BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico

IN THE MATTER OF:

Application of Texaco, Inc. for approval of a unit agrement and for a waterflood project, Lea County, New Mexico.

CASE NO. 2421

EXAMINER HEARING

November 8, 1961

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico

November 8, 1961

EXAMINER HEARING

IN THE MATTER OF:

Application of Texaco Inc. for approval of a unit agreement and for a waterflood project, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval of the Northeast Caprock (Queen) Unit Agreement, covering 1360 acres, more or less, in Township 12 South, Range 32 East, Caprock Queen Pool, Lea County, New Mexico. Applicant further seeks authority to institute a unit-wide waterflood by the injection of water into the Queen formation through 19 wells located within said unit.

CASE NO. 2421

BEFORE: ELVIS A. UTZ, EXAMINER

TRANSCRIPT OF HEARING

EXAMINER UTZ: The hearing will please come to order, please.

We will first take up Case No. 2421.

MR. MORRIS: Application of Texaco Inc. for approval of a unit agreement and for a waterflood project, Lea County, New Mexico.

The applicant in this case has requested that it be

continued to the November 29 Examiner Hearing.

EXAMINER UTZ: Is there objection to the applicant's request for continuance?

If not, the case will be extended to November 29.

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STATE OF NEW MEXICO)
) ss.
COUNTY OF SAN JUAN)

I, THOMAS F. HORNE, NOTARY PUBLIC in and for the County of San Juan, State of New Mexico, do hereby certify that the foregoing and attached transcript of hearing was reported by me in stenotype and that the same was reduced to typewritten transcript under my personal supervision and contains a true and correct record of said proceedings, to the best of my knowledge, skill and ability.

DATED this 20 day of November, 1961, in the City of Farmington, County of San Juan, State of New Mexico.

T. F. Horne
Notary Public

My Commission Expires:

10-5-63

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 2421 heard by me on Nov. 29, 1961.

New Mexico Oil Conservation Commission, Examiner

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico

November 29, 1961

EXAMINER HEARING

IN THE MATTER OF:
Application of Texaco Inc. for approval of a unit agreement and for a waterflood project, Lea County, New Mexico. Applicant, in the above-styled cause, seeks approval of the Northeast Caprock (Queen Unit Agreement, covering 1360 acres, more or less, in Township 12 South, Range 32 East, Caprock Queen Pool, Lea County, New Mexico. Applicant further seeks authority to institute a unit-wide waterflood by the injection of water into the Queen formation through 19 wells located within said unit.

CASE NO. 2421

BEFORE: Daniel S. Nutter, Examiner

TRANSCRIPT OF HEARING

EXAMINER NUTTER: The Hearing will come to order, please. We will call Case No. 2421.

MR. WHITFIELD: Application of Texaco Inc. for approval of a unit agreement and for a waterflood project, Lea County, New Mexico.

MR. WHITE: May the record show the same appearances and the same witness and also that he's been sworn.

EXAMINER NUTTER: Yes, sir, it will.

J. E. ROBINSON, JR.,

called as a witness, having been previously duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. WHITE:

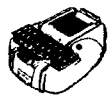
Q Will you state what Texaco is seeking by the subject application?

A Texaco is requesting approval of the unitization agreement for the Northeast Caprock unit and to initiate waterflooding activities in the unitized area on a unit-wide or field-wide basis and to convert nineteen wells to injection purposes.

Q What efforts, if any, have been made on the part of the working interest in forming the unit agreement?

A On October 14, 1957, the first meeting of the operators in the Caprock Queen field was held in Midland, Texas, and at that meeting it was generally agreed upon that the field was in an advanced stage of depletion and to recover the most oil from the field, it would be necessary to conduct secondary operations. An engineering committee was formed. However, it was agreed upon that the size of the field would make it almost impossible to unitize the field on a field-wide basis. The field is about seventeen miles long and four miles wide and contains 725 wells.

