BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
December 14, 1965

EXAMINER HEARING

IN THE MATTER OF:

Application of Shell OilCompany for a unit agreement, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks approval of the North Square Lake Premier Unit Area comprising 1,080 acres, more or less, of Federal, State and Fee lands in Township 16 South, Range 31 East, Eddy County, New Mexico, and Application of Shell Oil Company for a waterflood project, Eddy County, New Mexico. Applicant, in the above-styled cause, seeks authority to institute a waterflood project in its North Square Lake Premier Unit Area by the injection of water into the Premier Sand of the Grayburg formation through thirteen wells located in Sections 5, 6, and 8, Township 16 South, Range 31 East, Eddy County, New Mexico.

Case No. 3355 and 3356.

BEFORE: Elvis A. Utz, Examiner.

TRANSCRIPT OF HEARING

MR. UTZ: Case 3355 and Case 3356 pertaining to application of Shell Oil Company for a unit agreement in the North Square Lake Premier Unit Area; waterflood for the same unit.

MR. MORRIS: Richard Morris of Seth, Montgomery, Federici and Andrews, Santa Fe, New Mexico, apprearing for Shell Oil Company in these cases and I request that the cases be combined for the purpose of testimony.

MR. UTZ: The cases will be consolidated for the purpose of testimony and separate orders will be written on each case.

MR. MORRIS: We will have one witness, Mr. R. E. Johnson.

(Witness sworn.)

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

R O B E R T E. J O H N S O N, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. MORRIS:

Q Mr. Johnson, please state your name, where you reside, by whom you are employed and in what capacity?

A My name is Robert E. Johnson. I'm employed by Shell Oil Company as a Senior Reservoir Engineer in Shell's Western Production Division in Midland, Texas.

Q Mr. Johnson, have you previously testified before the Commission or one of its Examiners and had your qualifications made a matter of record?

A I have.

Q What is it that Shell Oil Company seeks in these two applications?

A Shell Oil seeks approval of a unit agreement and a designation of the unit area in the first case and seeks approval to inject water into the unit area in the second case for the purposes of recovering oil through secondary recovery techniques.

Q Referring to what has been marked Exhibit Number 1 in Case 3355, would you state what that is and what it shows?

A Exhibit Number 1 shows an index map, a general map, of the area in southeastern New Mexico showing the location of the North Square Lake field which is marked with respect to the other fields in the area and it shows the proximity of the North Square Lake field to the West Henshaw field to the west, the Northeast Square Lake to the east, and the Square Lake field to the south.

Q Refer next to what has been marked Exhibit Number 2 in this case and state what it is?

A Exhibit Number 2 is the unit agreement for the development and the operation of the North Square Lake Premier

Unit.

Q Refer to Exhibit A to that unit agreement which is the ownership plat. Referring to that plat would you state what acreage is included within that proposed unit, what type of acreage we are dealing with here?

A Within the proposed unit there 1,080 acres of Federal, State and fee lands. The unit area is shown by the small dotted area and the different classifications of lands, location of these tracts, is shown by the hashered area as indicated on the legend.

Q Predominately these lands then are Federal lands with one 40-acre State tract and one 40-acre fee tract, is this correct?

A Yes.

Q The different tracts are designated by a number which in turn the ownership of which are shown on Exhibit B to the unit agreement?

A That is correct.

Q Who are the working interest owners in the unit?

A There are four working interest owners in the unit: Mobil Oil Company, Shell Oil Company, Tennaco Oil Company and Bogle Forms, Incorporated.

Q What is the status of the commitment of the working interests to the unit agreement?

A We have been advised that Mobil is signing up and their interests together with Shell's would amount to approximately 97 per cent of the unit being signed up and we've also received indications from Tennaco and Bogle Forms that they will join.

Q Which will make 100 per cent joinder indicated of the working interest owners?

A That's correct.

Q What is the status of your negotations with the Federal government?

A The Federal government has given preliminary approval of the unit agreement if certain changes would be made which have been incorporated in this unit agreement which is entered in evidence.

Q Has a copy of this agreement been furnished to the State of New Mexico?

A A copy of this agreement has been furnished to the State of New Mexico and I assume that it's being considered by them.

Q What is the status of your negotiations with any fee royalty owners?

A Well, outside of the Federal government and the State of New Mexico there are three royalty owners, one of which - Bogle Forms - is also a working interest owner and have advised

us that they will sign up. The other two: Midwest Investment and Darmouth College have been furnished copies of the unit agreement.

Q And their joinder is being sought?

A Right, there joinder is being sought.

Q Are there any overriding royalty interests in the unit agreement?

