BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
July 24, 1963

EXAMINER HEARING

IN THE MATTER OF:

Application of George L. Buckles Company for a waterflood project, Lea County, New Mexico. Applicant, in the above-styled cause, seeks authority to institute a waterflood project in the Langlie-Mattix Pool by the injection of water into the Queen formation through nine wells on its Knight lease comprising the E/2 SE/4 of Section 21, W/2 SW/4 of Section 22, Township 24 South, Range 37 East, Lea County, New Mexico.

Case No. 2867

BEFORE: Daniel S. Nutter, Examiner

TRANSCRIPT OF HEARING

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BEFORE: Daniel S. Nutter, Examiner

TRANSCRIPT OF HEARING

MR. NUTTER: We will call Case 2867.

MR. DURRETT: Application of George L. Buckles for a waterflood project, Lea County, New Mexico.

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

(Witness sworn.)

(Whereupon, Applicant's Exhibits Nos. 1 through 5 marked for identification.)

GEORGE L. BUCKLE

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

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q Would you state your name, please?

A George L. Buckles.

Q What connection do you have with the George L. Buckles Company, applicant in this case?

A I own the George L. Buckles Company. It's just an operating company for my production.

Q Are you familiar with the application in Case 2867?

A Yes, I am.

Q Would you state briefly what's proposed by George L. Buckles Company in this application?

A This lease we propose to flood is known as the Knight lease in the Langlie-Mattix Field. It's composed of the West Half of the Southwest Quarter of Section 22, and the East Half of the Southeast Quarter of Section 21, Township 24 South, Range 37 East. The lease has four producing wells at the present time operated by pumping units and electric motors.

Q Referring to what has been marked as Exhibit No. 1, would you identify that exhibit and state what's shown on there?

A This is the exhibit that we sent with the application. It was our understanding that the Commission wanted a plat drawn approximately two miles each direction from the proposed area. This plat reflects the status of the area as reflected by our maps. The lease is shown in yellow on the plat. It shows all offset

operators: Shell to the west, Texaco to the northwest, Sinclair to the north, Pan American to the east, and the Amerada Woolworth Unit being four sections to the south, Sections 27, 28, 33, 34.

Q The Amerada Woolworth Unit is under waterflood at the present time, is it not?

A Yes. You will note on the plat that there are six wells circled to designate injection wells, and water is being injected into these six wells at the present time.

Q In your opinion, will injection of water, as you are going to propose in this case, have any adverse effect on the Amerada flood?

A No, sir.

Q Referring to what has been marked as Exhibit No. 2, would you identify that exhibit and discuss the information shown on it, please?

A This is merely a smaller scale plat showing the area enlarged, that is, the lease area enlarged. It's also colored in yellow. The circled locations are our proposed water injection wells to be drilled, one well in the center of the lease, one well, in each corner of the lease, and one well on each side of the lease centrally located, all wells being as close to the lease line as possible with the exception of the center well, but on the Knight lease. This will result in four 40-acre five-spot patterns.

Q Have you contacted the offset operators in connection with this?

A Yes, verbally and by letter. Shell and Texaco, Sinclair and Pan American.

Q And you have no arrangement with Amerada, is that correct?

A No, sir.

Q Referring to what has been marked as Exhibit No. 3, would you identify that exhibit, please?

A This exhibit merely states the facts and the proposals. I have already given the description of the lease which is shown at the top of Exhibit 3. It is shown as being in the Langlie-Mattix Field. The reservoir is the Queen sand. I've already stated the lease has four producing wells. The current production is 39 barrels of oil per day and no water. The average total depth of the wells is 3500 feet. The casing setting on the present wells averages 3,260 feet. The accumulated oil production, according to our records, from the entire lease as of July 1st, 1963, was 752,894 barrels. The gravity of the oil is 36 degrees API.

We have no well logs on the wells other than the old cable tool well logs, and our plan is to drill the nine water injection wells, as I have already mentioned. The first well is to be drilled with cable tools in the center of the lease. This is for the purpose of gaining information on the reservoir characteristics and try to determine the best way to flood the Queen sand in the Langlie-Mattix Field. It is our intention to drill through all fresh water sands, which would include the Santa Rosa

formation, to set casing and cement to the surface through all of these fresh water sands; then to test the casing for possibly -- going on down and encountering the Rustler formation at approximately 1100 feet, which is known to be a brine water, saturated salt water, and test that water zone for possible flooding purposes.

