NEW MEXICO OIL CONSERVATION COMMISSION

COMMISSION HEARING

SANTA FE, NEW MEXICO

Hearing Date MAY 20, 1986 Time: 9:00 A.M.

NAME	REPRESENTING	LOCATION
Chad DICKERSON	Dickerson, Fed & Vandeven	Artesia
Deen Wood	TXO	Midland
Jeff Bourgeois	"	"
Greg Wilson	TXO	Midland
Emery Chavez	OCD	Aztec
Jack Cayeas	Mewbourne Oil Co.	Hobbs
SD SPHAR	NM & AZ LANDCO	ALBU Q
A.R. KENDRICK	Mewbourne Oil Co.	Aztec
Bob Frank	Union Texas	Farmington, NM
W.T. Kellahin	Kellahin & Kellahin	Santa Fe
MIKE PIPPIN	UNION TEXAS	FARMINGTON, NM
C.J. Boyce	Amoco Prod	Denver Colo
R.J. BOYER	Amoco Production Co	DENVER CO
KENT LUND	"	"
Bob Durham	Boyce	Santa Fe
James A. Norton	Columbus Energy Corp	Denver CO

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NAME	REPRESENTING	LOCATION
Kevin McCord	KM Production Co.	Farmington
Price M. Bayless	Bayless Drlg.	Farmington
Kevin A. Fitzgerald	Mallon Oil Co	Denver
Scott Hall	Campbell & Black	SF
John Bruce	Hinkle Law Firm	SF
Doug Endsley	Merrion O & G	Farm
Michael K. Merrion	Merrion O & G	Farm
Karen McIntosh	Mallon Oil Company	Denver
Gregory K. Phillips	Mesa Grande Resources	Tulsa OK
Tommy Roberts	Mallon Oil Company	Farmington
Geo. Mallon	Mallon Oil Co	Denver

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BUILDING
SANTA FE, NEW MEXICO

20 May 1986

COMMISSIONER HEARING

IN THE MATTER OF:

Application of Amoco Production Company for pool creation and special pool rules, Rio Arriba County, New Mexico. CASE 8822

BEFORE: Richard L. Stamets, Chairman
Ed Kelley, Commissioner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

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Legal Counsel to the Division
Oil Conservation Division
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I N D E X

I N D E X

E X H I B I T S

MR. STAMETS: We'll call next Case Number 8822.

MR. TAYLOR: The application of Amoco Production Company for pool creation and special pool rules, Rio Arriba County, New Mexico.

MR. PEARCE: May it please the examiner, I am W. Perry Pearce with the law firm of Montgomery and Andrews, appearing in this matter on behalf of Amoco Production Company.

Appearing with me in this matter is Mr. Kent J. Lund, an attorney with Amoco in their Denver office.

We have two witnesses in this matter.

MR. STAMETS: Other appearances?

MR. KELLAHIN: Mr. Chairman, I'm Tom Kellahin of Santa Fe, New Mexico. I have two clients. I'm appearing on behalf of Union Texas Petroleum Corporation. I'm also appearing on behalf of Minel, Inc. That's M-I-N-E-L, and I have three witnesses to be sworn.

MR. STAMETS: Thank you. Any other appearances?

I'd like to have all those who

are going to be witnesses in this case to stand and be sworn at this time.

(Witnesses sworn.)

MR. STAMETS: You may fire when ready.

MR. PEARCE: Thank you, Mr. Chairman.

Mr. Chairman, if I might, I'd like to make a brief opening statement to try to give you some indication of where we think this case ought to go and why we're here.

Amoco appears before you today seeking a change in the spacing rules applicable to a 4-section lease known as the Jicarilla A-118, located in Sections 25, 26, 35, and 36 of Township 26 North, Range 3 West.

Amoco presently operates six wells in that 4-section lease. It has an additional four wells drilled which are currently shut in.

Tests of those wells indicate that they will each drain more than 40 acres; that's despite the fact that this lease has been made a part of the Ojito Gallup Pool, which requires 40-acre spacing.

As a result of this incorrect

spacing, several of these wells are forced to periodically shut in, stop production because of an allowable established on the basis of the 40 acres. This results in revenue loss to everybody interested in those wells, as well as the royalty owners and other revenue collecting entities.

We're going to call two witnesses today to show that the same stratigraphic interval is currently spaced differently in four pools in the vicinity of the lease that we're discussing. That stratigraphic interval appears to cover this whole area.

We are also going ot show that currently the area covered is inappropriately and incorrectly spaced and that the change in that spacing is necessary in order to allow my clients to produce their just and equitable share of the reserves underlying their land.

