BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico

April 25, 1962

EXAMINER HEARING

IN THE MATTER OF:

Application of William A. & Edward R. Hudson for a secondary recovery project, Maljamar Pool, Eddy County, New Mexico. Applicants, in the above-styled cause, seek permission to institute a secondary recovery project in the Maljamar Pool in an area underlying their Puckett "A" and "B" Leases located in Section 24, Township 17 South, Range 31 East, Eddy County, New Mexico, with the injection of water into the Grayburg-San Andres formation initially to be through six wells, said project to be governed by the provisions of Rule 701.

CASE 2536

BEFORE: Elvis A. Utz, Examiner.

TRANSCRIPT OF HEARING

MR. UTZ: Case 2536.

MR. MORRIS: In the matter of application of William A. and Edward R. Hudson for a secondary recovery project, Maljamar Pool, Eddy County, New Mexico.

MR. KELLAHIN: If the Commission please, Jason Kellahin, Kellahin and Fox, representing the Applicant. We have one witness we would like to have sworn.

(Witness sworn)

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

RALPH L. GRAY,

called as a witness herein, having been first duly sworn on oath,

was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A Ralph L. Gray.

Q By whom are you employed and what position?

A By William A. and Edward R. Hudson as Consultant.

Q Are you an independent consulting petroleum engineer?

A Yes, I am.

Q Have you testified before the Oil Conservation Commission and made your qualifications a matter of record?

A Yes, I have.

MR. KELLAHIN: Are the witness's qualifications acceptable?

MR. UTZ: Yes, sir.

Q (By Mr. Kellahin) Were you employed by William A. and Edward R. Hudson in connection with 2536 before the Commission?

A Yes.

Q Are you familiar with the application that was filed on this case?

A Yes, I am.

Q Would you state, briefly, what is proposed here?

A William A. and Edward R. Hudson propose to inject water into six input wells on their Puckett "A" Lease in the Maljamar field as a pilot stage for a water injection project.

(Whereupon, Applicant's Exhibit No. 1 Marked for Identification.)

Q Referring to what has been marked as Exhibit No. 1 would you identify that exhibit and discuss the information shown there?

A Exhibit No. 1 is a map of the general area. It shows all the wells and leases within a two mile radius of the proposed injection area. The Hudson leases are shown by the yellow border area. The six proposed water input wells are designated by these red dots on the map. Four of these wells have been completed at the present time, that would be the four northernmost wells shown on the map. The Puckett "B" No. 21 Well is now being completed. There's one more well yet to be drilled which will be designated as their Puckett "A" No. 23 Well. The project boundary line as defined by the Commission Rules is shown by this cross-hatched line on the map. Everything within that cross-hatched area will be in the project area.

Q You mean as defined by Rule 701, Mr. Gray?

A Yes. As defined by the Commission waterflood rules.

Q And the application is based upon the provision of Rule 701, is it not?

A Yes, that's right.

(Whereupon, Applicant's Exhibit No. 2 Marked for Identification.)

Q Now, referring to what has been marked as Exhibit No. 2 would you identify that exhibit and discuss the information shown?

A Exhibit No. 2 is a structure map of this area and this map shows contours on top of the San Andres formation. The structural feature of this area is a plunging anticline and formations dip going towards the east and, also, going towards the south.

Q Is the formation contiguous and continuous throughout the area involved in this application?

A Yes, they overlay the entire area.

Q Is the San Andres the principal producing formation in the Maljamar at this point?

A I'd say that the Grayburg and the San Andres are the two producing formations.

(Whereupon, Applicant's Exhibit No. 3 Marked for Identification.)

Q Now, referring to what has been marked as Exhibit No. 3, would you discuss that exhibit?

