CASE 6247 & 6248

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
State Land Office Building
Santa Fe, New Mexico
7 June, 1978

EXAMINER HEARING

IN THE MATTER OF: (Consolidated)	
Application of Mobil Oil Corporation for a unit agreement, Lea County, New Mexico, or statutory unitization.	CASE 6247
AND	
Application of Mobil Oil Corporation for a pressure maintenance project, Lea County, New Mexico.	CASE 6248

BEFORE: Daniel S. Nutter

TRANSCRIPT OF HEARING

A P P E A R A N C E S

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E X H I B I T S CONT'D

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MR. NUTTER: Call Case Number 6247, which is actually two applications in one.

The first is the application of Mobil Oil Corporation for a voluntary unit agreement in Lea County, New Mexico.

The second portion of the application is the application of Mobil Oil Corporation for statutory unitization of its North Vacuum Abo East Unit Area in Township 17 South, Range 35 East, Lea County, New Mexico.

MR. SPERLING: James E. Sperling of Modrall, Sperling, Roehl, Harris and Sisk, appearing for the applicant.

We'd like to request, Mr. Examiner, that the two cases to which you referred be combined for purposes of the hearing.

MR. NUTTER: Off the record.

(There followed a discussion off the record.)

MR. NUTTER: Back on the record. We have, as I mentioned, we have the two cases in Case Number 6247, one for voluntary unitization; the other for statutory unitization.

MR. SPERLING: I would like to request at this time, Mr. Examiner, that for the purposes of the hearing Case 6247 and Case 6248 be combined, consolidated.

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MR. NUTTER: We'll call now Case 6248, which is in the application of Mobil Oil Corporation for a pressure maintenance project, Lea County, New Mexico.

And you do have 100 percent voluntary unitization in Case Number 6247, so you have requested the statutory unitization portion of that application be dismissed.

MR. SPERLING: Yes, sir.

MR. NUTTER: And we'll proceed, then, with the hearing for the voluntary unitization and the pressure maintenance project.

MR. SPERLING: Yes, sir, we have two witnesses, one whose testimony will be with respect to 6247 and one with respect to 6248.

MR. NUTTER: Will they both stand and be sworn, please.

(Witnesses sworn.)

MR. KELLAHIN: If the Examiner please, I desire to enter my appearance in both these cases on behalf of Pennzoil Corporation.

Pennzoil Corporation is a working interest owner in the adjoining North Vacuum Abo Unit. We are an interested party in this proceeding and we don't know that we are objecting to what -- what Mobil's doing. We're seeking information at this point but we did want

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to participate and be able to ask the witnesses some questions about the unit.

MR. NUTTER: You're not sure whether you're friend or foe, is that right?

MR. KELLAHIN: That's right.

MR. SPERLING: Mr. Examiner, before we begin, at the time of the submission of the application we were one log short with respect to an injection well, and I would like to have added to the file, with respect to Case Number 6247, the log of Texaco, Inc., New Mexico State VJ No. 3 Well.

MR. NUTTER: Thank you, Mr. Sperling.

E. R. FRAZIER

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. SPERLING:

Q. Would you please state for the record your name, your place of residence, the name of your employer, the capacity in which you are employed?

A. Yes. I'm E. R. Frazier, employed by Mobil Oil Corporation in Houston, Texas, as Joint Interest Administrator.

Q. What do your duties consist of in connection with being Joint Interest Administrator?

A. Well, it consists of, among other things, of negotiating unit agreements and the preparation of unit agreements such as we're considering here today.

Q. In that connection, Mr. Frazier, have you on any previous occasions testified as a witness before the Commission and have your qualifications in the capacity that you have described been accepted?

A. Yes.

Q. As a part of the application originally filed in this matter, there was submitted a copy of the unit agreement, proposed unit agreement. We have also marked the Unit Agreement as an exhibit in 6247.

Would you please refer to Exhibit Number One in that case at this time? And describe for the record what the Unit Agreement consists of and some of its features?

MR. KELLAHIN: Excuse me, Mr. Sperling, do you have an extra copy of that we might look at?

MR. SPERLING: Yeah, I'll get you one.

MR. KELLAHIN: Thank you.

MR. NUTTER: Is that Unit Agreement there identical with the one that was submitted with the application?

MR. SPERLING: Yes, sir.

A. Shall I --

Q. (Mr. Sperling continuing.) Yes, go ahead.

A. Exhibit One is a copy of the Unit Agreement of the North Vacuum Abo East Unit, and the Unit Agreement is for the unitization of the Abo formation only, and the interval being unitized is described in Section 2 (j), page 2 of the Unit Agreement, and that's the same interval that was described on the call of the hearing.

Exhibit "A" of the Unit Agreement is a map of the Unit Area, showing the Unit outline and the tract numbers.

Q. How many acres does the unit area consist of?

A. The unit consists of 865.74 acres and the working interest owners owning 100 percent of the working interests in the unit have approved the Unit Agreement and the Unit Operating Agreement.

The State of New Mexico has all the mineral interest ownership in the proposed unit and the New Mexico State Land Office has reviewed this Unit Agreement.

Exhibit Two is a letter from the Public Lands Office Oil and Gas Division, which indicates that it meets with their approval. All tracts in the unit area qualify for inclusion in the unit and there is one over-riding royalty interest in Tract Seven which has also been

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committed to the unit.

I'd like to call the attention to an ipso facto termination date in Article 26, page 14 of the Unit Agreement. That ipso facto date was July 1, 1978, and Mobil has requested approval from the working interest owners to extend this termination date one year and working interest owners owing 95+ percent have approved this extension, will extend the ipso facto termination date to July 1, 1979.