We drilled a well two and a half miles south of this lease and encountered the Rustler at about that same depth and tested it at about 2500 barrels per day with a drawdown to 700 feet from the surface, which left us another 400 feet to go without drawing clear down to the top of the Rustler formation; and if we encounter the Rustler formation here with the same quality of water that we found down there, we feel that we will have sufficient water to flood all of these nine wells with one water well.

Q What volume of water do you anticipate you'll use, Mr. Buckles?

A Our anticipated injection rate at the present time is 300 barrels per well per day, which may be changed. We felt that it would be a simple matter to construct a water plant capable of putting out about 2700 barrels of water a day with one pump and one water well. If indications are that that is entirely too slow a rate, we may -- and we encounter a large quantity of water, we may put in two pumps and go as high as five barrels a day injection rate, but we do intend to go to 300 barrels per day per well. The later injection rate will be dictated by performance

and, of course, proration problems.

Q In connection with the drilling of this initial well, you will test all zones, will you not?

A That is really the purpose for drilling this well with cable tools. Since we do not have definite information in the area as to the condition of the formation from the top of the Queen zone to the bottom, we will test these zones as we go through them. We intend to go through what is known as the Jalmat Gas Zone and test it for gas and go on down and test all oil zones as we go through them, test shale breaks for possible bentonite and things like that that might enter a waterflood. In this manner, we will be able to plan our casing program.

Q Before we get to that, Mr. Buckles, is there any fresh water zones in this area?

A Yes, the Santa Rosa is a fresh water zone, which is above the Rustler.

Q Will that be fully protected?

A Yes, sir. We plan to set casing through all encountered water sands and from the drilling of this first well, we can then log the well with some type of log and then drill the other eight wells with rotary and log them and correlate with the log from the No. 1 well or the first well drilled; and then we will know where to set the casing and for the fresh water sands, and also the injection wells in the Queen sand itself.

Q Now turning to what has been marked as Exhibits No. 4

and 5, would you identify those exhibits and discuss the information on them?

A This is just a schematic drawing, both are, with two possible injection well completions. The yellow casing shown at the top is the surface casing, which will protect all fresh water sands. It is estimated to be set at approximately 750 feet. However, if we encounter water below that fresh water, we will set it through any possible fresh water sands.

The Jalmat gas or the Yates gas, which is shown on both of these at 2590, which we took from our cable tool logs, we will definitely set a casing string through that so that it cannot possibly take any water. If we encounter nothing below the top of the Queen pay sand to indicate any possible hindrance in the waterflood, we would prefer to set casing on top of the Queen and injection in open hole, merely because in our experience the more area exposed to take water, the better performance we have with the flood.

If we encounter any possible thief zones in drilling our No. 1 Well, which might be a dry sand or gas sands that might be thief zones, or if we encounter shales that may swell the contact with water, then we will complete according to Exhibit No. 5, which is identical to No. 4 with the exception that the casing is run to the bottom of the hole and the casing is selectively perforated in the oil sands we will find.

You will note that we, in both cases, we have a string

of tubing. In Exhibit No. 4 the tubing is set at the bottom, open ended, and the tubing is packed off at the top of the well. The injection will be through the tubing, which will be protected for corrosion either by cement lining or some baked plastic. We have found through experience that by injecting water through the tubing, that the water in the annulus between the tubing and the casing rapidly becomes inert and dissipates whatever corrosion qualities it may have and thoroughly protects the casing and the tubing.

We have found that out by pulling the tubing out of the hole after several years of injectivity, and found that the outside of the tubing would be corroded up to the top of where the water was going in the formation and that the tubing from there to the top of the hole was in excellent condition with no corrosion whatsoever. In this manner we do not have to set a packer.

There's another advantage in this type of completion. If we have an open hole completion, the tendency is for the well to sometimes cave; also, the best water you can use would have some suspended solids that might tend to plug the formation, and let's assume we are injecting water at 1,000 pounds surface pressure and the tendency-- the records show that we may do some plugging by releasing the pressure in the tubing, the well tends to back flow and bring these particles that are plugging the pay into the well bore. Then we tie the injection line into this

valve shown at the upper left at the top of the well, inject water down through the annulus and reverse the flow through the tubing. In this manner we can clean the well out to bottom, cave-in's or any other matter that's in there, without having to move in a drilling rig to clean it out. That is done just when we feel it's necessary, and not very often. In the early stages of the well it's done more often than later.

No. 5 is the same identical situation except we see no reason to run the tubing above the top of the upper perforation. The tubing is merely to keep it from coming in contact with raw metals.

Q Have you used this type of completion in other waterflood projects?

A Yes, and very successfully.

Q Where was that?

A Winkler County, Texas, and Ward County, Texas, Pecos County, Texas.

Q Did you use salt water for injection purposes?

