

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
JULY 27, 1960

EXAMINER HEARING

IN THE MATTER OF:

CASE 2024 Application of Humble Oil & Refining Company for :
and an order authorizing it to institute a pressure :
maintenance project in the Horseshoe-Gallup Oil :
Pool by the injection of water into the Gallup :
formation through 29 wells located in Sections 3, :
4, 9, 10, and 11, Township 31 North, Range 17 :
West, San Juan County, New Mexico. Applicant :
further seeks the adoption of special rules gov- :
erning the operation of said project. :

CASE 2025 Application of Socony Mobil Oil Company for per- :
mission to convert to water injection its Navajo :
"A" Well No. 9, located in NE/4 NW/4 of Section :
14, Township 31 North, Range 17 West, Rio Arriba :
County, New Mexico, in conjunction with a pro- :
posed adjacent pressure maintenance project in :
the Horseshoe-Gallup Oil Pool. :
: :

BEFORE:

Daniel S. Nutter, Examiner.

T R A N S C R I P T O F P R O C E E D I N G S

MR. NUTTER: The next case will be Case 2024.

MR. PAYNE: Case 2024. Application of Humble Oil & Re-
fining Company for an order authorizing it to institute a pressure
maintenance project in the Horseshoe-Gallup Oil Pool by the injec-
tion of water into the Gallup formation through 29 wells located
in Sections 3, 4, 9, 10, and 11, Township 31 North, Range 17 West,

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San Juan County, New Mexico. Applicant further seeks the adoption of special rules governing the operation of said project.

MR. BRATTON: Howard Bratton, Roswell, appearing on behalf of the applicant, Humble Oil & Refining Company. We have one witness. I ask that he be sworn.

MR. ERREBO: If it please the Commission, I'm Burns Errebo, appearing on behalf of the application of Socony Mobil Oil Company. Socony Mobil Oil Company has an application for conversion to water injection of the Navajo "A" No. 9 in Case 2025, which immediately follows this case on the docket. The Navajo "A" No. 9 is designed and proposed as a buffer well on the south boundary of the pressure maintenance area, which will be proposed by Humble here today. We would like to ask that for the purposes of hearing and receiving evidence that the Commission combine these two cases, and then issue separate orders.

MR. NUTTER: In other words, your motion is for the consolidation for hearing purposes only of Cases 2024 and 2025?

MR. ERREBO: True.

MR. BRATTON: Fine.

MR. NUTTER: The cases will be consolidated for hearing purposes.

MR. BRATTON: Are you going to have any witnesses, Mr. Errebo?

MR. ERREBO: We will have one witness.

(Witnesses sworn)

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WILLIAM G. DUTTON,

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

DIRECT EXAMINATION

BY MR. BRATTON:

Q Will you state your name, address, by whom employed?

A William G. Dutton. Petroleum engineer for Humble Oil & Refining at Hobbs, New Mexico.

Q Will you state briefly your qualifications?

A I received a B.S. in petroleum engineering from Colorado School of Mines. Had approximately a year's training assignment with Humble, and attended their reservoir engineering school, and worked three years with the reservoir engineering department. I am currently doing reservoir engineering work at Humble's Roswell district office.

Q The area in question is within your jurisdiction?

A Yes.

Q You have made a reservoir study of this area?

A Yes, sir.

MR. BRATTON: Are the witness' qualifications acceptable?

MR. NUTTER: Yes. Please proceed.

(Whereupon, Applicant's Exhibits Nos. 1 through 7 were marked for identification.)

Q (By Mr. Bratton) Turn to Exhibit No. 1, and explain what it is and what it shows.

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A Exhibit No. 1 is a map of the Horseshoe-Gallup Oil Pool. The area cross-hatched by the black outline is the old Chimney Rock portion of the field which was consolidated into the present Horseshoe-Gallup Pool, and is also the area to which Humble confined its study. The area outlined in red is the proposed project area which Humble is requesting. This map shows the proximity of Humble's project to Atlantic's approved project, which is outlined in green. As you will note on this Exhibit, at Humble's southern lease line offsetting Mobil in Township 31 North, Range 17 West the field necks down to a very narrow oil productive interval, approximately two locations wide. This necking down facilitates a cooperative water injection project and will allow the creation of a water block at this point which will block communication from Humble's project with the larger or the original Horseshoe-Gallup Pool to the southeast, which is presently being studied and evaluated for unitization purposes.

Q Have you made a study of Humble's proposed project here and made a cross-section based thereon?

A Yes, sir.

Q Turn to your Exhibit No. 2, now, which is your cross-section, and explain what it shows.

A Exhibit No. 2 is a series of three cross-sections, the map showing how they lie through the field. This Exhibit demonstrates the continuity of the sand to be flooded and, in addition, cross-sections BB Prime and CC Prime indicate the sand pinchouts



which occur to the southwest and northeast of the field as demonstrated by the logs on the furthest extremities of these two cross-sections.