And pending approval of the Commission and the State Public Lands Office, we anticipate making the unit effective August the 1st of '78.

It is respectfully requested that the Commission approve the North Vacuum Abo East Unit as proposed in the Unit Agreement.

Q. Do you have anything further with respect to the Unit Agreement?

A. I don't think I have unless there's some questions.

Q. All right.

MR. SPERLING: We would offer Exhibits One and Two in Case Number 6247 at this time, Mr. Examiner.

MR. NUTTER: Mobil Exhibits One and Two will be admitted in evidence.

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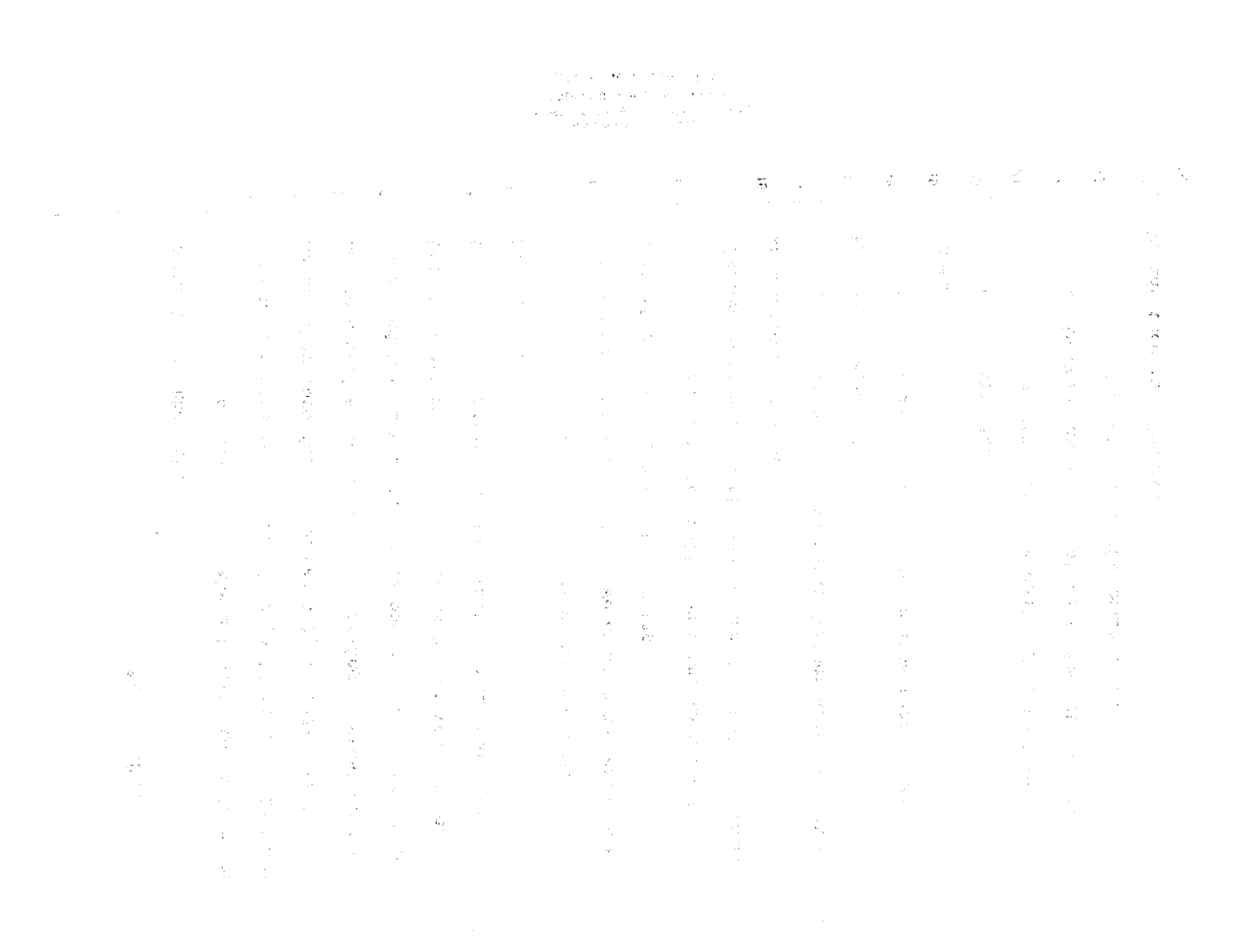

CROSS EXAMINATION

BY MR. NUTTER:

Q. Mr. Frazier, you mentioned that the Ipso facto termination date has been proposed to be changed to 7-1-79.

A. That's right.

Q. Did you state that 95 percent of the working interest has --

A. That's right.

Q. -- approved that proposition?

A. That's correct.

Q. Has the State Land Office approved it yet?

A. No, sir, it has not been submitted to them.

Q. Uh-huh.

A. I guess I overlooked that.

Q. Okay.

MR. NUTTER: Are there any further questions of Mr. Frazier?

MR. KELLAHIN: If the Examiner please.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q. Mr. Frazier, what if any working relationship do you have with the North Vacuum Abo Unit to the west of this subject unit?

A. Mobil is the operator of that unit as well.

Q. Let me -- let me show you what I have marked as Pennzoil Exhibit One, and ask you if you can identify that exhibit?

A. Yes, I believe I can.

Q. That's the boundary for the North Vacuum Abo Unit that adjoins this subject unit, is it not,sir?

A. That appears to be, yes.

Q. Let me trade copies with you, Mr. Frazier. It appears from looking at this exhibit, Mr. Frazier, that the subject unit for which you seek approval consists of the south half of Section 7, the north half of Section 8, the southwest quarter of 18 and the west half of the southeast quarter of 18. Is that all of it?