Since it was apparent that it would be almost impossible to unitize on a field-wide basis, then several smaller units were formed in the Caprock Queen field and today there are a number of



unitized areas in the field that are undergoing secondary operations. In this portion of the Caprock Queen field, the first meeting was held in Midland in April, '59 and it was agreed upon then that to more successfully deplete this portion of the field it would be necessary to unitize for unitized operations. An engineering committee was formed and they did the preliminary work and the study, and the work that the engineering committee did was unanimously accepted by the operators in this portion of the field to unitize.

(Applicant's Exhibit No. 1 marked.)

Q (by Mr. White) Will you refer to Exhibit 1 and explain that, please?

A Exhibit No. 1 is a plat showing the proposed necessary Caprock unit area. The unit area is outlined in the yellow border. It contains 1360 acres, more or less, and it contains 33 producing wells, including one undeveloped tract which is located in the Southeast of the Southeast of Section 17, and it is on this tract that one additional well will be drilled for injection purposes.

Q It also shows the lease ownerships?

A Yes, sir. It shows the lease ownership and it lists the present operators and the locations of all wells.

Q Does it show the producing wells as well as the dry well?

A The producing wells are shown in black, the dry holes are shown circled with a cross through the well.

(Applicant's Exhibit No. 2 marked.)

Q (by Mr. White) Will you refer to Exhibit 2. That merely defines the proposed unit area and is self-explanatory.

A That is correct. It lists the unit area as to quarter quarter sections and individual sections.

(Applicant's Exhibit No. 3 marked.)

Q (by Mr. White) Will you refer to Exhibit 3 and explain it, please?

A The unit agreement is limited to the Queen formation, which is defined as that underground reservoir where the top is found at 2986 and the base is found at 3323 on the gamma ray log of Texaco's State BA, NCT 8 Well 91, which is in the Caprock Queen field. I would like to introduce this log as Texaco's Exhibit No. 3. The formation shown on the log is that interval which the unitization is limited to.

(Applicant's Exhibit No. 4 marked.)

Q (by Mr. White) Mr. Robinson, will you refer to Exhibit No. 4 and explain what is stated thereon?

A Exhibit No. 4 is the proposed Northeast Caprock Queen unit parameters. We are proposing that the unitization contain

two phases of operation. Phase No. 1 will be limited to the participation that the individual tracts will receive until such time as all of the primary reserves have been produced.

As of January 1, 1961, this portion of the field had produced 1,005,219 barrels. It is calculated that the ultimate primary recovery from the field will be 1,107,219 barrels. The remaining reserves as of January 1st was 102,000 barrels. This remaining reserve is that amount that can be recovered by primary means until such time as the wells reach an economic limit. After the field has produced the primary oil, it then will go under operation, under what we call Phase 2. Phase 2 is the percentage that the ultimate or cumulative primary oil from an individual tract bears to the summation of all primary oil. We felt that this was the most equitable way to determine our parameters since a well should respond to secondary operation in about the same method that it recovered primary oil.

(Applicant's Exhibit No. 5 marked.)

Q (by Mr. White) Will you refer to Exhibit No. 5, the unitization agreement.

A Exhibit No. 5 is a copy of the unit agreement for the development and operation of the Northeast Caprock Queen unit.

Q Is the information patterned after any other agreement?

A Yes, sir. It is patterned after the West Lovington agreement which the Commission is familiar with. The West

Lovington was approved by Order R-2071 dated October 9, 1961.

Q The State Land Commissioner approved this agreement?

A Tentative approval has been granted by the New Mexico State Land Commission.

Q How about the USGS?

A We have obtained local approval from the USGS and a copy of the unit agreement has been sent to Washington, D. C. for the approval of the Director.

Q Has the unit agreement been approved or ratified by the operators in the pool?

A No, sir. It has not been ratified by any of the operators in the field. However, all of the operators have given tentative approval and it is anticipated that no difficulty will exist in having all operators to ratify the agreement. There is a possibility that there could be a few minor word changes in the unit agreement and we could save considerable time by just getting tentative approval and waiting until the final agreement is issued, and then we'll have all working interests and parties to ratify the agreement.