In view of opposition which was encountered at the last hearing, Amoco has dropped a request that a buffer to the south be established. The pool in question on the south butts up against the Ojito Gallup Dakota Pool, 40-acre spacing. We are not seeking any buffer to the south and the dividing line which we propose between 40-acre spacing in the Ojito Gallup and 160-acre spacing in -- on our lease, is to be the lease line.

We believe that the ability of the wells in question to drain is governed by natural frac-

turing in the area; that this fracturing results from the occurrence of a structural nose, which is similar to a structural nose which occurs in other places in the general area, and that in those other areas much wider spacing than 40-acre spacing has been found appropriate and necessary.

We're asking for the standard 790 feet offset to section lines and 330 line to quarter quarter -- 330 feet to quarter quarter sections. We're asking that any well which does not meet these spacing -- these location criteria, which has been previously drilled, be allowed to continue to produce at its present location with the full 160-acre allowable.

With that, Mr. Chairman, I do not know whether opposing counsel wishes to make an opening at this time, I'm ready to proceed with my witness.

MR. STAMETS: Mr. Kellahin?

MR. KELLAHIN: Thank you, Mr. Chairman.

I represent Union Texas Petroleum Corporation and Minel, Inc. They are both working interest owners of acreage in the Ojito Gallup Dakota Pool immediately to the south of the four acres that Amoco proposes to have respaced on 160 acres.

As Mr. Pearce has told you, this case involves the spacing of a portion of the Ojito

Gallup Dakota Pool in the San Juan Basin.

This pool was established some seventeen years ago on 40-acre spacing. The evidence will show you that Amoco in August of 1984 sought to have this same 4-section area included in the Ojito Pool and the Division extended the pool to include those four sections at Amoco's request. A downhole commingling order was entered at Amoco's request to commingle the Dakota and the Gallup.

Amoco has drilled some ten wells that are subject to the pool rules for this pool and they have now found that some of these wells have high initial producing rates. They want you to carve out a special deal whereby their 4-section area will now be spaced upon 160 acres so that they can produce an allowable in excess of that assigned to the other wells in the pool.

I will show you that that incident of the disparity of allowables of wells in the same pool, the same common source of supply, adversely affects the correlative rights of other operators.

I will present to you three witnesses, Mr. Bob Frank, a geologist with Union Texas Petroleum, Mr. Mike Tippen, an engineer also with Union Texas, and Mr. Al Kendrick, an engineer appearing for Minel.

I will show you that this is one Gallup oil pool. It will be uncontested that this is

the same common source of supply.

I will show you that the wells in the Ojito Gallup Pool to the south are correlative geologically with the four sections that Amoco proposes to respace on different spacing in the same pool.

I will show you that there is no geologic justification to treat the Amoco area any separately from the balance of the pool immediately to the south.

We will show you that there is no presently available engineering data from which an engineer can reasonably rely to anticipate that 160-acre spacing is going to be appropriate for the four sections.

I will show you that by treating the Amoco acreage differently than acreage in the same pool that correlative rights are going to be adversely affected.

I'll be the first one to concede to you, and I do so right now, that Amoco has some high potential, initial potential wells in the 4-section area, but we will contend that there is no reason to grant them a special sweet spot spacing to take care of the allowable problem they have on some of their wells.

The operators in the balance of the pool ought to be operating under the same allowables as the Amoco wells. We have suggested to the examiner when he

heard this case that if there is a spacing problem in the pool, then we set a hearing to pool -- to change the spacing in the entire pool, and we do not carve out for special treatment a certain portion of the pool.

The Examiner order denied Amoco's application and we believe that after you've heard the evidence we will persuade you and show you that again the application ought to be denied.

RICHARD BOTTJER,

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

DIRECT EXAMINATION

BY MR. PEARCE:

Q Thank you, sir. For the record would you please state your name and place of employment?

A My name is Richard Bottjer. B-O-T-T-J-E-R. I work for Amoco Production Company in Denver, Colorado.

Q And in what capacity do you work, sir?

A I'm a geologist.

Q Have you testified before the Commission or one of its examiners previously and had your credentials as a geologist accepted and made a matter of record?

A Yes.

Q Are you familiar with the subject matter, particularly the geology related to the subject matter, before the Commission today?

A Yes, I am.

Q And have you prepared certain exhibits for introduction at this proceeding?

A Yes, I have.

MR. PEARCE: Mr. Commissioner, are the witness' qualifications in the field of geology acceptable?

MR. STAMETS: He is considered qualified.

Q Mr. Bottjer, at this time, if you would, please, take what has been marked as Amoco Exhibit Number One in this proceeding and discuss what you have attempted to show with -- through that exhibit, please, sir.