A Yes. There are several overriding royalty interest owners indicated in the agreement and these also have been furnished copies of the unit agreement and their joinder is being sought.

Q Referring to the unit agreement itself, basically what is the form of the agreement?

A The unit agreement is basically the standard form used wherever Federal acreage is involved.

Q For secondary recovery?

A For secondary recovery, yes.

Q In the unit agreement what formation is unitized?

A The unitized formation is defined on page 3 of the unit agreement, Section 2-H, as the Premier zone which is the base of the Grayburg formation being the interval penetrated between 3159 feet and 3314 feet in Shell's Trigg Federal Number 3.

Q And this unit is being formed for the purpose of

conducting waterflood in that unitized interval?

A Yes, that is correct.

Q Just briefly, would you describe the nature of the participation factors that are involved in this unit?

A The participation factors which are involved in the unit is a six participating type unit. It does have a two-phase formula with phase one being in effect until the agreed upon primary recovery of slightly in excess of 89,000 barrels has been recovered. The formula for phase one is based 50 per cent on current production; 50 per cent on remaining primary reserves. Thereafter phase two will take effect and this is based 90 per cent on ultimate primary recovery and 10 per cent on original oil and gas.

Q Is this more fully set forth in the unit agreement at page 10, Section 12?

A Right. This is set forth in the unit agreement.

Q Does the unit agreement contain the standard provision for subsequent joinder with respect to non-joinder?

A Section 30 of the unit agreement on page 24 has the standard provisions.

Q Referring next to Exhibit 3 in this case, it is an exhibit, I believe, decribing the unit acreage and the classification of that acreage for the convenience of the Commission?

A That is correct.

MR. MORRIS: At this time, Mr. Examiner, we would offer into evidence Exhibits 1, 2 and 3 in Case 3355.

MR. UTZ: Without objection, Exhibits 1, 2 and 33 will be entered into the record of this case.

(Whereupon, Applicant's Exhibits 1, 2 and 3 in Case 3355 were offered and admitted into evidence.)

MR. UTZ: Are there questions of the witness?

MR. MORRIS: I was going to go on with the rest of the case.

(Whereupon, Applicant's Exhibits 1 through 9 in Case 3356 were marked for identification.)

Q (By Mr. Morris) Turning next to the waterflood apsect and your application in Case 3356, would you refer first to what has been marked Exhibit Number 1 in Case 3356 and state what it is and what it shows?

A Exhibit Number 1 is a lease and completion map showing the unit boundaries indicated by the green outline showing the proposed Premier sand injection wells within the unit boundary and showing the other producing wells within a two-mile area of the unit.

Q The legend on this exhibit shows the character of each particular shown on the plat?

A That's correct.

Q Referring next to what has been marked Exhibit Number 2 in this case, state what that is and what it shows?

A Exhibit Number 2 is a structure map contoured on top of the Premier Sand which is our unitized formation and it shows the unit outlined again has the hashered area. It is contoured on top of the Premier Sand which is the basal member of the Grayburg formation.

Q I see.

A The formation is the monocline dipping approximately 130 feet per mile toward the east and is found at an average depth of about 3300 feet. The gross thickness of the sand is between 20 and 65 feet with an average of 40 feet within the unit area. I would also like to point out the lines marked A - A prime and B - B prime which a line of cross section which we will get into later.

Q Referring next to what has been marked Exhibit Number 3 in this case, would you state what that is and what it shows?

A Exhibit Number 3 is a type log of the Premier Sand in the injection interval which we are requesting and it shows that the sand is lithologically composed of red shale, dense dolomite, a fine grain sand and some anhydrite.

Q I note on here that there are three intervals which are called: "the top zone," "the main zone," and the "bottom

zone." Our discussion is going to be mainly with the main zone which is the principal producing interval in North Square Lake.

Now in this connection, Mr. Examiner, we have furnished with our application in this case, copies of all of the logs that were available for the injection wells that are proposed. Of course, there is one injection well that we propose to drill and no log was shown on that of course. We ask that those logs be made a part of the record on this case although I see no need to actually have them marked as an exhibit.

Q So what you've done here, Mr. Johnson, on your Exhibit Number 3 is to show just a typical section of the Premier Sand?

A That is correct. That is a type log giving the log core description that were available on this one log.

Q Referring next to what has been marked as Exhibit Number 4 in this case, your cross section along --

A A - A prime axis as that axis was depicted on Exhibit Number 2.

Q Would you point out the features of that cross section?

A This cross section shows the three sand zones which I previously discussed and also shows the main sand zone is continuous throughout the unitized interval or area and the

top and the bottom zones are erratic and noncontinuous in there which are not considered really as part of the principal reservoir which we are going to try to flood.