A Exhibit No. 3 is a North-South cross-section through these Hudson properties, the location of the cross-section is shown on the vicinity map and this section extends from north on the left to south on the right side of the cross-section. This shows the main formation tops, the top of the Grayburg is indicated on the section by a cross-hatched line and the top of the San Andres is also indicated by a cross-hatched line. All of the various zones that produce are designated, the main producing zones in the field are the sixth zone which is the lower part of

the Grayburg and the zone seven which is the first zone in the San Andres, and zone nine, also in the San Andres. The Grayburg formation consists of a series of sands and domomites and most of the oil in this area is found in the sand members of the Grayburg formation. The red areas on the cross-section indicate perforations. Zones seven and nine within the San Andres formation are dolomite zones. Zone eight is what we call the Lovington sand member and doesn't usually produce very much in this area.

Some of the wells that are shown on the cross-section are new wells in which the casing has been cemented near the bottom of the hole and then completion has been made by perforating these various zones. However, the older wells were drilled with open hole through the pays and, as an example, the Puckett "A" No. 8 on the section shows 7-inch casing set at about 3,300 and then everything below the 7-inch is open hole, so there are both types of completions on these properties, both open hole and pipe set through perforated.

Q In the main, what zones would be flooded, Mr. Gray, in your opinion?

A Probably the predominant zone in this area is zone seven which is the top member of the San Andres and then, probably, to a lesser extent in importance are zones six, in the lower Grayburg, and zone nine.

Q You would expect to flood all of those zones, though, would you not?

A Yes.

Q In the application that is what you propose?

A Yes.

Q Do you anticipate selectively flooding any particular zone?

A At this stage we are unable to determine that because I think it will take a little experience to know whether or not we can flood all of those zones simultaneously or whether we'll have to resort to some selective flooding in some cases.

Q Do you plan to make any injectivity survey or anything of the kind?

A Yes. As we progress we anticipate that permeability profile surveys will be made of the input wells at various stages of injection and then we'll determine from that whether or not these can be flooded together or whether some type of control will be necessary.

Q In your opinion, is this formation suitable for water flooding and will it take the water?

A Yes, we think it's suitable for water flooding.

(Whereupon, Applicant's Exhibit No. 4 Marked for Identification.)

Q Referring to what has been marked as Exhibit No. 4, Mr. Gray, would you identify that exhibit and discuss it?

A Exhibit No. 4 is a tabulation showing the annual oil production figures for the Puckett "A" and the Puckett "B" Leases.

This exhibit also shows the cumulative oil recovery for each lease as of January 1st, 1962. In the case of the Puckett "A" Lease the lease has recovered 1,904,160 barrels of oil. The Puckett "B" Lease has recovered 1,050,362 barrels.

(Whereupon, Applicant's Exhibit No. 5 Marked for Identification)

Q Now, referring to what has been marked as Exhibit No. 5 will you discuss that exhibit?

A Exhibit No. 5 is a graph and it shows, graphically, the same information that's shown in the tabular form on Exhibit 4. This curve also shows the number of wells and I might comment by saying that the increase in the recovery rate, as indicated on the last two or three years of this curve, is due principally to the drilling of new wells. Also, some of the increases back a few years is due to some workovers that were performed.

(Whereupon, Applicant's Exhibit No. 6 Marked for Identification.)

Q Referring to what has been marked as Exhibit No. 6, what information is shown on that exhibit?

A Exhibit No. 6 is also a graph of production data, this is for the Puckett "B" Lease, while Exhibit No. 5 was for the Puckett "A" Lease. The same thing applies to the case of Exhibit 6, production shows very pronounced increase from 1959 through 1961 and this is due to the drilling of new wells on the lease.

Q Do you have logs of the proposed injection wells?

A Yes. We have a set of gamma ray neutron logs.

(Whereupon, Applicant's Exhibits No. 7, 8, 9, 10, Marked for Identification)

Q Are they marked as Exhibits 7, 8, 9 and 10?

A Yes. That's right.

Q Will you discuss what is shown on those exhibits?

A These logs show the gamma ray neutron curves, and the zones that are perforated and are presently producing are also indicated on these logs. The logs also show the top of the San Andres formation.