A. Yes. That's all of it.

Q. As opposed to creating a new separate unit, Mr. Frazier, what if any efforts have you made to expand the existing North Vacuum Abo Unit to include this area?

A. Well, there was not any effort made to expand the North Vacuum Abo Unit. You want to know the reason why?

Q. Yes, sir.

A. Okay. The reason why that there had been some response already in the North Vacuum Abo Unit and we felt like it would be easier and expedite matters by forming

a new unit rather than expanding the old unit.

Q. You indicate it would be easier. In what ways, Mr. Frazier?

A. Well, the fact that we could -- we would negotiate participation for the new unit and would not have to go into all the production history, and so forth, of the unit that was already in effect, and the fact that the production -- we had production increases in the old unit.

Q. Now, all the wells in the subject unit, they were all in existence prior to November of '76, were they not, sir?

A. Well, that I can't say without checking the records out, but you probably know more about that than I do. I don't know offhand.

Q. When was the last time you expanded the North Vacuum Abo Unit?

A. Let's see, the last time was when they expanded it to take in the Texaco tract there in the southeast quarter of 13, and I believe at that same time there was a Shell Tract 19 -- let's see, it would be -- okay, it's now Tract 19 in the North Vacuum Abo Unit; it's in the southwest quarter of Section 10, 34 East, 17 South. Those two tracts, I believe, were expanded. I believe that's the last time it was expanded.

Q. That expansion of the North Vacuum Abo Unit

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took place about November of 1976, did it not?

A. I believe that's probably true.

Q. And at the time you made that expansion you had to work out different parameters for the unit itself to include those tracts.

A. Yes, sir, I believe so.

Q. In addition, you made investment adjustments at that time.

A. That's correct.

Q. Now, prior to that date, with regards to the North Vacuum Abo Unit, did you ever propose and consider the expansion of the existing unit to include any portion of that acreage now proposed for the new unit?

A. No, it never was proposed for expansion.

Q. To the best of your recollection, then, in August of 1973, none of this acreage now in question was considered for expansion to inclusion in the existing North Vacuum Abo Unit.

A. You mean August of '73 or '76?

Q. Yes, sir, I believe '73.

A. '73?

Q. Yes, sir.

A. Well, to my recollection, all of these wells were not drilled then in August of '73. They're in the new unit.

Q. To the best of your memory, none of the existing acreage now under consideration for this unit was ever proposed for inclusion in the North Vacuum Abo Unit.

MR. SPERLING: Not of 1973, as you asked him.

A. I don't believe so, no.

Q. Other than '73 at any time?

A. We never proposed this for an expansion in '73. The reason is that this was being developed over here and I would have to, like I say, I don't recall exactly when every well was drilled, but this was developed later than the part that's in the North Vacuum Abo Unit.

Q. If I understand you by your answer, Mr. Frazier, you then have not made any feasibility studies to consider whether the existing unit could have been expanded to include any of the acreage now under consideration?

A. Well, I guess that would be hard to answer just yes or no. We considered that, expanding the unit, but the main reason we didn't try to expand it was the fact that we felt like it would be more expedient and that it would be more difficult to expand the unit than it would be to form a new unit.

Q. Is the area of the North Vacuum Abo Unit and the new unit all within the Abo Pool?

A. Yes.

Q. You said you, in response to a question, I

believe, asked earlier, that the existing unit was receiving some response from the offset acreage on the east side?

A. No. You mean -- which unit are you talking about now?

Q. Well, I'm not sure and that was --

A. Oh.

Q. -- the question.

A. The one I'm talking about the response was in the old unit, in the North Vacuum Abo Unit.

Q. The North Vacuum Abo Unit as it now exists was receiving response from the injection --

A. In that unit. See, we haven't started injection in the new unit yet.

Q. All right. What if any lease line agreements do you anticipate between the two units in order to protect the correlative rights of each?

A. We anticipate protecting the correlative rights by maintaining corresponding injection wells across the line. In other words, protect the equity across the lease line of the two units, and I would suppose we would make a unit -- a cooperative agreement to that effect, but anyway, we do anticipate protecting correlative rights of the two units by corresponding injection across the two -- across the common lease line.

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Q. Mobil, as the unit operator for the North Vacuum Abo Unit, has not called a working interest owners meeting in order to accomplish that at this point?

A. That's right.

Q. You've never made demand upon any of the working interest owners of the existing unit to expand, or proposed to expand, in this easterly direction?

A. That's correct.

Q. I don't recall exactly what you said, Mr. Frazier, you have or you have not made any economic studies to determine whether this acreage could be reasonably included in the existing unit?

A. I don't believe -- to my knowledge there wasn't any economic studies made just for that purpose. There have been economic studies made for the new unit but to my knowledge we didn't compare one to the other.

Q. And again, why didn't you make that comparison?

A. Well, the reason is that we intend to protect the correlative rights of the two units across that common boundary and that we felt like it would be more expedient and easier to form a new unit than it would to expand the old one.

Q. Do you have any particular lease problems within the acreage included in the new unit?

A. Lease problems?

Q. Yeah, you running into the end of the primary term on any of your leases?

A. No, sir.

MR. KELLAHIN: Mr. Examiner, I have nothing else. Thank you, Mr. Frazier.

MR. NUTTER: Are there any further questions of Mr. Frazier?

MR. SPERLING: I have one question.

REDIRECT EXAMINATION

BY MR. SPERLING:

Q. I believe the application, Mr. Frazier, showed the percentage working interest of Mobil to have been 50.05455. What is the correct working interest percentage attributable to Mobil's ownership?