Q This just generally shows the continuity of the sand in the area?

A And the definition of the reservoir by sand pinchout.

Q Then, have you made a structure map of the area? Your Exhibit No. 3, will you refer to it, please?

A This Exhibit delineates the oil column and shows the control that the structural influence has on the trap condition by the presence of the two gas caps. The oil accumulation is in a saddle between two structural highs.

Q Is there anything else you care to say with regard to your structure map, now, Mr. Dutton?

A No, sir.

Q Turning now to your Exhibit No. 4, which is the proposed water flood pattern within your project area, will you explain what that shows, Mr. Dutton?

A The red outline on Exhibit 4 is the proposed project area which Humble is requesting. The wells circled by the dashed circles are the proposed injection wells.

Q And to the south and east lies the Mobil area, which would be the water block?

A Yes, sir. We are mainly dealing with Mobil's lease in Section 14. It's the only one that offsets our production, but they



also offset a Humble lease, which is nonproductive in Section 13.

Q What are the allowables of the wells in the red area, the project area?

A This project will have 29 injection wells, one of which remains to be drilled. The current allowable from the proposed injection wells is 605 barrels per day. The 29 producing wells have a current allowable of 525 barrels per day, for a total allowable for the Humble Navajo "F" and "G" lease of 1130 barrels per day.

Q What allowable provisions have you requested in your application?

A It is proposed that Humble's flood receive the same treatment as Atlantic's Horseshoe-Gallup project that they requested in Case 1979, and was approved by Commission Order R-1699.

Q What is that, Mr. Dutton? Explain what that is.

A The allowable provisions that they requested?

Q Yes.

A Basically, they requested a project allowable equal to the sum of the capabilities of the individual producing wells not to exceed top allowable and top allowable credit for all injection wells.

Q And that's the provisions of that Order and that's all you are asking in this case?

A Yes, sir.



Q What would the immediate project allowable be under these proposed rules?

A Humble's immediate project allowable would be 2,555 barrels per calendar day, assuming the remaining injection well is drilled immediately.

Q We'll get, in our next Exhibit, into the production, the present production of these wells, but as a matter of fact, can this project area, or are these wells now capable of that kind of production?

A No, sir. They have declined considerably in capacity and have little capacity in excess of their existing allowables. The excess capacity above the present 2525 barrel a day allowable is virtually nil because there are only four top allowable wells and two of these will be converted to injection.

Q Actually, there are only two top allowable wells--

A That could take a transfer.

Q --that could receive a transfer before you get a response from the pressure maintenance?

A Yes.

Q Would you explain the flood pattern that you have set up here?

A We are proposing a compensatory injection pattern, as pointed out earlier, you see it better on this Exhibit. The reservoir necks down to your southern lease line and cooperative injection can be obtained by injecting Humble's "G" 4 and "G" 5, and



Mobil injecting their "A" 9. In addition to creating compensatory injection at that point, this will also create a water block which will block communication with the major portion of the Horseshoe-Gallup field to the southeast.

Q And your pattern is shown on this Exhibit as well as the outline of your proposed project area?

A Yes, the dark blue lines are connections from the injection wells.

Q The project area itself includes only producing acreage or acreage upon which wells are drilled?

A It includes developed 40-acre units, yes, sir.

Q Do you have anything else you care to say with regard to this Exhibit, Mr. Dutton?

A We have informed our offset operators of this plan, of our plan of operation here and have requested their cooperation and proposed to offer them the same provisions we have offered Mobil, to furnish them water at Humble's handling cost pending approval of the Navajo Tribal Council.

Q Under this arrangement, if you do or don't have any additional cooperation from any other operators, the only ones whose correlative rights could be violated would be Humble's?

A That is correct.

Q The entire area is Navajo royalty, is it not?

A That's right.

Q All the area and the surrounding area is the same basic



royalty owner?

A Yes, sir.

Q Turn to your Exhibit No. 5, Mr. Dutton. Go through there and explain what your Exhibit 5 shows with relation to all of your wells in this area.

A Well, Exhibit 5 was prepared and submitted with the application to include the casing information on the injection wells. It was further enlarged to show the initial potential and the May '60 production of the individual wells, and cumulative production, which exhibits a magnitude of decline by individual wells. It further shows the status, the proposed status of all the wells under the proposed program. As stated previously, we said our producing wells were not capable of the proposed project allowable. For example, "F" 4 has declined from 77 barrels to 31 barrels per calendar day, per day; "F" 11 has declined from 92 to 9 barrels per day; "F" 19 from 108 to 49 barrels per day; "F" 22 has declined from 102 to 24 barrels per day. All of this decline has occurred since completion, which is a matter of 12 to 15 months' interval.

Q This shows all the wells, both injection and producing, that will be in the area?