A Yes.

Q Do you have any analysis of the Rustler water you propose to use?

A I am not sure -- I didn't bring it, anyway, but I can testify it's a brine. It's thoroughly saturated with salt.

Q Does it have any hydrogen sulfide content?

A No, it does not. It's just a brine. It has sulfates

and some carbonates, but no sulfides.

Q Will this be a closed system?

A Yes, sir.

Q In your opinion, is there danger of corrosion that would cause contamination to other producing zones or fresh water zones in this type of completion?

A No. In the first place, we will use brand new casing, heavy pipe, and cement it with the quantity of cement designated by the Commission. In other words, we'll bring the cement up as high as the Commission wants it to prevent corrosion. We feel that since the corrosive water cannot come in contact with the casing itself, that the danger of causing a casing leak is very remote. We keep curves on each well showing the performance, injectivity against time and pressure, and if a leak ever develops, it will show up on this curve and we immediately then investigate to protect any zones that we don't want water to enter, and it would be a great mistake on our part to inject water in any zone that would not help us produce oil.

Q Mr. Buckles, have you ever testified before the Oil Conservation Commission and made your qualifications a matter of record?

A Yes.

MR. KELLAHIN: I overlooked qualifying the witness.

MR. NUTTER: Mr. Buckles is qualified.

Q (By Mr. Kellahin) Will the approval of this application

in your opinion result in the recovery of oil that would not otherwise be recovered?

A Yes, sir. You will note that in Exhibit 1, the Amerada Unit, or the Woolworth Unit operated by Amerada are on an 80-acre five-spot pattern. They have two 80-acre five-spots already in operation. Five of these wells were all producing wells, and the Well No. 3-8 shown in Section 28 was drilled. Their spacing is twice the size of our proposed spacing, and we feel that we'll be doing the State of New Mexico and the oil operator in general a great service by putting in this small flood which, incidentally, will be the same size as the two 80-acre five-spot pilot flood of Amerada's.

By having a good comparison of the flood performance under both conditions, we will also have the advantage of being able to complete our injection wells to direct the water only into the oil-bearing formation. That may not be the case by using an old producing well. We've noticed that in the Langlie-Mattix Field in general, there were some rather high gas-oil ratios shown even in the original completions. It's possible that some upper gas sands that were not productive of oil contribute some of this gas that was called high gas-oil ratio oil wells.

We've also witnessed some floods that had thief zones by utilizing the old producing wells, and these wells were drilled back in the 30's and heavily shot with nitroglycerin. Caliper surveys have shown rather enormous bore size holes and it's almost

impossible to find out whether or not you have thief zones until maybe two or three years after water injection has started. But at any rate, by having the two systems very close together in the same area, we will have something to compare with, one form against another, or one flood pattern against another.

Q Were Exhibits 1 through 5 prepared by you or under your supervision?

A Under my supervision, yes, sir.

MR. KELLAHIN: At this time I would like to offer in evidence Exhibits 1 through 5.

MR. NUTTER: Applicant's Exhibits 1 through 5 will be admitted in evidence.

(Whereupon, Applicant's Exhibits Nos. 1 through 5 admitted in evidence.)

MR. KELLAHIN: That's all I have on direct examination.

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

CROSS EXAMINATION

BY MR. IRBY:

Q Mr. Buckles, with regard to the volume of water, can you tell me the total volume for the entire flood?

A No, sir. I can tell you better after we drill our well and find out. The only thing we have to go by now is the primary production which gives us some indication of the reservoir but we haven't any definite proof as to thickness of pay, the

permeability or porosity, and until I had that determination, it would be impossible to do other than just make a conjecture as to the total volume of water in this 160 acres.

Q Without this information you speak of, you wouldn't be able to determine the formation volume factor?

A No, sir.

Q With regard to your schematic drawings, Exhibits 4 and 5, the estimated depth of the surface casing setting is 750?

A Yes, sir.

Q I know this isn't exact for each of the wells. Can you tell me the name of the formation and the nature of the formation in which this casing will be set below the Santa Rosa?

A It will be set in Triassic red beds below the Santa Rosa, above the Rustler.

Q And the character of this formation?

A It's an impervious red shale. The reason we said 750 feet, because when we reached that depth in this well we drilled two and a half miles south of here, we encountered no fresh water below 750 feet, and this is an estimated depth. However, in drilling the well, we will go to better than 1,000 feet to determine that we're through all fresh water zones before we set casing; and assuming that we do not have any water bearing zones below 750 feet, then we will swing the casing up 750 feet and cement it to the surface. That's our plan, and we will absolutely protect all fresh water sands that we encounter in the drilling of the No.