A. In the unit under discussion?

Q. The unit under discussion, which is the North Vacuum Abo --

A. The East unit?

Q. Yes.

A. It has two phases, Mr. Sperling, and the Phase One participation is 52.05455 and the Phase Two is 52.32657.

Q. What is the most significant feature with -- that causes the percentage interest to vary as between

Phase One and Phase Two?

A. Well, it's almost exactly the same for Mobil. The basis of participation was Phase One was 50 percent current production and 50 percent remaining primary, and the basis of Phase Two was the ultimate primary recovery estimated from each tract.

Q. Was -- is there any difference in the participation factor as between the existing North Vacuum Abo Unit and the proposed unit?

A. I believe that there is a difference. I don't recall exactly what the basis was on the old unit. Do you have it there?

MR. KELLAHIN: Yes, sir, I believe it --

MR. RAINEY: I don't know whether you can read my writing. Can I read it for him?

MR. NUTTER: Read it into the record.

MR. RAINEY: Okay. The initial parameters for the -- before the unit was ever expanded, was 65 percent net pore -- net hydrocarbon pore volume; 17-1/2 percent current production, which was the first six months of '71; 17-1/2 percent remaining primary.

On the first expansion the parameters remained the same.

On the second expansion, which included the Texaco and Shell acreage, as effective on 11-1-76, the

parameters were 24 percent primary reserve, 38 percent ultimate primary production, and 38 percent net hydrocarbon pore volume.

MR. NUTTER: Would you state for the record your name, Mr. Rainey?

MR. RAINEY: J. C. Rainey, Petroleum Engineer with Pennzoil.

MR. NUTTER: Thank you.

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RECROSS EXAMINATION

BY MR. NUTTER:

Q. Mr. Frazier, in response to Mr. Sperling's question on that Mobil interest, would you repeat those figures you gave again?

A. Okay. Phase One participation, Mobil's interest if 52.05455.

Q. Wait just a minute, 52.0 --

A. 5455.

Q. Phase One, huh?

A. Yes, sir. Phase Two is 52.32657.

MR. NUTTER: Did you want to amend your application, Mr. Sperling, to reflect that combined figure rather than the --

MR. SPERLING: Yes, we do make that request.

MR. NUTTER: -- figure that you gave?

MR. SPERLING: Yes.

MR. NUTTER: Okay, fine, thank you. The application is being amended.

Are there any further questions of Mr. Frazier? He may be excused.

A. J. HANKINSON

being called as a witness and having been duly sworn upon his oath, testified as follows, to-wit:

DIRECT EXAMINATION

BY MR. SPERLING:

Q. Would you please state your name, your place of residence, your occupation, and by whom you're employed?

A. My name is Jim Hankinson. My place of residence is now Denver, Colorado. I'm employed by Mobil Oil and I'm a Staff Engineer.

Q. Have you on any prior occasions testified before the Commission as an expert witness and have you made your qualifications in that capacity a matter of record? And have those qualifications been accepted?

A. Yes, sir.

MR. SPERLING: Is the witness considered qualified, Mr. Edaminer?

MR. NUTTER: Yes, he is.

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Q. (Mr. Sperling continuing.) You, as a matter of fact, were a witness at the time of the hearing on the application for approval of the North Vacuum Abo Unit, the existing unit?

A. Yes, sir, I was.

Q. Would you now please refer to what has been marked as Exhibit One and describe for the record what that exhibit is supposed to show?

MR. KELLAHIN: Excuse me, do you have another one of those?

MR. HANKINSON: I think so.

A. Exhibit Number One is a map showing the well-bores in the area that we're proposing unitization and color coded to mark the reservoir that they have or are completed in. And as you will notice from this map, the red color, which is what we've used to designate the Abo formation, is rather extensive and continues on across from the older North Vacuum Abo Unit to the proposed unit area.

Q. The legend in the lower lefthand corner of the exhibit is color coded to indicate the conclusions that you have described?

A. Yes, sir, these are the reservoirs they have or are currently completed in.

Q. And also shown are existing injection wells?

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A. Yes, both the Abo injectors and San Andres injectors.

Q. Okay. Now would you please refer to what's been marked as Exhibit Two and describe the purpose of that exhibit, what is shown upon it?

A. To clarify the situation, Exhibit Two is a map of the project showing only the wells which have penetrated the Abo or deeper horizons. It also shows the proposed injectors in the new unit area and the proposed unit well numbers.

Q. Now would you review for us a brief history of the North Vacuum Abo Pool in Lea County, New Mexico?

A. Yes, sir. The North Vacuum Abo Pool is located about 25 miles northwest of Hobbs, New Mexico, in Lea County.

The first well was completed in the proposed unit interval was Mobil's Bridges-State No. 112 for a flowing potential of 312 barrels per day on June 15th, 1966. The original pressure was 3230 psi and the bubble point was 2800 psi. Oil gravity is 36 API. The reservoir produces by solution gas drive, although a large portion of the field has been unitized and is under, now, pressure maintenance by water injection.

The Mobil operated North Vacuum Abo Unit became effective 12-1-72 and has responded very favorably

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to water injection using a 5-spot pattern. Current production of this older unit is 4100 barrels of oil and 76 barrels of water per day.

Q. Now would you describe for us by reference to Exhibit Number Three the characteristics of the reservoir in which the proposed unit is located?

A. Yes, sir. Exhibit Number Three is a structure map on top of the Abo pay. It's a north/south trending anticline and shows that the old unit and the new unit are on the same Abo structure, just a continuation to the east.

Exhibit Number Four is an east/west cross section of the Abo horizon. As you might note on the righthand side of this exhibit it shows the line of continuity or cross sectional position from Well No. 158 in the North Vac Abo Unit to Mobil State JJ, to the State "U" No. 1, to the TT No. 1, and finally to the State MM No. 1.