A Yes, sir. It also includes the additional injection well to be drilled.

Q It shows your casing program and your cementing as well as showing the status of these wells, as far as production, that



they are on the decline?

A Yes, sir.

Q In your opinion, is the casing and cementing program such as to protect any fresh water strata in the area?

A Yes, sir, it is.

MR. NUTTER: What will be the number of the proposed well, Mr. Dutton? Is that No. 44?

A The proposed--

MR. NUTTER: Injection well?

A Yes, sir, No. 44. Its location is, I believe, 1,000 feet from the South line, 1980 from the East line, Section 10.

MR. BRATTON: Did you have it located, Mr. Nutter?

MR. NUTTER: Yes, sir.

MR. BRATTON: All right.

Q (By Mr. Bratton) Is there anything else that you would like to comment about Exhibit No. 5?

A No, sir.

Q Turn to your Exhibit No. 6, Mr. Dutton, and state what that shows.

A This is a performance curve on the combined Humble Navajo "F" and "G" lease. As this curve indicates, it emphasizes the decline in production which has been experienced. It emphasizes the need for immediate pressure maintenance project in order to prevent waste and guarantee maximum economic return.

Q It shows that you are just over the top of production



and on the way down?

A It shows that we've definitely declined in production.

Q In this connection, Mr. Dutton, is there a necessity for an immediate order on this project? Are you in a hurry on it?

A Yes, sir. In addition to economic reasons for desiring immediate approval, we are very anxious to receive approval of this project in order that the equipment, which is on hand, can be installed before cold weather sets in to hinder or defer its installation.

Q Turn to your Exhibit No. 7, Mr. Dutton, which, I believe, are just the logs of the wells?

A Yes, sir.

Q Those are the logs of what, all the wells in the area?

A Exhibit 7 is a copy of the log on all the proposed injection wells, plus a log on our Navajo "F" water Well No. 1, which will be our water source well. One copy of these logs was submitted with the application, and we are furnishing a second set.

Q Mr. Dutton, is this program in the interest of conservation? Where are you in relation to the development production history of this area?

A My study indicated that primary recovery would be in the order of 18 percent of the original oil in place. This proposed project is estimated to increase recovery to 42 percent recovery of the original oil in place. The value of the additional re-



covery is considerably in excess of the investment required to install the project. In view of this, I think we can definitely say that this project will contribute considerably to the conservation of oil.

Q How about your water source?

A Our water source is located on Navajo "F" lease, and it's completed in the Morrison formation.

Q And do you have permission to use this water?

A Yes, sir. By letter from the Navajo Tribal Council, dated February 23, 1960, the permission was granted to use the water for water flooding on Humble's leases. It is our intention, in order to obtain the most efficient flooding of this area, to offer Mobil and any other offset operators water at Humble's handling cost. Permission has been requested of Navajo Tribal Council to do this, but has not as yet been obtained.

Q That's just a matter of process, it's going toward the same end that they have already approved?

A That's correct.

Q Have you complied with the requirement of furnishing information to the State Engineer in connection with the water and casing program and so forth?

A Yes, in our letter of July 1st, 1960, subsequently acknowledged by their letter of July 8.

Q This area is entirely Navajo and is under the supervision of the U.S.G.S.?



A That is correct.

Q Have you submitted this matter of the U.S.G.S. for their approval?

A Yes, sir, and we received their approval in their letter of July 7.

Q Will you explain very briefly, without going into detail, just exactly what you are requesting in your application in connection with this matter?

A As requested in Humble's application, we are requesting authority to install a pressure maintenance project by conversion of the proposed injection wells shown on Exhibit 4 to water injection. As stated previously, we are very anxious to receive this approval in order that our equipment installation may be completed before cold weather sets in. We are requesting a project allowable for the proposed project area as outlined on Exhibit 4. The requested project allowable is the same as that granted Atlantic, which is equal to the sum of the capabilities of the individual producing wells, not to exceed top allowable, plus top allowable credit for the injection wells. Each producing well will remain subject to limiting GOR with voidage replaced. Monthly pressure maintenance operators' reports will be submitted for the allowable for the several wells in the total project allowable on which the Commission will calculate succeeding month's allowable. We are further requesting that administrative approval to expand this project, the project area to drill or to convert ad-

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ditional wells also be granted.

Q In your opinion, would the granting of the application be in the interest of conservation and protect correlative rights?

A Yes, sir, it would.

Q Do you have anything further to offer in this case, Mr. Dutton?

A No, sir.

Q Did you prepare all of Humble's Exhibits here?

A Prepared or under my supervision, yes, sir.

MR. BRATTON: We would offer Humble's Exhibits 1 through 7, inclusive.

MR. NUTTER: Humble's Exhibits 1 through 7 will be admitted.

(Whereupon, Humble's Exhibits Nos. 1 through 7 were received in evidence.)

MR. BRATTON: That concludes our direct examination.