Q Will a copy of the ratified agreement be submitted to the Commission at a later date?

A It will as soon as it is ratified. We will submit a final copy of the unit agreement to the Commission.

(Applicant's Exhibit No. 6 marked.)

Q (by Mr. White) Will you refer to your structural map, Exhibit 6, and explain that, please?

A The proposed Northeast Caprock Queen unit is located in the northeastern extremity of the Caprock Queen pool, produces from the Queen sand at a depth of approximately 3,050 feet. Production in this portion of the pool was begun in 1954 and the field, or this portion, had been essentially developed by the latter part of 1955. There are 12 dry holes which offset production in the area and the engineer committee had complete records available on nine of these twelve dry holes. In each case, on the twelve dry holes, the operator set casing and attempted to fracture and stimulate the formation to obtain production. However, they were unable to recover any new oil and the wells were plugged. This is a stratographic trap-type reservoir with the productive limits being determined by the increase in shale content and there is a soft deposit in the formation. It was the opinion of the engineer committee that the present development exactly defined the production limits in this portion of the field and that no additional development will be required.

Q What is the porosity, permeability, and the inter-stitchural water content?

A The average porosity of the sand is 15.3 percent. The permeability ranges from 108 to 113 and the inter-stitchural water is estimated at 40 percent. At the present time, the reservoir is approximately 95 percent depleted as to primary

production. Excess is contoured on top of the Queen pay. All of the control was picked from 34 radioactivity logs that were available from wells both producing and dry holes in the area. From the configuration of the structure map and with the dry holes which border the unit on all sides, it is apparent that the structural position that a well occupies actually has no bearing on its productive capacity, this being a stratographic trap with no known oil-water contact.

Q What type of dry mechanism does it have?

A It's a gas drive reservoir.

Q What is the approximate percent of primary depletion would you say at the present time?

A It is approximately 95 percent depleted.

(Applicant's Exhibit No. 7 marked.)

Q (by Mr. White) Will you refer to what has been marked Exhibit No. 7 and explain the performance curve.

A Exhibit 7 is a performance curve of this portion of the Caprock Queen pool. Initial development was started in 1954 and the pool had been essentially developed by the latter part of 1955. There were a maximum of 33 producing wells in this portion of the field. One of these wells has been shut in and there are presently 32 wells producing now. The peak production from this area was 26,000 barrels per month, which was reached in January of 1956 and since that time, production has declined

until in the month of August of this year, this area produced 3,950 barrels for the month of August.

The cumulative production as of September 1, 1961, was 1,049,853 barrels.

EXAMINER NUTTER: What date was that?

THE WITNESS: September 1.

EXAMINER NUTTER: Thank you.

A (continuing) The monthly water production has fluctuated from approximately 600 barrels to 2500 barrels per month with the present water production being approximately 14 percent of the produced fluid. This fluctuation in water production is due primarily to wells stimulated through remedial operations. All of the wells in the field have been fractured at one time or another since their completion.

Q Mr. Robinson, what calculations, if any, have you made to predict the performance of this waterflood project?

A There is a lack of basic reservoir data in this area of the field where we could actually calculate and predict reservoir performance of the waterflooding activities and no attempt has been made to do -- or no attempt has been made to calculate the performance. However, based on performance of the Graridge power project in the Northeast Caprock Queen unit, it is estimated that recovery of the secondary operation should be at least 100 percent of the primary production, and we feel that this 100 percent is probably a little bit underestimated. It's a conservative

figure.

(Applicant's Exhibit No. 8 marked.)

Q (by Mr. White) Will you refer to Exhibit 8, please, and describe that?

A Exhibit No. 8 is a plat showing the proposed unit area. It is proposed to initiate waterflooding activities on a field-wide basis by converting 18 preliminary producing wells to water injection and to drill one additional well in the Southeast quarter of the Southeast quarter of Section 17 as an injection well. This will be a normal five-spot pattern on a field-wide basis.