The red interval is the Abo pay and where you see the interval marked with sort of a rectangular appearance, this is the overall perforated interval. Within that overall interval there it's selectively perforated.

MR. NUTTER: I take it then that this Mobil State UU, the one that's in the center, is not perforated in the interval?

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A. No, sir, it is not.

MR. NUTTER: Okay.

A. This shows that the structure dips to the east, as the previous exhibit showed.

Exhibit Number Five is a reference log of the proposed North Vacuum Abo East Unit. This is a log of Mobil's State UU Com. No. 1, a deeper Atoka-Morrow gas well. On this exhibit the unit -- proposed unit interval is defined as that point from 8420 feet t0 9260 feet sub-surface.

I might make a few comments about the Abo It is a back reef deposit anhydritic dolomite with inter-bedded shales. The gross section is about 550 feet thick and is capped by dense dolomite. The productive interval is confined almost entirely to the upper 100 feet. The porosity within the producing interval has good continuity through the proposed unit area as shown by this cross section, Exhibit Number Five.

Q. Now, would you furnish us with a description of the pertinent data which relate to the project which has been identified as the proposed North Vacuum Abo East Unit?

A. The proposed unit shown on Exhibit Two covers 866 productive acres and includes 11 active producing wells. Cumulative oil and gas production as of 1-1-78 was

767,529 barrels and 762,878 Mcf respectively.

Oil producing rate for December, '77, was 293 barrels per day and the average gas/oil ratio was 1220 cubic feet per barrel. Water production was extremely small, only 2.1 percent of total fluids produced.

MR. NUTTER: How many producing wells are in that?

A. At the present time there are eleven.

Q. With respect to the production to date, would you please refer to Exhibits Six and Seven and briefly describe those for the record and what they're intended to show?

A. Yes, sir. Exhibit Number Six is a production history for the proposed unit area. The units and columns are self-explanatory.

Q. And Exhibit Seven contains the same information in different form?

A. Yes, sir. Exhibit Seven contains the same information in graphic form, showing gas/oil ratio, oil production, and water production. I would like to call your note to the water production curve. The scale that applies to the water production is on the righthand side of this curve. This means that the average water production is less than 10 barrels per day, whereas the oil production is in the range of 290 barrels per day; the gas/oil ratio

is a little over 1200 cubic feet per barrel.

Continuing, the effective pay was estimated at 18 feet. The porosity is estimated at 11.3 percent and average permeability of 1 to 2 md. The original oil in place was approximately 7,000,000 barrels and the ultimate primary recovery is estimated to be 1,000,000 barrels, or 14.4 percent of the original oil in place.

It is estimated that the proposed unitization and water injection project will recover an additional 1,000,000 barrels of oil that would not be recovered under primary means. Total recovery, primary plus secondary, is calculated to be 2,000,000 barrels with approximately 29 percent of the oil in place.

Q. Mr. Frazier made reference to tract participation and the factors taken into consideration for the purpose of establishing those factors, would you elaborate on the participation a little more?

A. All right. The tract participation was divided into two periods.

Q. That's what you call Phase One and Two?

A. Phase One and Phase Two. Phase One was 50 percent primary reserves and current production. The primary reserves were determined by extrapolation of primary decline curves and the current rate was for the period mentioned in the Unit Agreement.

Q. In view of the history which you have developed by actual operation with respect to the North Vacuum Abo Unit, what would you anticipate by way of performance for the proposed unit?

A. Well, as I mentioned, I would anticipate a recovery of an additional 1,000,000 barrels of oil, which is more or less equal to the primary recovery.

Q. Would you describe for the record the plan of operation which is proposed mechanically for the operation of the unit? Proposed unit?

A. Yes, sir. I'm sorry, but I forgot to mention one thing that I think is pertinent, and that's what we call our Exhibit Number Eight. This is the performance curve of the existing North Vacuum Abo Unit. I would like to discuss this very briefly to show that the current production now exceeds the primary production in this unit area. That's a little over 4000 barrels per day, whereas the peak primary from this area was averaged in the range of 3500 barrels per day. The gas/oil ratio, which is the curve with little circles, has shown a classic decrease and is currently approximately 600 cubic feet per barrel, and our produced water is a little over 80 barrels per day, which is substantially less than what was produced under primary, after injection of a little over 14-1/2 million barrels of water.

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Q. Well, do I understand from that that you anticipate excellent results from the introduction of the proposed plan of operation into the East Unit area?

A. Yes, sir, we hope that it would perform as well on a comparable size basis.

Q. Now, describe for us the pattern, the injection pattern, that you expect to use, the source of water for the purpose of injection, the disposition of produced water, and those relevant matters pertaining to the plan of operation.

A. Mobil plans to initiate a 5-spot water injection program using Ogallala water similar to our North Vacuum Abo project.

Ogallala water will be obtained from Mobil wells on the Bridges-State lease under permits authorizing usage of 1200 acre feet per year, or 25,500 barrels per day. At a later date we may consider injection of CO_2 or other substances. Initially, we plan to inject approximately 500 barrels per day per well and we anticipate a maximum injection pressure later in the project life of 4800 psi, which is below the estimated frac pressure.

This is in line with performance of our offsetting North Vacuum Abo Unit, which is currently operating at wellhead pressures of 3700 to 4500 psi. Step rate tests that we have performed indicate that the cur-

rent frac pressures range from 4250 psi to 5000 psi at the North Vacuum Abo Unit.