Q On this cross section your sands are shown by the stippled area and dolomite is shown by your crosshatch?

A That is correct.

Q Referring next to Exhibit Number 5 which is the cross section along B - B prime axis as that axis was depicted in Exhibit Number 2, would you point out the features of this cross section?

A The features of this cross section are essentially the same as on the previous exhibit as showing the continuous nature of the main sand zone and the erratic nature of the top and bottom sand zones. Then again dolomite stringers are shown as the hashered area and the sand zones are shown as the stippled area.

Q Referring next to what has been marked Exhibit Number 6 in this case, will you state what that is and what it shows?

A Exhibit Number 6 is an isopach of the net pay of the main sand zone in North Square Lake. This shows the sand to be continuous throughout, have a thickness from 0 to 14 feet of net pay and in the thickest portion this indicates you see it here three distinct highs within the sand. This indicates a shoreline deposition. Probably the sand was deposited in

channels in the area.

Q Does this also show that your main sand body is continuous throughout the project and unit area?

A Yes. It shows the continuity of the main sand belt.

Q Referring to the next exhibit, number 7, what is this exhibit and what does it show?

A Exhibit 7 shows the proposed injection pattern which we are planning to develop at North Square Lake within that area and also it shows the current producing rate and the cumulative production of the various wells within the area. You will see down in the southwest portion of the unit we are proposing to drill an injection well at this point and this pattern is essentially a peripheral pattern in each one of the three distinct channels which were shown on the previous exhibit.

Q How many injection wells total including the one to be drilled are you proposing?

A We are proposing 13 injection wells and 8 producing wells.

Q Your production figures are shown in barrels per month with the total cumulative shown underneath?

A That is correct as indicated in the legend.

Q The total cumulative is to what date?

A It's to March 5, 1965. Excuse me, that is January 1,

1965. I would also like to point out the circled wells here are the wells which contain pay in the bottom sand zone and we are going to attempt to put water into this zone and see what we can get out of this zone.

Q Your main flood is what you have called your middle or main sand?

A That is correct. This pattern that we are putting in does attempt to produce a better producing well producers and use the poorer wells which have the thinner pay as the injectors.

Q Now, Mr. Johnson, we have submitted with our application and we refer now to the diagrammatic sketches of each of these proposed injection wells. Would you comment generally upon their design?

A We are planning to inject water through tubing and beneath a packer into perforations in the Premier Sand zone.

Q Those perforations are as shown on each of those --

A That is correct.

Q -- diagrams. I would like to discuss with you one moment the water requirements for this project. At what rate do you anticipate your injection into to each of these injection wells?

A We anticipate putting in between 100 and 180 or 200 barrels per day into each of the injection wells which will make a maximum of 2600 barrels per day.

Q For the project?

A For the project.

Q How long do you anticipate having to inject in order to reach fillup?

A We anticipate that fillup will occur if these rates are maintained approximately one year from the date injection starts.

Q And what pressures will you have inject this water?

A Well, there have been no injectivity tests run in the Square Lake Premier Sand area to date to my knowledge. We are designing the system so that we can put in excess of 1 psi per foot from the sand face. We hope we won't have to go to this pressure but we are designing the system so we can if necessary.

MR. UTZ: One psi per foot of depth?

THE WITNESS: Per foot of depth.

Q (By Mr. Morris) What will be your total water requirement for the project?

A We are estimating a requirement of six and a half million barrels of water of which 40 per cent or 2.6 million barrels will be make-up water which will be required to be purchased.

Q And what will be the source of that water?

A We are currently in negotiations considering purchasing

water from one of the salt water supply companies: Yucca or Double Eagle, at the present time.

Q Do you have an analysis of water from each of these possible sources?

A Right. We have an analysis of the water which I believe was submitted with our application. This will be fresh water from the Ogallala formation as we understand it.

Q If I understand you correctly now, your source of water is not definite except that it will be from one of the two companies that are selling water in the area and you have given or furnished an analysis of the water from each of these two prospective sources?

A That is correct.

Q All right. Referring, Mr. Johnson, to Exhibit 8 in this case, will you state what that is and what it shows?

A Exhibit 8 is a performance curve with our predicted performance under primary depletion and under waterflood for the North Square Lake Premier unit. You will see on this that we have estimated the primary ultimate which was estimated on Malees decline curves as some 450,000 barrels. This is approximately 14.1 per cent of the original oil in place. Waterflooding should add an additional 650,000 barrels as indicated in the curve.

Q The curve itself does not show what your current

rate of production is in this area, Mr. Johnson. Do you know what that is?

A Currently the wells are producing between 1 and 23 barrels a day with the average of production in barrels per day per well being 6.