(Applicant's Exhibit No. 9 marked.)

Q (by Mr. White) Will you refer to Exhibit No. 9 and also explain what is stated thereon?

A Exhibit No. 9 is a tabulation of the wells that will be converted to injection in the proposed unit area. It lists the operator, the lease, and the well number that will be converted to injection purposes and I believe it is self-explanatory. I won't read the list of wells into the record.

Q When do you anticipate fill-up?

A It is estimated that during fill-up, we will take approximately 7400 barrels of water per day through 19 injection wells, and we will obtain fill-up in nine months.

Q After fill-up, how much do you anticipate to inject per

day?

A After fill-up, we will inject a sufficient quantity to replace withdrawal losses that we might have through the reservoir. It is calculated that we will inject approximately 1800 to 2000 barrels per day after fill-up.

(Applicant's Exhibit No. 10 marked.)

Q (by Mr. White) Will you please explain Exhibit No. 10?

A Exhibit 10 is a well completion data sheet of the wells that will be converted to injection as required by the Commission. It lists the operator, and the lease, the well number, the total depth of each individual well, the completion interval, the surface casing, the size of the surface casing, where it was set, and the number of sacks of cement. It lists the intermediate casing, if any is in the well, its size, depth, and number of sacks used in cementing; and then the long string, or the productive string, its size, depth, and number of sacks of cement used in cementing.

I might point out that these wells to be converted to injection, the completion interval is both through perforation and open-hole. I will read the wells that will be completed in open-hole: Amerada State NCDW No. 1 is completed in open-hole; Great Western Speed No. 3, an open-hole; Great Western's Magnolia Speed No. 1 is open-hole; all of Sunray's state leases are completed in open-hole intervals; Texaco's State BANCT 6 is open-

hole completion; Texaco's State BANCT 7 No. 1 is open-hole; State BANCT 8 No. 2 is both open-hole and perforation; and Triggs Federal S Well No. 1 is an open-hole completion. There are a total of eleven wells that are completed through open-hole sections.

(Applicant's Exhibits 11 through 20 marked.)

Q (by Mr. White) Mr. Robinson, will you refer to Exhibits 11 through 20 and explain what they are?

A Exhibits 11 through 20 are 10 logs of wells that are going to be converted to injection. These are all of the logs that are available of the wells. There are eight wells that will be converted to injection for which logs are not available, but these are the only available logs, for ten of the wells.

Q Why do you wish to propose a unit-wide waterflooding program?

A As previously stated, it is estimated that the reservoir is approximately 95 percent depleted as to primary production and is in the advanced stage of production. At the present time, the average production per well is 3.9 barrels per day and it is the desire of all of the operators in the proposed unit to initiate a waterflooding project on a field-wide basis since it is believed that the Queen formation is susceptible to waterflooding operation in that a pilot project would serve of no useful purpose since there are a number of waterflood projects currently being conducted in other portions of the Caprock Queen

field and they are being very successfully waterflooded.

Q Are you familiar with any of these waterflood projects?

A Yes, sir, I am. I am familiar with the performance of the Graridge pilot project in the North Caprock Queen unit.

(Applicant's Exhibit No. 21 marked.)

Q (by Mr. White) Will you refer to Exhibit No. 21 and explain that, please?

A Exhibit No. 21 is a map where the proposed unit is colored in yellow. Down to the southwest are a number of other unitized operations that are in effect in the Caprock Queen field. The unit outlined in red is Graridge's north Caprock unit and the area that is shaded in purple on this unit is the pilot project for the Caprock Queen field. It consists of six injection wells, a five-spot pattern, and there are 18 wells included in the project area, six injection wells and twelve producers. The other units that bound this are also unitized operations operated by Ambassador, Great Western, Graridge and those three other operators also have unitized operations there.

(Applicant's Exhibit No. 22 marked.)