Q. Have you prepare an exhibit, which I believe is marked Nine, which --

A. I believe that s Eleven?

Q. I believe -- yeah, the step rate tests are reflected in Eleven.

A. Right.

Q. Yeah, refer to Eleven. I was a little out of order but I don't think it will make any difference.

A. Exhibit Eleven is information concerning step rate tests that we've run in the Abo project supporting the maximum injection pressure of 4800 psi. The first curve behind the written work that shows more or less two parallel lines and a series of circles connected by lines, is an average by time period of the step rate tests that we've conducted within the project. For example, during the latter part of 1973 the average of our step rate tests for frac pressure indication varied from a low of around, oh, 3300 psi to a high of 3800 psi, and at each time period thereon, you can notice that these curves generally increased. The point I'm trying to make is that frac pressure increases with fill-up. As we continue to inject and put additional water in the ground, our frac pressure measurements continued to increase.

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MR. NUTTER: Why?

A. This is customary. This is typical reservoir performance. The frac pressure under a depleted condition is much lower than the frac pressure under initial conditions.

MR. NUTTER: Why would this happen?

A. The reservoir, when you inject water, you build a bubble of water around that injection well. You provide it with a reservoir pressure, and this pressure in turn pushes back, is a resistance, so the frac pressure determined under depleted conditions is not the same value as the frac pressure determined under initial conditions or under partial fill-up conditions, as you conduct your injection program.

MR. NUTTER: I'll have to think about that.

A. The next curve, which shows a typical step rate test conducted on our North Vacuum Abo Unit No. 220. The point I'd like to show on this is rate increases with pressure linearally in the first part of the curve but at the point of intersection you can see that the rate continues to increase but there's only a very, very shallow increase in pressure. This means that we have exceeded the capability of the rock to contain the water and it is parted. So the intercept there represents the frac pressure determination in Well 220 at that point in time,

which was December, 1975. We estimate the frac pressure to be 4150 psi.

The next curve is on Well 159. As you will note on the lower curve on the test dated 6-20-74, after I don't know exactly how many barrels of water injected, we determined that the frac pressure was 3500 psi surface wellhead duty. The curve above on a test some six months later, which is dated 12-3-75, we see no break in the curve, at approximately the same injection rates. Therefore, the only thing that we could conclude, since there is no break in the curve, it's linear, that the frac pressure is somewhat above the final pressure reading of 3950 psi, meaning that in that six-month interval our frac pressure has increased approximately 450 pounds on the same well through nothing more than fill-up in our reservoir.

Q. Is that -- are those tests the basis for your conclusion that with injection that the frac pressures increase?

A. Yes, sir.

Q. Do you have anything further to add with respect to Exhibit Nine?

A. You mean Eleven?

Q. I mean Eleven.

A. Yes, sir, I do. I'd like to point out that

in view of our very successful flood, if we are limited to a .2 psi per foot surface pressure measurement, or approximately 1750 psi, it is doubtful that we will be able to inject water after about two months of operation.

Q. Now are you making reference to Memo Number 3-77 dated August 24, 1977, from the Commission to operators and attorneys?

A. Yes, sir, I am.

Q. Okay. Which appears to place some restraint upon surface injection pressures.

A. Yes, sir.

Q. And your testimony is that with respect to the proposed project, that is the East Abo Unit project, that you require relief from the requirements set forth in that memo?

A. Yes, sir, we request it.

Continuing on our plan of operation, injection in a typical well will be through corrosion-resistant lined tubing below a mechanical packer. The annulus will be filled with treated fresh water and a pressure relief valve will be installed on the casing at the surface. Sketches of all wellbores penetrating the Abo within one-half mile of the proposed injectors in the project are shown on Exhibit Number Nine.

Q. Now to complete the description of exhibits,

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would you refer now to what's been marked as Exhibit Number Ten and explain the information contained in that exhibit and its purpose?

A. Yes, sir, Exhibit Ten is a tabulation of the wells shown in graphic form in Exhibit Nine and does show the casing size, setting depths, volume of cement, cement tops, et cetera. It's the same information in tabular form.

Q. Okay. What do you propose with respect to the disposition of produced water?

A. We plan to dispose of our produced water through Mobil's waterflood project in the Vacuum-Grayburg-San Andres.

Q. Do you have recommendations to make to the Commission with respect to the application and the proposed unit project?

A. Yes, sir. Mobil Oil Corporation respectfully asks the Commission for the following:

Number 1. Approval of the North Vacuum Abo East Unit Agreement.

2, Approval of the plan of operation to inject fluids into the Abo formation to the five wells described in Exhibit Two at pressures not to exceed the lessor of 4800 psi of wellhead pressure or frac pressure.

Number 3, an allowable formula to be fixed by

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the Commission to provide for a maximum daily unit allowable not to exceed the number of 80-acre proration units times the daily top unit allowable set for the wells in the North Vacuum Abo Pool; such unit allowable may be produced from any well or wells in the project area in any proportion.

4, Establishment of an administrative procedure, whereby the Commission may authorize the completion of the second producing well on the 80-acre proration units at unorthodox locations within said unit providing such wells are located no closer than 467 feet from the outer unit boundary, nor closer than 10 feet to any quarter quarter section or subdivision inner boundary.

In explanation of this, the 80-acre spacing in the large pattern areas, 160-acre 5-spot, coupled with low permeability of the reservoir and its effect on project response, may make it necessary in this area to infill drill producers in certain areas of the project. We're not prepared to say which area yet may require this, but it quite well may require it.

MR. NUTTER: Have you done any infill drilling in the North Vacuum Unit?

A. Yes, sir, we have.

Number 5. That the project area be fixed as the total area within the boundaries of the said North Vacuum Abo East Unit as described in this application and

with further provisions that the project area may be expanded administratively by the Commission upon meeting the conditions set forth by the Commission.