MR. NUTTER: Does anyone have any questions?

MR. ERREBO: Yes, I have a question.

MR. NUTTER: Mr. Errebo.

CROSS-EXAMINATION

BY MR. ERREBO:

Q With regard to your injection wells 4 and 5, which immediately offset the Mobil lease, the Mobil lease in Section 14, under the rules which you propose, would each of those wells receive 70 barrels a day, which could be transferred?



A The injection wells ultimately would receive 70 barrels a day. Well, initially, under Atlantic's rules, they would receive it immediately. The injection wells would; we could not produce it, but they would receive it.

Q You mean your project would not be able to produce it, is that it?

A Our producing well capability would not allow us to.

MR. ERREBO: That's all I have.

MR. NUTTER: Any further questions?

MR. PAYNE: Yes, sir.

MR. NUTTER: Mr. Payne.

BY MR. PAYNE:

Q Mr. Dutton, I understand that the Horseshoe-Gallup Pool actually has two producing zones; is that right?

A Yes, sir.

Q Do you intend to flood both of them?

A We intend to flood the lower, as we call it, the "B" sand, which is the only one present under Humble's acreage.

Q Are you going to inject the tubing?

A Propose to inject down the casing.

Q How old are these wells?

A Earliest one is not quite two years old, and the latest one about a year old. They're very near.

Q Will Humble be satisfied with an order that limited the allowable to a well which offsets a well outside the project area



to top unit allowable? In other words, not transfer your allowables to wells which offset someone else who is not in the project area; at least until such time as that well has received a response from water injection?

A If I follow you right, well, for example, our No. 1--

Q Yes.

A --and Mobil did not inject their No. 9.

MR. NUTTER: A better example, Mr. Dutton, would be your No. 2 Well over in Section 4 offsetting Baylis?

A We would, under the provisions granted Atlantic, we would ultimately desire to have two times top allowable assigned to that well, assuming that would be after response.

Q After response?

A Yes.

MR. NUTTER: You weren't aware that this provision in Atlantic's hearing is up for hearing de novo?

A Yes. But pending the outcome of that under the present rules, we would desire equal treatment with Atlantic. We would abide by whatever rules come out of the other hearing. As stated previously, our main interest here is to get approval of the project in order that we can get our equipment installation going.

Q (By Mr. Payne) Do you anticipate, Mr. Dutton, that in a relatively short period of time this entire pool will be water flooded?



A I don't know the time involved, but eventually it should all be flooded, yes, sir.

MR. PAYNE: Thank you.

BY MR. NUTTER:

Q Mr. Dutton, you heard counsel for Honolulu request that that case be dismissed, Do you know what the status of Honolulu's plans is for conversion of a well out there on their acreage?

A I don't know exactly what prompted all of that, and I don't feel qualified to make a statement along that line.

Q I see. So, you are not aware whether they plan to go ahead and inject some water out there or not?

A All of our offset operators have been offered and requested to cooperate with us and exactly why they have withdrawn from the hearing, I cannot state.

MR. PAYNE: Do you propose to initiate your entire project all at the same time? In other words, put all your wells on injection at once?

A Yes, sir.

Q (By Mr. Nutter) What is the total cumulative production to date from this area, Mr. Dutton?

A As Exhibit 5 indicates, production through the end of May was 484,076 barrels.

Q What is your estimate of total production by primary means only for this area?

A 1,935,000 barrels.



Q So you might say this is 25 percent depleted, as far as primary is concerned, approximately 25 percent?

A No, it's approximately--of the original in place?

Q No, your expected ultimate?

A Right.

Q You are expecting about two million. You have roughly half a million?

A We have produced right at four point seven percent of our estimated primary.

Q What percentage did you anticipate that you would recover on primary?

A 18 percent.

Q And you expect to raise this to 42--

A 42 percent.

Q --by water injection, and gain an additional two million barrels of oil?

A That is correct.

Q Have you made tests, Mr. Dutton, of the water from your water well in the Morrison formation to test its compatibility--

A Yes, sir.

Q --with formation waters here?

A Yes. The matter of formation water is very difficult. This has produced very little water. You just get a trace of it, but by simulating other Gallup waters and on Gallup sand floods from this field, we have found it to be compatible.

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Q Do you anticipate any serious treating problem for this water?

A No, sir.

Q Will you be using an open system or closed system?

A Closed system.

Q I note, Mr. Dutton, that you have several wells which have high GOR's. You are requesting a net water injection gas credit be allowed for these high GOR wells?

A These wells, yes, specific reference to "F" 9, I would imagine, and "F" 40, these wells, "F" 9 will be converted to injection. And these high GOR's are not a function of completion but strictly of their proximity to the gas cap.

Q I see.

A They will be closed in. I haven't done any figuring on it, but I doubt if the net ratio rule will amount to anything to Humble at all.