Q In your opinion would the production in this area probably be considered and classified as stripper production?

A It would, yes. Approximately 85 per cent of the estimated primary reserves has been recovered to date.

Q Now, on your Exhibit Number 8, you show what your predicted waterflood performance will be and at the maximum rate of production which you show occur during the year 1967, will the project be operated within the allowable provisions of Rule 701?

A Yes, sir. Well, our maximum rate of production is less than we would be permitted under Rule 701.

Q Turning next to your Exhibit Number 9 in this case, entitled "Waterflood Calculations", would you state what that exhibit shows?

A This shows a summary of our waterflood calculations for which we base our 650,000 barrels of secondary oil to be recovered. This assumes that 80 per cent sweeping say within the flooded area, complete resaturation of the unsweeped area, and indicates that we will recover 650,000 barrels or

approximately 1.45 times the primary ultimate recovery.

Q Mr. Johnson, is there any sense of urgency for the approval of your applications in Cases 3355 and 3356?

A There is a sense of urgency. We would prefer to have these acted on as quickly as possible before budget matters so we can get the project committed probably by the first of the year.

Q Were exhibits 1 through 9 in Case 3356 prepared by you or under your direction and supervision?

A They were.

MR. MORRIS: We offer Exhibits 1 through 9 in Case 3356 into evidence.

MR. UTZ: Without objection, Exhibits 1 through 9 will be entered into the record in this case.

(Whereupon, Applicant's Exhibits 1 through 9 were offered and admitted into evidence.)

MR. MORRIS: I have nothing further of Mr. Johnson at this time.

CROSS EXAMINATION

BY MR. UTZ:

Q Mr. Johnson, what type of plat pattern would you call this?

A I guess you would call it a peripheral flood but a few of the wells would be in there but it's sort of a ragged

flood is the way I would describe it. It employs the existing wells. You might look at the isopach and you will see that our flood is essentially a peripheral flood on each one of the periphery channel areas with our infilling injection wells being on the inner channel or center area.

Q And you will have eventually 13 injection wells, is that correct?

A That is correct.

Q Now, are these injection wells described anywhere in the exhibits or the application?

MR. MORRIS: Mr. Examiner, we will be glad to furnish to you a description of the location of each of these injection wells by footage if that would be of assistance to you.

MR. UTZ: It certainly will. It will save us lots of file work and I would like to have them by Unit letters rather than footage which is close enough for a 40-acre tract than letters.

MR. MORRIS: I think we could probably do that right now if that would be satisfactory. Would you prefer a tabulation of it?

MR. UTZ: I would suggest that if Mr. Irby has them tabulated here that you just take Mr. Irby's letter and put the description opposite and just give it to me a little later

after the Hearing without cluttering up the record.

MR. MORRIS: Fine.

Q (By Mr. Utz) Now in regards to your completion methods here, these will all be completed with 2" tubing, injection under a packer?

A No. Some of them are completed with 2" tubing -- are you talking about the injection string?

Q Yes.

A Yes, it would be 2" tubing.

Q And the tubing is not coated?

A The tubing will be coated.

Q Internally coated?

A Internally coated.

Q Would it be with the gauge at the top of the annulus?

A Right.

Q Will all these injection wells be through perforations or are there any open hole injections?

A They will all be through perforations.

Q And the perforations will be only in the main zone?

A At certain wells the perforations, the ones where the bottom zone exists, we will perforate there also. The top zone we don't anticipate being of any significance for this unit.

Q Is this tubing to be all new tubing?

A I can't say right now. I don't believe some of it will be.

Q Your secondhand tubing will also be coated however?

A That's right.

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

(Witness excused.)

Any other statements in this case?

MR. MORRIS: I have nothing further to offer.

MR. UTZ: The case will be taken under advisement and the hearing is adjourned.

(Whereupon, Case Number 3355 and 3356 were concluded.)

I N D E X

E X H I B I T S

Exhibit	Marked for Identification	Offered	Admitted
Case 3355			
App's. 1	2	9	9
App's. 2	2	9	9
App's. 3	2	9	9
Case 3356			
App's. 1	9	18	18
App's. 2	9	18	18
App's. 3	9	18	18
App's. 4	9	18	18
App's. 5	9	18	18
App's. 6	9	18	18
App's. 7	9	18	18
App's. 8	9	18	18
App's. 9	9	18	18

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, DEAN A. ROBINSON, 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 3rd day of January, 1966.

Dean A. Robinson
NOTARY PUBLIC

My Commission Expires:

October 16, 1969.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 3355 & 3356 heard by me on 12-14, 1965.

Examiner
New Mexico Oil Conservation Commission