Q. Is the allowable formula suggested in your recommendation the same as or at variance with that which is established for the North Vacuum Abo Unit?

A. To my knowledge, it's the same.

Q. Do you have an opinion, Mr. Hankinson, as to whether or not the granting of the application in these cases will be in the interests of conservation, will prevent waste, and will protect correlative rights of the operators in the area?

A. Yes, sir, we believe it will.

MR. SPERLING: At this time I'd like to offer Exhibits One through Eleven.

MR. NUTTER: Mobil Exhibits One through Eleven will be admitted in evidence.

CROSS EXAMINATION

BY MR. NUTTER:

Q. Mr. Hankinson, I missed writing the figures down when you were giving the estimated primary and secondary and total ultimate, and so forth.

A. All right.

Q. Would you repeat those figures again, please?

A. Yes, sir, I will.

The estimated primary ultimate is 1,000,000, or approximately 14.4 percent of the oil in place. I estimate the secondary recovery, or rather pressure maintenance recovery, to be an additional 1,000,000 barrels. Therefore the primary plus secondary would be 2,000,000 barrels, or approximately 29 percent of the original oil in place.

Q. Well, if I'd known they were good round numbers like this -- I had the 29 percent. That's all I had.

Okay, now, Mr. Hankinson, on these frac pressures, if you refer to your Exhibit Number Eleven, we see that the second paragraph states there that present frac pressure ranges from 4250 to 5000 psig. Now, I understand that some of this variation is due to the interval of time in which these tests were taken because, as you show in your exhibits, the frac pressure seems to go up with time and fill-up.

A. Uh-huh.

Q. However, there is a variation, is there not, in the reservoir at a given time? I mean every well doesn't have the same frac pressure, does it?

A. No, sir, not all -- not exactly the same.

Q. Well, don't you think that the Commission should restrict the injection pressures to the frac pressure

that's indicated in an area by the lowest pressure of any well?

I mean that's the breakdown pressure for the formation at some point in that reservoir around there.

A. No, sir, I don't. I think our proposal accomplishes what you're trying to get at, in that if we set a pressure that we've determined by actual tests or -- which is this 4800 psi -- or the lessor as determined by frac pressure -- individual frac pressure tests.

Q. You'd take a frac pressure test on every single well, then?

A. Yes, sir, we do.

As you might note, our water production in the North Vacuum Abo Unit, after approximately five years of operation is 81 barrels per day.

Q. Uh-huh, and with 14,000,000 barrels --

A. After 14-1/2 million. We're most concerned about fracturing that reservoir and have attempted to operate at all times under frac pressure so that the water injected is confined to the Abo and does its job of displacing oil to our Abo producers.

Q. Well, you've got such wide spacing there, it's obvious that you haven't had the complete sweep of the reservoir and one of these days you will be producing more than 80 barrels out of those wells.

A. Yes, sir, absolutely, but the point I'm trying to make, I guess, is if we were fracturing these wells, one of the best things that -- not the best things, but best indicators of fracturing is rather imminent water production in one of the offset wells.

Q. Or breakthrough sometimes in an inside well.

A. Yes, right.

Q. And you've experienced no breakthrough in any of the wells --

A. No, sir.

Q. --in that other unit.

A. No, sir. It's our calculation both from hand calculations and from simulator studies that we have very well controlled volumetric flood that is doing what it should do.

Q. I know the responses given on Exhibit Eight has been rather gratifying.

A. Yes, sir, it has.

Q. Those proposed rules that you had for the operation of the project, are they contained in any of these things you submitted to us here today?

A. Yes, sir, they are. Now, with the exception of a little amendment on Item Two.

Q. What are they in?

MR. SPERLING: No, they haven't been. We

propose to do that, right.

A. I stand corrected.

MR. SPERLING: We were going to leave a copy of that with the reporter for the purpose of her being assured that she got all of this.

MR. NUTTER: I'd like to have a copy of it.

MR. SPERLING: Sure, we can certainly do that.

MR. NUTTER: Are there any other questions of the witness? Mr. Kellahin?

CROSS EXAMINATION

BY MR. KELLAHIN:

Q. Mr. Hankinson, you testified a moment ago about one of the similarities between the unit agreement for the North Vacuum Abo and the North Vacuum East Abo, with regards to assignment of allowables.

Are the two unit agreements materially different in any respect, and if so, what are they?

MR. FRAZIER: As far as -- may I answer that?

MR. NUTTER: Yes, sir. The record will show that Mr. Frazier is answering that.

MR. FRAZIER: Essentially there is no difference between -- there's probably some difference in wording but the -- basically they're practically the same.

Q. Let me ask you, Mr. Hankinson, on one of your exhibits you've shown the wells in both the existing unit and the proposed new unit. If you'll locate one of those for yourself.

Are any of the wells in the proposed new unit receiving any response from wells in the existing unit, and if so, which ones?

A. I believe there is some degree of response indicated on the Mobil well which is called the State JJ No. 1.

Q. In the northwest corner?

A. Which would be proration unit H, J, --

Q. L.

A. -- K, L. Seven-L.

Q. Do you know how much response it's receiving?

A. No, sir, I don't have that well curve in front of me, but it is receiving some response.

Q. All right. Do you have any recollection of an approximate amount of response it's receiving from the offset unit?

A. Not specifically. I'd hate to give you a number and that not be correct.

Q. Could you furnish that to us when you get the curve?

A. I certainly will.

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Q. I'd appreciate that. In addition to that one well are there any other wells that are receiving responses from the existing unit?