Q Of the three high ratio wells, only one will be a producer; that's "F" 41. What is the location of it?

A "F" 41 is again closed to the gas cap, if you will make reference to Figure 3,--

Q Yes.

A --Exhibit 3.

Q Everything to the south of that dotted line would be gas productive within the limits of the pool; is that correct?

A Within the accuracy you can define a gas contact, yes,



sir.

Q The acreage to the northwest of the dotted line in the upper left-hand corner of this Exhibit would be gas productive?

A The area south of the dotted line.

Q The other dotted line up in the upper left-hand corner--

A Yes, sir.

Q --northwest of that line would be gas productive?

A Yes, sir.

Q I see. Now, your estimate of allowable, I think you stated you had approximately 2555 barrels?

A That's correct.

Q What is that assuming, 70 barrels per day for 29 injection wells?

A 29 injection wells, and the present capabilities in the 19 producing wells.

Q I see. Of the two sands that are productive in the Horseshoe-Gallup Pool, the one that you've labeled Gallup "B" sand on your cross-section is the lower sand; is that correct?

A Yes, sir.

Q And you show Gallup "A" sand in the long cross-section in a few wells. Is that interval perforated in those wells?

A I could not testify to that. That is, I believe that is on other operators' leases. Possibly--

Q It is in all cases except one?

A R. C. Mills.

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Q Your No. 4 "G" Navajo shows that sand?

A It is not perforated in that well.

Q So, all of your flooding activities will be in the lower sand; is that correct?

A Yes, sir.

Q Are you perforated in the upper sand in any wells?

A The only place we even catch a very limited amount of the upper sand is right along this area offsetting Mobil. They aren't completed in that sand. You cannot make a commercial completion in it on our acreage.

Q So, you haven't perforated the upper sand in any wells; is that correct?

A No, sir.

BY MR. PAYNE:

Q Mr. Dutton, did you say the Baylis and Honolulu lease in Section 5 was, generally speaking, the gas cap area?

A By our geological information, they should have gas contact on their acreage. If you notice, Baylis No. 5 is a gas well or was at one time.

Q So that when your No. 2 well in Section 4 responds to injection, if you didn't have complete flexibility in transferring your allowable and producing it out of that well, you might have some oil pushed into the dry gas sands outside your project area?

A If we install this total project immediately without offsetting cooperation, we could push some oil that way. That is



correct.

Q So that it would be to everybody's benefit if another project is started offsetting you here?

A Well, that is our ultimate desire, to get everybody's cooperation all the way around us.

BY MR. NUTTER:

Q Has Humble conducted any negotiations with Baylis to discuss the possibility of putting an injection well on their acreage?

A We have contacted all of our offset operators and requested their cooperation with the exception of Mobil. We don't have anything from them at the present time.

Q Is there any possibility that this area may be unitized at some future date?

A Not the northern portion of it, I don't believe so.

MR. NUTTER: Are there any further questions of Mr. Dutton? He may be excused.

MR. BRATTON: I want to ask one or two questions.

MR. NUTTER: Oh.

REDIRECT EXAMINATION

BY MR. BRATTON:

Q On this question of top allowables offsetting, offset operators, do you have any top allowable wells offsetting anybody here?

A We have one. Our "F" 3 offsets Honolulu, but that is one of the top allowables that will be converted to injection.

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Our other top is "F" 6, which does not offset anybody. "F" 8 does not offset anybody, and "F" 39 does not offset anybody.

Q So, actually, it's a question of whether you have a single or double allowable for wells offsetting adjoining properties rather academic under your proposed pattern here?

A That is correct; we couldn't produce it.

Q Now, when you said you would recover 42 percent by pressure maintenance and secondary recovery in this area, that is actually 42 percent of a somewhat smaller area than your primary area you were talking about?

A That is correct. That is 42 percent from the area enclosed by our pattern. The 18 percent recovery as applied to primary applies to the total area as defined by the reservoir configuration, pinchout, and gas contact.

Q So, your percentage of total primary would be a little less than 42 percent, but it would still be in the magnitude of 20 percent or 22 percent of total oil above what you would get by primary method?

A If you are referring to the original in place underlying all of Humble's acreage, yes.

MR. NUTTER: Do I follow you correctly, sir, that the 18 percent represents the entire productive area that Humble owns whereas the 42 percent is restricted to the project area only?

A Which is the restricted area that will be affected by injection.



MR. NUTTER: So those two figures cannot be compared in the strictest sense?

A No, sir.

Q (By Mr. Bratton) If you were to have a figure comparable to your 18 percent, it would probably be in the neighborhood of 40 percent, wouldn't it?

A Yes, sir.

Q A little smaller than the 42 percent?

A Yes, sir. I can probably clarify that a little right here. The total oil productive acreage, Humble's total oil productive acreage is 16,800 acre feet; for the pattern enclosed or the area enclosed by the pattern is 15,200 acre feet. That is the difference that they are based on.