Q What type of casing program do you propose for these injection wells or what casing is in them at the present time?

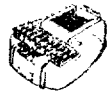
A Our casing program on all of the proposed input wells consists of setting a string of 8-5/8's casing into the anhydrite section just above the salt, and usually they're cemented with 100 sacks which will come up close to the surface.

(Whereupon, Applicant's Exhibits Nos. 11, 12, 13, 14 and 15, Marked for Identification)

Q Is that shown on your Exhibits 11, 12, 13, 14 and 15?

A Yes, that's right. Then, the second string of pipe consists of the production string which is 5-1/2-inch casing and it will be set near bottom and usually they're cemented, the 5-1/2 casing is cemented with 350 sacks which will bring the cement almost back to the bottom of the 8-5/8 casing.

Q Have you made a survey on the cementing on any of the wells involved?



A Only the one well and that was the Puckett "A" 19.

Q Which exhibit is that shown on?

A That's shown as Exhibit No. 11. This isn't the usual case because in the cementing process on this well the cement apparently bridged during the process of cementing and we were unable to get the entire amount of cement back of the pipe. So the top of the cement was determined by temperature survey in order to be sure it was sufficiently high.

Q And, was it?

A Yes, sir.

Q With the casing and cementing program which you have on these wells and propose on the other wells to be completed, in your opinion, will all the formations encountered in the well bore be protected?

A Yes. I might state that there are no domestic water sands present in this area. In some cases no water at all is encountered above the anhydrite section. In other cases, there's a small amount of brackish water that is encountered at a depth of, usually around 500 feet. The 8-5/8 casing in all instances is set into the anhydrite section which is a very dense, hard formation and is a very suitable casing point. The eight and five is cemented almost back to the surface so everything above the anhydrite section is adequately protected.

Q Is there anything below the anhydrite section which would require any protection other than as given by the completions

you have?

A No, sir.

(Whereupon, Applicant's Exhibit No. 16 Marked for Identification)

Q Referring to what has been marked as Exhibit No. 16 will you identify and discuss that exhibit?

A Exhibit No. 16 shows the well data for each of the proposed water input wells. This is statistical data and shows the date the wells were completed, the elevation, the total depth, the casing programs, the perforations, and treatment and initial potential of each of these wells.

(Whereupon, Applicant's Exhibit No. 17, Marked for Identification)

Q Referring to what has been marked as Exhibit No. 17, would you discuss that exhibit?

A Exhibit 17 shows some pertinent data for the Puckett "A" and Puckett "B" Leases. In the case of the Puckett "A" lease the number of producing wells is 20, the February oil production for this lease was 4,832 barrels, the February water production was 1,280 barrels. And the February oil production per well was 8.6 barrels. In the case of the Puckett "B" Lease, this lease has 20 producing wells; February oil production was 6,989 barrels, February water production was 1,745 barrels, and the February oil production per well is 12.5 barrels. So this serves to show that these wells are in what we normally consider as a stripper stage.

Q That would qualify this project as a secondary recovery project under the provisions of Rule 701 in your opinion?

A Yes, sir.

(Whereupon, Applicant's Exhibit No. 18 marked for Identification)

Q Now, referring to what has been marked as Exhibit No. 18 will you discuss that exhibit?

A Exhibit No. 18 shows various data for each of the producing wells on the Puckett "A" and Puckett "B" Leases. This tabulation shows completion dates, the latest test of each well showing oil and water per day, the status of each well as to whether it is pumping or flowing, and the cumulative oil recovery as reflected by the records as of January 1st, 1962.

Q What is the producing mechanism, generally, in this area, Mr. Gray?

A This is a solution gas drive type of reservoir, although some water is produced from wells that are low structurally, the water is not effective in maintaining bottom hole pressures.

Q You have no active encroachment which would aid in that?

A No, sir.

Q Have you made any estimate as to what recoveries might be anticipated under the secondary recovery project?