1 Well, and do the same in all the other eight wells.

Q Before you make your final plans, you are going to have an analysis of the water in the water well you propose to drill --

A Yes, sir.

Q -- is this correct?

A Yes, sir.

Q Could you furnish my office a copy of that analysis, please?

A Yes, sir. We will have the Santa Rosa water analyzed and also the Rustler and furnish your office with a copy of the analysis.

Q Thank you, Mr. Buckles. Can any general statement be made as to the cost of this water at this time?

A Normally we can produce water in this volume at about a cent and a half a barrel and inject it into the formation. We see no reason why this would be any different. That's 42-gallon barrel.

MR. NUTTER: Mr. Reynolds.

MR. REYNOLDS: Mr. Buckles, I am Steve Reynolds, State Engineer.

BY MR. REYNOLDS:

Q I wonder if you are able to tell me approximately the concentration of the total dissolved solids in this water?

A 60,000 per minute.

Q What treatment, if any, is required before you inject

the water?

A We don't plan any treatment at the present time. We will have a closed system. All of our injection wells have a small filter at the well, which is a fiber filter with a permeability of 25 microns. The filter is for the purpose of protecting the meter and also to tell us the condition of the water. If we get a pressure drop across this filter, we will know that something is plugging it. Then we will immediately try to find out what the plugging agent is. It could be bacteria, slime forming bacteria or some other suspended solids that tend to plug. If it is bacteria, we have in our plant arrangements made to put in a bactericide, but at any rate, that's the way we keep track of our water and it determines what treatment is necessary.

Our entire system from the bottom of the source water well through our plant and to the bottom of the injection well is all protected from corrosion. All the pipe, the tanks, and every piece of equipment will be protected as well as it can be.

Q Using lined pipe, that sort of thing?

A Yes, baked-on plastic and things like that, and the tanks will be plastic coated inside.

Q Will you recycle the produced water?

A Yes.

Q All the produced water will be recycled?

A Yes, sir.

Q Are you able to tell us what the recovery rate is, that

is, how many barrels would be recovered per barrel of water injected?

A From experience in, say, Ward County, Texas, and Winkler County, Texas, on floods that we operate, by the time that we have injected ten barrels of water per barrel of oil produced, we have approached ecomonic limit.

Q Does that count your recycled water--

A All water.

Q -- or is that additional water? All water, about ten barrels per barrel of oil?

A Some floods we know of have already injected 20 times the produced oil and are still being operated. However, our floods are approaching economic limit, from experience, when we have injected about ten barrels of water to one barrel of oil produced? The floodable characteristics of this Langlie-Mattix Queen pay are not known. The things that cause high water ratio or thief zones are highly permeable streaks that you flood out first, and then have to carry water through that zone continuously while you're producing from the tighter zone. If this sand is as uniform as we think it is, we feel that ten times the water will be about all we will use.

Q Yes. Why did you elect to use brine here instead of fresh water? Usually in these floods, as I understand the matter, the fresh water is used. Now why did you elect to use brine here?

A We would prefer to use brine because, talking to the

operators in the Langlie-Mattix Field, they refer to bentonitic shale formations in the formation. They complain of trouble cleaning, which may tend to swell what shales are exposed in this well, and fresh water will swell bentonitic shales or any shales much more than any brine will. I might make a flat statement that almost any oil sand is more permeable to fresh water than it is to salt water. Another thing, we want to protect the fresh water, if possible.

Q Do you anticipate any troubles due to incompatibility of this injected water?

A No, sir.

Q Is the Rustler water in Southeastern New Mexico generally compatible with the formation?

A Yes, sir. The only water we have found anywhere in West Texas that was not compatible was produced water in the Sprayberry with Santa Rosa water. All the Rustler water is compatible with all the waters in Ward and Winkler County, Texas. I assume it's the same condition in Lea County, New Mexico.

Q Do I understand that you might run into compatibility problems if you use the fresh, your Santa Rosa water?

A I don't think so, because the incompatibility in the Sprayberry is due to barium sulfate saline deposits, and I don't believe there are any barium deposits in the Queen sand any place.

MR. REYNOLDS: That's all.I have. Thank you. Thank you very much, Mr. Buckles.

BY MR. NUTTER:

Q I might explain we are not trying to put you on the hot seat. It's just not often that we have an expert of your stature in this field for answering some of the questions, and there are some questions that we have been wondering about. I might ask one here. Do you have any general rule of thumb which you could go by as to the total amount of original water? I'm not talking about the recycled water,being the ten to one to the economic limit, but is there any general rule of thumb in these Permian Queen formations that you could go by as to the amount of original water that's necessary to resaturate your sand, take the place of the oil that's withdrawn on secondary,plus any gas withdrawals?