Q Do you have anything else you care to state, Mr. Dutton?

A No, sir.

RECROSS EXAMINATION

BY MR. PAYNE:

Q At such time as one of the wells did receive a response, which was offsetting the well not in the project, would you anticipate that there should be any top limitation on that well? It's received a response, but it offsets a well which is outside the project area?

A I may need to huddle on this. We would have to look at it on the individual basis, depending on what our injection program was, and how migration was going at the time.

Q The reason I brought it up, I'm still somewhat concerned



about this gas cap area. If those wells were restricted to normal unit allowable, and your well which had received a response was restricted to two times top unit allowable, some of the oil might end up in the dry gas sand which neither well got a chance to produce. At least, that's a possibility; isn't it?

A There's some conjecture right here on exactly what our offset operators are going to do, but I feel fairly safe in saying that before too long in the near future our pattern will be set, and injection will be instigated along the gas cap, so you will not have to worry about pushing it into the gas cap.

MR. BRATTON: Would it be a fair statement to say that Humble is going to seek cooperation and, as you say, attempt to complete the pattern?

A Right.

MR. BRATTON: And if a situation arises where it appears that some oil is going to be pushed into a dry gas zone, that Humble will come before the Commission to seek to prevent that situation?

A As stated previously, Humble, pending approval of the Navajos, we are installing plant facilities, our water source is capable, and we will furnish offset operators water at cost to get their cooperation.

MR. BRATTON: Do you have anything further?

A No, sir.

MR. NUTTER: Is there anything further from Mr. Dutton?



He may be excused.

(Witness excused)

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

MR. BRATTON: No, sir.

MR. NUTTER: Mr. Errebo.

MR. ERREBO: If it please the Commission, we would like to call Mr. Mills at this time as a witness.

ROBERT MILLS,

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

DIRECT EXAMINATION

BY MR. ERREBO:

Q State your name, please.

A My name is Robert Mills.

Q Mr. Mills, where are you employed, in what capacity, and by whom?

A Senior production engineer for the Mobil Oil Company in Durango, Colorado.

Q Have you ever appeared before this Commission as an expert witness?

A No, sir, I have not.

Q Would you give the Commission staff a brief resume of your experience and education?

A Yes. I graduated from the University of Southern California with a Bachelor of Engineering degree, major in petroleum



engineering and a minor in geology. I worked for Mobil Oil Company, formerly General Petroleum Corporation, for seven years. Spent two years on an engineering training program in California. I worked one half year in Wyoming, another year back in California as a junior engineer, and I have worked in Durango, working the Four Corners area for the past three and a half years. My work has involved drilling, engineering work, development, and evaluation work.

MR. ERREBO: Are Mr. Mills' qualifications acceptable?

MR. NUTTER: Yes, sir. That time in California, I guess that was with General Petroleum?

A That's right. We just changed our name January 1st this year. Same organization but just a different name.

MR. NUTTER: Same horse but a different color?

A No, it's still red.

MR. NUTTER: Still red.

Q (By Mr. Errebo) Mr. Mills, as a part of your duties in your location in Durango, have you had occasion to become acquainted with the Mobil Oil Company's Navajo "A" lease, which was the subject of the previous Humble hearing?

A Yes, sir.

Q Well, actually, this lease offsets the area involved in the previous hearing, is that not correct?

A Yes, that is correct.

Q Are you familiar with the application of the Mobil Oil



Company today insofar as the injection into the Navajo "A" No. 9 is concerned?

A Yes, I am.

(Whereupon, Applicant's Exhibits Nos. 1, 2, 3 and 4 were marked for identification.)

Q I'll refer you to what has been designated, I believe, Mobil's Exhibit No. 1, and ask you to state just briefly what that shows?

A It's a plat showing Mobil's Navajo "A" lease which is shaded there in red pencil. It encompasses an area of about 1760 acres, has 21 wells on it. You will note that Navajo "A" No. 9 is marked with a blue ring around it that denotes the well that we are requesting permission to inject water into.

Q Now, does the Navajo "A" lease lie between the Humble and Atlantic areas which were depicted on Exhibit No. 1 of Humble Oil & Refining Company?

A Yes, it does.

Q Actually, the Mobil lease abuts each area, does it, on opposite sides?

A Yes, sir, that's correct.

Q So the Mobil lease lies between these two areas, and what are the plans of the Mobil Oil Company insofar as participating in either of these projects?

A For the immediate present, our plans would call for the conversion of Navajo "A" No. 9 to a water injection well to help



provide a buffer zone along the common lease boundary between Humble's "G" lease and Mobil's Navajo "A" lease to prevent migration along that line. We have also been engaged in engineering committee activity with other operators in the field to the south and east, an engineering committee which has been chaired by Atlantic. The ultimate hope there and goal is to form a field-wide unit for water flooding purposes; field-wide to the exclusion of Humble's proposed water flood at the northwest extremity of the field.