A. I think I'd have to refer to the production curve. There may have been more than one along that edge, but as I remember, that was the only well of any significance, where you might say there was any significant amount of oil.

Since Mr. Rainey is in Midland, it's quite possible that we could send production curves directly to him of those offset wells, if you would wish.

Q. I'd appreciate it. I'd appreciate that, Mr. Hankinson, that would be just fine.

A. All right.

Q. Let me ask you this about your methods for calculating the participation factors on the new unit.

Is your method for conducting or calculating those participation factors any different from the method used to determine the participation factors on the existing unit?

A. Method, no, formula, yes.

Q. All right. Tell me what different formulas were used for each.

A. Well, as you mentioned, from your own testimony, that there was 65 percent net pore volume, 17-1/2 percent,

and so on, whereas, in this we've testified that Phase One is 50 percent primary reserves, 50 percent current production, and Phase Two is 100 percent alternate primary.

Q. Why did you not use the same method as in the existing unit?

A. Because our control, our log control, the status of being more towards the edge of the reservoir, possibly higher water saturation, indicated to engineering that it may be more desireable to go on an ultimate primary basis as an indicator of secondary rather than something indicating pore volume.

Q. Would that cause you to want to change the method of use for participation in the existing flood from the pore volume calculation to this other method?

A. This is why we selected the method. We prepared a number of parameters data, ultimate, primary, oil in place estimates, and submitted these to the working interest owners, who in turn negotiated a formula of equity.

Q. Did you conduct any studies or to your knowledge were any studies conducted that would consider the question of expanding the existing unit to include the area under consideration for your new unit?

A. Not complete studies. We have thought of the idea, and as Mr. Frazier pointed out, the fact that one unit has made their investment, the production is re-

sponding very favorably, whereas, the other unit the production is down, they haven't made it, would cause a rather difficult time with regard to obtaining each individual's equity on a participation formula.

Q. You're talking about in investment adjustment?

A. Yes, that and the difference in production in time. In other words, you have production response, a significant production response in our present unit. These people have invested their money and are seeing response.

The new unit, there is no response. Production is down. It's under partially depleted primary and the problems involved in determining equity between those two areas with those differences we believe would require considerable more time in order to accomplish the same purpose than approaching it from a new unit concept.

Q. Other than the factor of time, it still could be economic to expand the existing unit to include the -- expand the existing unit to include the acreage under the new unit, could it not?

A. You put the word "economic" to it, and I am not prepared to answer that. I do know that because of the pressures involved in our project the addition of lines for additional wells may not be feasible to our present wells, because of limitation of injection lines.

In other words, you may have four or five injection wells on a present injection line. It's physically impossible without substantial pressure drop to add another three or four injectors onto it. So I really am not prepared to agree with your --

Q. In your opinion will it be more profitable for Mobil to create a new unit for this acreage as opposed to including it in an expanded participation in the existing unit?

A. We prepared economics on the new unit and it will be profitable to all the working interest owners. I have not, as I've stated, I have not prepared economics of expanding the unit to the original --

Q. Mobil's been the unit operator of this North Vacuum Abo Unit from its inception, has it not?

A. That's correct.

Q. As the unit operator, would you not think it your responsibility to conduct such kinds of analyses to determine whether it's better for expansion of the existing unit as opposed to creating the new unit? Would that not be your responsibility as the unit operator?

A. Yes, I suppose it would be. It calls for a conclusion, I guess, and we in turn believe that it would be more advantageous to all concerned to do the method that we have, which would protect lease lines, people

would participate equitably, we came up with a formula that they could agree with, rather than go through the expansion problems and sometimes quite lengthy negotiations required to achieve expansion.

Some of the original expansions were necessitated and were brought forth because these people participated in the original unit concept, but were in the development phase and decided by -- voluntarily to keep these areas out until they were developed, but asked that they be considered in this unit at a later date. This is true of that Shell tract.

Q. The operators and working interest owners of the new unit all participated in the existing unit.

MR. FRAZIER: No, that's not correct.

A. Not true. Let's see. Elk Oil is not in the existing unit.

Q. Are there any other exceptions?

A. No.

Q. Which -- what acreage is the Elk Oil acreage?

A. This would be the -- what is called the Elk State Com No. 1 and No. 2, located in the south half of Section 18.

Q. I see it, okay. You've not made this proposal or informed the working interest owners of the existing unit of your desire to create a new unit, have you?

A. This has been published in whatever papers that all the operators normally subscribe to for information with regard to the Commission activities.

Q. Apart from that notice you've not made any effort to contact the working interest owners of the existing unit to propose the possibility, or have them consider for a vote the possibility of expanding the existing unit to include any portion of the new unit?

A. No.

MR. KELLAHIN: Thank you very much.

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

He may be excused. Did you have anything further, Mr. Sperling?

MR. SPERLING: No, sir.

MR. NUTTER: Does anyone have anything they wish to offer in Case Number 6247, 6248, consolidated?

MR. KELLAHIN: Move the introduction of Pennzoil Exhibit One. I believe it's a duplicate of one of Mr. Sperling's exhibits.

MR. NUTTER: It's very close to it. Pennzoil Exhibit Number One will be admitted in evidence.

Does anyone have anything further to offer in either of these cases? We'll take the cases under advisement.

(Hearing concluded.)

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REPORTER'S CERTIFICATE

I, SALLY WALTON BOYD, a Court Reporter, DO HEREBY CERTIFY that the foregoing and attached Transcript of Hearing before the Oil Conservation Division was reported by me; that said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability, knowledge, and skill from my notes taken at the time of the hearing.

Sally Walton Boyd, C.S.R.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 6347-48 heard by me on 6/7, 1978.

Examiner
New Mexico Oil Conservation Commission