.

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

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

DATED this 25th day of April, 1962, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Ada Dearnley
NOTARY PUBLIC

My Commission Expires:

June 19, 1963.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 2545, heard by me on Apr. 25, 1962.

Elvis A. Utz, Examiner
New Mexico Oil Conservation Commission