Q I take it that you anticipate that ultimately the Mobil Navajo "A" lease will be taken into the Atlantic unit, and the northwest boundary of the Atlantic unit will be moved to what is now the northwest boundary of the Mobil Navajo "A" lease?

A Yes, sir, that is correct.

Q I'll now refer you to Mobil's Exhibit No. 2, and ask you to state what that is and what is shown thereon?

A This is a copy of the induction electric log of this proposed water injection well, Well No. 9, down in the 1,000 foot depth range is shown the production, casing string, cementing information, the perforations and the formation tops.

Q What does the red color on that Exhibit depict?

A It depicts the zone into which we plan to inject water.

Q Now, referring to the cross-section which Humble introduced as their Exhibit No. 2, does any part of the upper stringer appear in the log on this well that you are now--

A Only a vestige of it. It's not deemed productive in



that area of the field.

Q Then, actually, you will be injecting only to the lower zone which is the main producing zone; is that correct?

A Yes, sir.

Q Is the upper zone behind the pipe now, or what is its status?

A Yes, sir, it has never been perforated in this well.

Q When was this Navajo 9 completed?

A It was completed in June of 1959.

Q What was the initial potential on it?

A The initial potential was 114 barrels a day.

Q What was the initial gas-oil ratio?

A 65 cubic feet per barrel.

Q What is the present ability of the well to produce?

A Well, in June of 1960, its average daily production was 19 barrels per day.

Q What is the present gas production?

A It's, on the basis of recent gas-oil ratio tests, it's reported as too small to measure.

Q Now, I'll refer you to your Exhibit No. 3, and ask you to explain just briefly what that shows? That actually depicts, does it not, the information that you have just given?

A That is correct. Exhibit No. 3 is a production curve for both oil and gas production of Navajo "A" No. 9 by months since the time of its completion.

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Q Is there anything in connection with that Exhibit which you would particularly desire to call to the attention of the staff?

A I think it's significant that within the first few months after completion, there was a rather marked decline in oil production. There is still some tendency towards decline, has been for the past seven months, but not nearly as severe as in the first four to five months of continuous production.

Q Refer, now, if you will, to your Exhibit No. 4, and just briefly state what that shows?

A Exhibit No. 4 depicts the cumulative oil and gas production for Navajo "A" No. 9.

Q Have you been in contact with Humble in regard to the buffer system of which this well will be a part?

A Yes, we have. We have corresponded with Humble in an effort to reach some equitable agreement whereby we can provide a water injection buffer zone along the common lease boundary.

Q Have you reached such an agreement?

A A verbal agreement has been reached, yes, sir.

Q In other words, you have no objection to the injection pattern immediately offsetting your lease to the north?

A No, we haven't.

Q What do you anticipate will be the initial injection rate into the well No. 9 if your application is granted?

A Approximately 125 barrels a day.



Q Do you have any idea as to what the ultimate maximum rate might be?

A We anticipate that that initial rate of 125 barrels a day will probably be the maximum injection rate, and that after we have achieved fillup in the area in which we're injecting, and we see some response in offsetting producing wells, that the injection rate of Navajo "A" No. 9 would be roughly comparable to the withdrawals of the surrounding producing wells, and that would be limited by the top unit allowable.

Q Now, have you determined or given any thought as to what the method of completion, downhole speaking, would be of the injection well?

A Yes, we have. As you may note on Exhibit 2 where the perforations are shown and the injection zone depicted with the red pencil, there's a small stringer of sonosity formation which was perforated in this well depth of 1046 to 1051. We plan to squeeze, cement that zone and inject water into the upper stringer there from 1014 to 1032 through tubing which would have a packer isolating the injection zone from the annular space between the tubing and the casing.

Q You figure this would be sufficient to prevent any escape of the water or the pressure?

A Yes.

Q It would be sufficient?

A Yes.



Q Let me ask you this: Have you contacted at this point the office of the State Engineer?

A No, we have not.

Q Do you expect to contact them and satisfy such requirements as they may have?

A Yes, we certainly do.

Q What will be the source of the water which you will inject?

A We have a verbal agreement with Humble whereby they will supply us with the necessary injection water for which we will pay their operating costs.

Q Do you feel that the buffer which has been proposed today, both by Humble and by Mobil, will be effective in preventing communication between your lease and the Humble barrier?

A Yes, sir.

Q Now, as an adjunct to the conversion of this well into an injection well, have you given thought to production of the allowable which will be lost by such conversion from other wells?

A We would like to receive permission to have a top unit allowable assigned to the injection well which could be transferred to other wells on our lease, excluding those wells which are offset by wells of another operator.

Q Actually, this would be giving your injection well the same treatment as the well in the Atlantic area and the wells in the Humble area would receive, is that not correct?