A Of course, there are two different types of formations involved, the sand zones in the Grayburg, and the dolomite in the San Andres. We think that over an average we can expect at least

to equal the primary recovery and, possibly, to slightly exceed it.

Q The approval of the project, in your opinion, would be in the interest of conservation?

A Yes, sir.

Q What are the general characteristics of the fluids in the pool, Mr. Gray?

A The oil is approximately 36 degree gravity crude, viscosity is one centerpoise , and the solution gas-oil ratio in a nearby part of the field is 460 cubic feet per barrel. The formation volume factor is 1.24 and the reservoir is generally considered to have a saturation pressure of approximately 1,097 pounds per square inch.

Q Do you have any core information on the area?

A One well has been cored which is their Puckett "A" No. 17 Well, the core is not considered representative core information for the area since this well was very definitely an edge well and,therefore,we do not have any representative core data at this time. However, in drilling the six proposed input wells, the Puckett "A" No. 23, our plans call for coring the entire Grayburg and San Andres zones in that well.

Q In general, do you have any information as to what the permeabilities and porosities are in the Grayburg and San Andres?

A Well, we do.

Q Within a range?

A We are aware of some core analyses in the other parts of the field and we find, generally, in both of these formations that permeabilities vary over a very wide range. It doesn't seem to be too much uniformity in regard to permeability.

Q Until you get a core in the area you wouldn't be in a position to say what you might encounter?

A That's right.

Q Do you anticipate that you'll have any trouble with the formation taking water?

A Well, no, we think, of course, there will be some of the usual problems connected with injecting water.

Q Do you anticipate that it will have to take it under pressure?

A We think that pressure will be fairly high, comparatively speaking, and we look for the pressure of these input wells to be in the neighborhood of 1,500 to 2,000 pounds per square inch during the initial fill-up stage. We propose to inject from 400 to 600 barrels of water per day into each input well.

Q What is your source of water, Mr. Gray?

A The operator has water appropriations and water leases on the Caprock, approximately 18 miles northeast of this area and we propose to use the shallow fresh water from the Ogalala formation for the project.

Q Does the operator have a sufficient appropriation of water to carry on this project?

A Yes, they do.

Q Were Exhibits 1 through 18 inclusive prepared by you or under your supervision?

A Yes, sir.

MR. KELLAHIN: At this time I would like to offer in evidence Exhibits 1 through 18.

MR. UTZ: Without objection the Exhibits 1 through 18 will be entered into the record of this case.

(Whereupon, Applicant's Exhibits Nos. 1 through 18 Received in Evidence.)

Q (By Mr. Kellahin) Do you have anything further, Mr. Gray?

A I don't believe so.

MR. KELLAHIN: That's all the questions I have of the witness.

CROSS EXAMINATION

BY MR. UTZ:

Q Mr. Gray, I notice that you have a few wells on your Exhibit 18 that still produce quite a little bit of oil. The No. 5 Well on your Puckett "A" Lease, for example, which happens to be surrounded by four injection wells. Do you consider that to be a stripper well?

A The information shown on Exhibit 18 shows that Puckett "A" No. 5 Well produces 39 barrels of oil and 2 barrels of water per day. This is the latest test available on this well, however,

I might add that it isn't a representative test. Approximately one month ago the production from this well had stopped entirely and the tubing was pulled and it was found to be corrosive and several holes were found in the tubing, so when this condition was corrected, apparently they conducted this production test shortly after the well was put back on production, and it, of course, the fluid had been building up there for some time, so actually the figures shown on this exhibit really aren't a representative figure for this well. Normally it doesn't produce that much oil.

Q Do you have,somewhere in this eighteen exhibits, you must have a monthly production figure for that particular well. Do you?

A Well, the production for each lease goes into one common tank battery.

Q I see.

A It's not possible to determine the production figures for each well individually.

Q Do you propose to make any more tests on that particular well?