Q (by Mr. White) Now, will you refer to Exhibit No. 22 and explain the performance curve of the Graridge waterflood project?

A Exhibit 22 is a waterflood pilot performance curve of the Graridge pilot program which is shown on Exhibit 21 and that area being shaded in purple. Water injection in the pilot area began in April, 1957. The area consists of 18 wells, of which six are injection and twelve are producers. At the time water injection began in this pilot area, the wells were producing an average 1.2 barrels of oil per day. The cumulative production from the 18 wells was 699,389 barrels at the time injection was begun. Since that time, 3,134,520 barrels of water has been injected into the six injection wells and 1,177,446 barrels secondary oil has been produced.

As of September 1, 1961, a total of 1,876,000 barrels of oil have been produced from the 18 wells included in the pilot area. After Graridge obtained fill-up, they got an immediate response and production went from approximately 600 barrels per month to about 48,000 barrels per month in 1959, during September 1959. Production started to decline from the project area and presently the project area is producing 11,000 barrels per month. The water cut percent is about 87 percent and they are presently injecting about 2550 barrels of water per month. From the results of this pilot project, it appears that Graridge will recover about 200 percent secondary oil versus primary oil. Actually, they will recover almost twice the amount in secondary oil that they recovered under primary operations. It's through the very successful waterflooding activity that is being carried

on in this portion of the field that we think that we can at least recover secondary oil to be equal to primary oil, and we feel that perhaps this may be a very conservative figure.

Q What is your source of water supply?

A We have water rights in the Southwest quarter of the Northwest quarter of Section 15. The permit allows us to remove 350-acre feet per year. We will take our water from this area. We plan on drilling a fresh-water well approximately 300 feet deep, we'll set 13 3/8-inch casing and produce our water from this one supply well.

Q In your opinion, would it be an adequate supply of water?

A Yes, sir, we think so.

Q Do you have any further statements?

A I would like to make a statement in regard to our requesting to go to a unit-wide waterflood at the beginning, rather than initiating a pilot since there are a number of successful operations in the Caprock Queen area. We see no reason to believe that this project will not also be successful. It could be that if we initiated a pilot project and then expand to a full unit-wide basis that there would be a time that we would have to operate wells at a time when it would be uneconomical to operate and the initial unit-wide basis will result in the most economical recovery of oil.

Q Were exhibits other than the logs prepared by you or

under your supervision?

A Yes, sir, they were.

MR. WHITE: Offer Exhibits 1 through 22 in evidence.

EXAMINER NUTTER: Exhibits 1 through 22 will be entered in evidence.

MR. WHITE: That concludes our case.

EXAMINER NUTTER: Are there any questions of Mr. Robinson?

CROSS EXAMINATION

BY EXAMINER NUTTER:

Q Mr. Robinson, you stated that this area had an average production at the present time of 3.9 barrels per day per well?

A Yes, sir.

Q What is the range of that production in these wells?

A I may not be able to give you the exact range. There are a number of wells that are reaching their economic limits, and as I recall, I think about eight barrels is the top production at the present time. That is the last figure that I had available.

Q Eight barrels is the best one?

A I believe that's correct. I might stand to be corrected, but as I recall, eight barrels was one of the better wells.

Q What did you say that the pilot area in Gray Ridge flood had produced up to the time that injection program was started, six hundred some thousand?

A 699,389 barrels has been produced prior to injection.

Q What is your average pay thickness in this unit area, Mr. Robinson?

A Around 20 feet. Actually, it's a thick section but trying to calculate the net pay through the section would have to be calculated from some of the available gamma neutron logs, but there are approximately from 20 to 30 feet of fairly good pay sand scattered out through the interval.

Q You have not used any sand thickness or any other reservoir as part of the participation formula? It's all based on production?

A No, sir, we have not, and the reason for this, if you will examine a log of one of the dry holes, actually the characteristic of the pay from one of these dry holes appears to be very similar to the characteristics of a log from a productive well and we felt that the performance under primary operation would be an excellent indication of its performance under secondary operation, and since -- actually, from calculating from the log it would almost be impossible to correlate net pay. No attempt was made since all of the operators believe this was the most equitable parameters that could be made and agreed upon by all parties.