A We think the maximum original water that you would ever use would be 100 percent of pore space.

Q 100 percent of the pore space?

A Yes.

Q How would you relate that to the oil recovered? Is there any rule of thumb on that?

A You couldn't, and that statement that I made sounds unreasonable because we possibly have 30 percent of connate water in the formation, we also have oil, and possibly as high as 60 percent of the pore space is presently occupied with fluid; but you are going to lose some water. You can't retain all of your water. You are going to lose some of it some way, and I was using

that figure as a maximum. If you want to calculate the amount of water you take from a source well and then recycle, I say the maximum would be 100 percent of pore space, which is not a great deal of water in barrels. We could calculate it, but I don't know the thickness of the pay.

Q Well, there are quite a number of unknowns here as far as this reservoir is concerned that you are going to try to determine when you drill that first well?

A Yes, and we would be glad to furnish the Commission a complete report of our findings from the first well we drill.

Q We'd appreciate that.

A If we can take chip cores through the cable tool, we can come up with the present oil saturation, which we could not do for sure with a rotary core.

Q At the present time, are you able to make any estimate of the secondary recovery you'll obtain from this project?

A Mr. Nutter, we wouldn't be surprised if we produced a million and a half barrels on this 160-acre lease.

Q Which would be about twice the primary?

A Yes. Yes, that's right.

Q That would be on secondary, a million and a half on secondary?

A Yes. Unless we find some conditions there that are not indicated from present observation in the operation of the Field, we would not be surprised if we produced a million and a

half barrels or even two million barrels from this 160 acres.

Q You don't know what percent of the original oil in place has been produced on primary?

A No, but I would state that the maximum that has been produced is about one percent of pore space.

Q I see. Has the Amerada flood to the south had any responses yet?

A No.

Q When did they commence injection, do you know?

A No, sir. We have an Amerada man here that can answer that for you.

MR. THOMAS: May 1st.

MR. NUTTER: Of this year?

MR. THOMAS: Yes.

MR. NUTTER: Are there any other questions of Mr. Buckles?

MR. DURRETT: Yes, I have a question.

MR. NUTTER: Mr. Durrett.

BY MR. DURRETT:

Q Could you give me the footage locations of the present injection wells that you are going to drill?

A That is a question that I was planning to ask the Commission. Of course, the first well will be in the center of the lease, which would be 1320 feet from each line.

Q Yes.

A We want to drill these wells as close to the property line as possible, and I had planned to ask the Commission how close we can get. We definitely want the wells on our lease, and I thought the Commission may have already set up a precedent as to how close you can get to a lease line to drill a well.

MR. NUTTER: We frequently designate the location of corner injection wells like this as five feet out of the corner.

A We'll put it five feet.

Q (By Mr. Durrett) You would propose to put it five feet?

A If permissible, or as close as we can because the further away we get, we are losing acreage on our lease.

MR. DURRETT: I think that's all I have.

BY MR. NUTTER:

Q You stated that all of the offset operators had been advised of your intentions here. Have these offset operators concurred with your proposal, to your knowledge?

A They have not objected to it. Now all of the offset operators have been contacted, with the possible exception of the Amerada Unit to the south. We offered to drill these wells and asked the offset operators, which included Shell, Texaco, Sinclair, and Pan American, to share in the cost. We offered to drill the wells and asked them the share in the cost of drilling only, and that we would build a water plant, drill at the source of the water well and inject all the water into the wells at our sole cost. If they did not want to do that, we offered to farm

their property out and extend the floor across their acreage at any kind of a reasonable farmout arrangement. To date we don't know for sure what the offset operators intend to do.

Q You have no agreements with any of them as yet?

A No, sir.

MR. NUTTER: Any further questions? The witness may be excused.

(Witness excused.)

MR. NUTTER: Did you have anything further in this case, Mr. Kellahin?

MR. KELLAHIN: That's all, Mr. Nutter.

MR. NUTTER: Does anyone have anything they wish to offer in Case 2867? We will take the case under advisement.

* * * *

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 before the New Mexico Oil Conservation Commission was reported by me, and that the same is a true and correct record of the said proceedings, to the best of my knowledge, skill and ability.

WITNESS my Hand and Seal this 19th day of August, 1963.

Ada Dearnley
NOTARY PUBLIC

My Commission Expires:

June 19, 1967.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 2867, heard by me on 7/24, 1963.

Examiner
New Mexico Oil Conservation Commission