A Yes, normally we make production tests about twice a year. One test is required by the Commission and, of course, under the rules, the waterflooding rules, we will be required to conduct monthly tests on these wells.

Q Is it your opinion that if you ran another test on that well it wouldn't produce 39 barrels per day?

A Yes, sir. I anticipate that within a short time that the production will be back to considerably lower figure than the one indicated on the table.

Q In reference to your Puckett "B" there are four wells on that lease that produce considerably high amount of oil. The No. 12, with 36; 13 at 44 and 16 at 24 and 19 at 40 barrels. Do you consider these wells to be stripper wells?

A Not at the present time. These are all new wells that have just been drilled within recent times and that's the reason the production is high on those particular wells.

Q Those wells are not in the project area as would be defined by Rule 701?

A No. They are outside of the project area. I will refer you to this Exhibit No. 1 again. Approximately, here two and a half years ago, the operator started a development program and extended the known producing area on the Puckett "B" Lease. Now the wells which you referred to are in the southern portion of the Puckett "B" Lease and these are all new wells which have been drilled within the last two years, whereas wells north are in the old part of the field which was drilled anywhere from ten to twenty-five years ago.

Q Mr. Gray, your No. 21 injection well, do you know the foot location of that, as to how far it is from the 40-acre line?

A These wells are all at least twenty-five feet from the unit corner, but are less than one hundred feet, and usually the wells are staked twenty-five feet out of the 40-acre unit corner. We do have one or two cases where the locations had to be moved further than twenty-five feet from the corner due to some power lines that were close and I don't have in my records the available, the exact footage on that particular well, but I can obtain that information for the Commission. I'm sure you have it in your records, but I will state that it is less than one hundred feet, but more than twenty-five feet from the 40-acre unit boundary.

Q That well is definitely in the Southwest of the Southeast quarter of Section 24?

A You are referring to which well, now?

Q The No. 21, one of your injection wells.

A 21 is in the Southwest corner of that 40-acre tract. In other words, it's in the same unit as the Well No. 2.

Q Well, we're looking at two different 21's, I believe.

A I was looking at "A" 21.

Q I'm looking at "B" 21.

A All right. "B" 21 is in the Northwest corner of the 40-acre tract and it is on the same 40-acres as the Puckett "B" No. 3 Well.

Q Which would be the Southwest of the Southeast?

A Yes, sir.

Q By virtue of the fact that is twenty-five feet south of your 40-acre tract enables you, under 701, to use 40-acre tracts on which 6, 7 and 8 are in the project area?

A Yes, that's right. Because they're offsetting the 40-acre tract on which the injection well is located.

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

MR. MORRIS: Yes, sir.

MR. UTZ: Mr. Morris.

BY MR. MORRIS:

Q Mr. Gray, still talking about that well, Puckett "B" 21, a directional survey was run when that well was drilled, was it not?

A No, sir, it was not.

Q It was not? Now, Mr. Gray, let's take the well, Puckett "A" 19. Do you consider that a fairly average log on that well, a fairly average log for the wells in this particular area?

A Yes. I think it would be an average log.

Q I note on that log that there are some perforations below 3,800 feet which do not appear to exist in the other injection wells, 20, 21 and 22.

A Yes. I think the perforations that you referred to are within what we designate as zone 9. We did not, or we have not as yet opened up zone 9 in all of these input wells. We anticipate that ultimately they will be opened, but we have some additional

work to do on the input wells before they will be entirely acceptable as input wells.

Q So, the perforations then that are shown on, say, wells, 20, 21 and 22 are not necessarily the only intervals into which you plan to inject water?

A That is right. They are the zones that have been opened up as of the present time, but ultimately there will be additional zones opened in those wells.

Q It will be necessary to open up those other zones in your injection wells as well as your producing wells if you are going to get an adequate or efficient sweep of the oil in that zone, would it not?

A Yes. In fact, we have a program in process now in which we're going to go into these proposed input wells and open up some of these zones and, alos, go into the producing wells and clean them out and get them in satisfactory condition for waterflooding.