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A Yes, that's the basis for this request.

Q Do you have anything further to offer at this time?

A No, I haven't.

Q Were these Exhibits prepared by you or under your supervision?

A They were prepared by me and under my supervision.

MR. ERREBO: We would like to offer these Exhibits, Mobil's Exhibits 1 through 4 inclusive, in evidence.

MR. NUTTER: Socony Mobil's Exhibits 1 through 4 will be entered in evidence.

(Whereupon, Applicant's Exhibits Nos. 1 through 4 were received in evidence.)

MR. ERREBO: That's all we have.

MR. NUTTER: Does anyone have any questions of Mr. Mills?

MR. IRBY: I would like to ask a question, if I may.

MR. NUTTER: Mr. Irby.

CROSS-EXAMINATION

BY MR. IRBY:

Q Mr. Mills, not having your Exhibit, I'm not sure where your project is going to be. Can you describe that for me, please?

A The map may be more helpful to you.

Q Thank you. Mr. Mills, you propose expansion of this from this one well, I presume?

A What we propose to do would be to join with Atlantic and El Paso and Sohio, and many of the other operators down in the



southeast portion of the field to form a field-wide unit. This is a temporary measure; its aim is to cooperate with Humble, permitting their lease to commence water flood operations, but we would not propose at this time to expand the water flood on our lease except when it's done on a field-wide unit basis.

MR. NUTTER: All you are seeking today is authority for this one well; is that correct?

A That's correct.

Q (By Mr. Irby) And this is a protective agreement between you and Humble--

A Yes, sir.

Q --to keep from affecting each other?

A Yes.

Q Do you have the construction of this well with regard to the casing, cementing program and so forth?

A Yes, sir. Are you interested in just the production casing, or would you also like the information regarding the surface casing? I have both here.

Q Both, if you please.

A Have 8 and 5/8ths inch casing cemented at 119 feet with 80 sacks. The 5 1/2 inch casing cemented at 1101 with 100 sacks.

Q What do you know of the waters encountered in the drilling of this well?

A I have no information on that.

Q Is it available to you?



A It possibly would be by referring to people that were experienced with the drilling of this well. I was not responsible for the northwest New Mexico area at the time this well was drilled, and I have no first-hand knowledge of what occurred. However, I do know that the well spudded in Mancos and it's doubtful that any appreciable amount of water was encountered while drilling.

Q That's what I was waiting for. Thank you. And you said that the water supply for this will come from Humble's well?

A Yes, there'll be a common source of supply from Humble's water source well which they described before.

BY MR. NUTTER:

Q Mr. Mills, you stated that you would be injecting at the rate of 125 barrels a day in your 9-A until fillup?

A Yes, we think that would be approximately the initial rate.

Q And then after fillup, you would adjust the injection rate to coincide with the withdrawals from the adjoining wells?

A Yes.

Q Mr. Dutton's is approximately the same as in your No. 5 injection well?

A 4 and 5. We correspond with the 125 based on an average well. The individual wells will be adjusted, based on the pay thickness involved. But we are basically in accord with the 125.

Q The water injection rates between the two of you will be



adjusted to coincide with each other by a line agreement of some sort?

MR. DUTTON: Yes.

A Yes.

Q Mr. Dutton, will the injection be done in the casing or through tubing?

MR. DUTTON: Down the casing.

Q Did you say you would set a packer, and inject through the tubing?

A That's the way we anticipate doing it.

Q Mr. Mills, you said that this 70 barrels or top unit allowable which would be assigned to the No. 9 "A" after it is converted to water injection would be distributed to other wells on the lease with the exception of wells which offset other operators' properties. It would appear that probably your 16 "A" is going to be a well that will receive a response to water injection. Now, that offsets Humble's acreage. Would you be interested in perhaps transferring some of the allowable to that well?

A I think that would depend on what transfer provisions are made for their well immediately across the line, their No. 4.

Q Would Humble have objection to Socony's No. 16 "A" being eligible for receipt of transferred allowable?

MR. DAVIS: Do you want me to swear myself in? We would expect equitable treatment among the respective injection



projects in this field, and we feel that the Commission will so rule to that end. We have asked for equal treatment with the one existing project that is there now. If you feel like one or two allowables in this instance would probably be equitable, if Humble had it and Mobil also had it, I feel there would be no objection.

BY MR. PAYNE:

Q What's the producing ability of the No. 16 Well at the present time?

A About 16 barrels a day.

Q So that until it did receive a kick, this is academic too?

A Yes, it is.

MR. NUTTER: We have a lot of academic wells here. Are there any further questions of Mr. Mills? He may be excused.

(Witness excused)

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

MR. ERREBO: Nothing further, Mr. Nutter.

MR. NUTTER: Does anyone have anything further to offer in Cases 2024 and 2025? We will take these cases under advisement and call next Case 2026.