Q Would you explain Phases 1 and 2 of your participation parameters a little more fully, please?

A Yes, sir. Let's take the first lease, Amerada's State

ECA lease.

Q On Exhibit 4?

A Yes, sir, on Exhibit No. 4. As of January 1, 1961, this lease had recovered 30,969 barrels of oil. At that time it was calculated that there was an additional 14,600 barrels remaining of primary oil. If the field was not unitized, we assume that this lease could produce 45,569 barrels.

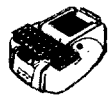
Now, once the unitization goes into effect, Amerada will receive 14.31 percent of production until such time as the field has produced 1,107,000 barrels of oil. Once the unit area has produced all this primary oil, then the subject lease will have a participation of 4.11 percent. You can see that this lease has a greater percent of remaining primary production to be produced than some of the other leases. However, its ultimate primary will be small, perhaps, as compared to some of the other leases.

Q In the second column from the right, Phase 1 percentage remaining primary, 14 percent reflects the percentage that 45,569 is of what?

A No, sir. The figure 14.31 percent is the ratio of 14,600 barrels is to a 102,000. That is the percentage that this lease has of the total remaining primary production from the unit area.

Q This is Phase 1, then?

A This is Phase 1.



Q What is Phase 2?

A All right. Once the field has produced the amount of oil that we calculate to be primary production, well then, the participation factor of Phase 2 goes into effect. Phase 2 is the percentage that a lease primary production bears to the summation of all production from the field.

Q I see. You said you had the water rights under what tract of land, Mr. Robinson?

A We have the water rights under the Southwest quarter of the Northwest Quarter of Section 15.

Q That is a 40-acre tract?

A That is a 40-acre tract. The file number on this water right is L-4415.

Q And your permit allows you 350 feet?

A That's 2,715,000 barrels per year and we will, during fill-up, be injecting a volume that will yield 350-acre feet per year and then once we obtain fill-up, we'll cut back our injection in equal withdrawals, then.

Q After the well starts producing water, will the produced water be re-cycled?

A Yes.

Q Is it your intent to inject down the casing or tubing?

A Down the tubing.

Q Will there be a packer on the tubing?

A Yes, sir.

Q Have the working interest owners in this unit, although they haven't signed the unit agreement, concurred in the formula?

A Yes, sir. It has been unanimously approved by all working interests.

Q Has the State Land Office approved the participation formula?

A Yes, sir. They have given their tentative approval.

Q And the local office of the USGS has given their tentative approval and it's in Washington for Washington's approval?

A Yes, sir.

EXAMINER NUTTER: Are there any further questions of Mr. Robinson?

He may be excused.

(Witness excused.)

MR. WHITE: That's all we have.

EXAMINER NUTTER: Does anyone have anything they wish to offer in Case No. 2421?

MR. MORRIS: I have a communication from Socony Mobil Oil reference Case 2421. Socony Mobil Oil Company, Inc., recommends approval of the Northeast Caprock Queen unit agreement and unit-wide waterflood as proposed by Texaco.

EXAMINER NUTTER: Is there anything else?

We will take the case under advisement.

* * *

STATE OF NEW MEXICO)
) ss.
COUNTY OF SAN JUAN)

I, THOMAS F. HORNE, NOTARY PUBLIC in and for the County of San Juan, State of New Mexico, do hereby certify that the foregoing and attached transcript of hearing was reported by me in stenotype and that the same was reduced to typewritten transcript under my personal supervision and contains a true and correct record of said proceedings, to the best of my knowledge, skill and ability.

Thomas F. Horne
NOTARY PUBLIC

My Commission Expires:

October 2, 1965

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 2421, heard by me on 11/29, 1961.

Examiner
New Mexico Oil Conservation Commission