Q Perforations are also shown on the log, I believe all four of these injection wells above the San Andres in the Grayburg formation. Are you planning to inject water into that section?

A Yes. We plan to inject water into the sixth zone which is the lower member of the Grayburg.

Q Within a given well, let's take No. 19 as an example, do you find great substantial range of porosity and permeability

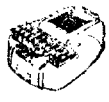
between the various intervals that are perforated and into which you expect to inject water?

A Unfortunately, we don't know what the permeabilities are in there because, with the exception of one well, none of these wells were cored. So about all that we know about the many porosity determinations which can be made by interpretation of these neutron logs and the general primary permeability characteristics, of course, are known because most of these were drilled with cable tools and the amount of fluid that comes into the hole, naturally, from each zone is some indication of the degree of permeability that exists, so we know in a general way what the permeability characteristics are, but not quantitatively.

Q Assuming a diverse range of porosity and permeability within the areas opened to the well bore, and at the pressure at which you expect to inject your water into these wells, do you believe that you will get water into all of these zones that are open to the well bore and have an effective flood in each of the zones?

A We hope so. We do propose to start the pilot stage by injecting into all zones simultaneously and as the flood progresses, we will run permeability profile surveys which will indicate the comparative amounts of fluid which are going into each zone.

Q Is that the same thing as I believe they referred to as the iso-flow?



A Yes, that's one type. There are several types. That will show what each zone is taking. Now, it's entirely possible that we will have to exercise some type of control if we find that some zones aren't taking water.

Q You mean by that selective injection?

A Well, selective injection, but --

Q It would be possible, would it not, if you needed to, to set a packer between these zones?

A Yes, a packer could be set, but it's the operator's opinion, based on experience in their waterflood projects, that it's better practice to have tubing in there without a packer and inject down the tubing, and then, from time to time, accumulation of foreign material on the face of the formation or in the perforations can be removed by back-flowing these wells and in those cases they reverse the flow of fluids and pump water down a casing and out the tubing and they have found that that's a very effective means of removing the foreign material that collects from time to time down in the well bore. We would prefer, if possible, to be able to inject into all of these simultaneously but in case we find it can't be done, well, then later it may be necessary to set packers.

Q In any event, Mr. Gray, you believe that you can satisfactorily control the injection pressures and injection rates in this project and stay within the allowable provisions of Rule 701?

A Yes, sir, we think so at this time.

MR. MORRIS: That's all I have.

BY MR. UTZ:

Q Mr. Gray, in reference to your Puckett "A" No. 5 Well, do you believe that another test would indicate more accurately the producing ability of that well?

A Yes. It's rather unfortunate that this schedule of well testing came right at the moment it did because the test on this particular well was made at a time when I'm sure that the production hadn't had a chance to stabilize after the remedial work, I'm sure that in a matter of a short time that we'll find that the production in this well will be back to its normal figure.

Q But you'd be willing to run another potential test on that well and submit it to the Commission?

A Yes, we would.

Q Is that a flowing or pumping well?

A No, it's pumping.

Q I wonder if you would do that, and how long do you think it would take you to accomplish that?

A Pardon?

Q How long would it take you to accomplish another test?

A I'd suggest that maybe we take two or three tests over a period of, say, two or three weeks and see just what the trend is. I think that will maybe be more beneficial than just one test.

Q That would be satisfactory and I would like to request that you do so and submit those tests to the Commission.

A All right.

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

(Witness excused.)

MR. UTZ: Any other statements in this case?

MR. KELLAHIN: No, sir.

MR. UTZ: The case will be taken under advisement. The Hearing is recessed until 1:30.

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STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Notary Public and and for the County of Bernalillo, 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.

NOTARY PUBLIC

My Commission Expires:

June 19th, 1963.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 2536, heard by me on Dec. 5, 1962.

, Examiner
New Mexico Oil Conservation Commission