A Exhibit Number One is a one inch equals 4000 foot scale map that illustrates the current spaced pool in the area in question. The map covers parts Township 24 North, all of Township 25 North, part of Township 26 North, and parts of Range 1 West, all of Range 2 West, and Range 3 West and a part of Range 4 West, in Rio Arriba County, New Mexico, and it's located in the southeastern corner of the San Juan Basin.

The area in question this morning is

labeled "Amoco Jicarilla 118 Lease" and it's got an arrow pointing to it; four sections, Sections 25 and 26, 35 and 36, in Township 26 North, Range 3 West.

The dark dots on here indicate wells that are either producing from the Gallup and/or Dakota. They're producing oil. And line A-A', which we'll get to in a few minutes, is a cross section and that's Exhibit Two.

Now there are four separate pools shown on here. Actually there's a fifth one that's irrelevant to this dicussion. I'd like to start from the west and work my way to the east.

The pool furthest to the west is West Lindrith Gallup-Dakota Pool. Spacing is currently designated at 160 acres. The wells in that pool are generally not highly productive. They're marginal wells right now, given current prices.

Ojito Pool is the second pool. It's shown in a diagonally striped pattern. Again it has marginally economic wells in general except for the wells in and near our lease. Spacing is currently 40-acre statewide in there. To my knowledge the spacing problem has never really been attacked in this pool and this is the first time anybody's really tried to get a designated spacing for this pool.

Q With regard to that answer, sir, do I un-

derstand you correctly that you believe only as to a portion of the Ojito-Gallup you would have sufficient information at this time to indicate any spacing other than statewide?

A That is correct.

Q All right, sir, with regard to the next pool to the east, please.

A The next pool to the east is the Gavilan Mancos Pool. Currently it is under temporary 320-acre spacing, and that produces from the Gallup interval, which is called Mancos. Essentially it's the same thing as what we call Gallup in these other pools to the west.

The next pool to the east is West Puerto Chiquito Mancos. It's entirely within, at least the mapped area, is entirely within Canada Ojitos Unit, which is operated by Benson-Montin-Greer of Farmington and the spacing in there is 640 acres per well, again from the Mancos, same producing zone as in the Gavilan and in Ojito.

Q All right, sir, at this time let's open what you have marked as Exhibit Number Two and we will come back to Exhibit Number One.

A Exhibit Number Two is a stratigraphic cross section from east to west that shows at least one well in each of the pools that I've described on Exhibit One.

Q And the line of this cross section is A-A', shown on Exhibit Number One?

A That is correct.

Q All right. Go through and describe these wells from west to east, again, if you would, please.

A Okay. First let me describe the cross section for a second.

Q All right.

A Each of the logs on the cross section are dual induction logs, showing resistivity on the righthand tracks and SP, and if it's available, gamma ray on the left-hand track.

The cross section was hung on a datum at the top of the Graneros or the base of the Greenhorn.

I'd like to start on the left side and go through the cross section.

The well on the left is the Jicarilla Apache 125 No. 4. It's an Amoco well that was completed in 1980. It's in West Lindrith Gallup-Dakota Pool. You can see that it was completed in the Gallup intervel, which is essentially the same as the Mancos and also completed in the Dakota for an IP of 77 barrels of oil per day.

MR. STAMETS: Now your -- all right, the lower perforations below 7500 feet are the Dakota perfs, is that correct?

A Yeah. There is a set of perforations below 77 that would be in the Dakota and there's another set

between 7550 and 7650, which you could say are in the Graneros.

MR. STAMETS: Okay. Do we have a base of the Gallup or Mancos interval shown on this?

A As it's defined geologically, Gallup is not a good term to use. The Graneros is actually within the Mancos. The Gallup, as we call it informally within Amoco is shown as the dashed line on the righthand column of the cross section. They would essentially correspond to a zone somewhere up above the top of the Sanistee, but I think technically, according to the State, the Gallup producing interval is everything between the base of the Mesaverde and the top of the Greenhorn, if I'm not mistaken.

MR. STAMETS: Sorry for the interruption.

A That's all right.

The second well on the cross section is Union Texas Petroleum McCrodden A No. 4. It is in the Ojito Gallup-Dakota Pool. It was completed in 1984. As you can see, it's completed in the Gallup interval, also in the Greenhorn, in the Graneros, and in the Dakota; has an IP of 57 barrels of oil per day.

The third well on the cross section is our Amoco Jicarilla Apache A-118 No. 14, which is in the area that we propose should be spaced at 160 acres. As you

can see, it was completed in both the Gallup zone and in a Dakota sand. It was completed last September and the Dakota zones both made water so we set a bridge plug above those and we have -- got an IP of 492 barrels of oil per day out of only the Gallup perforations.

The next well on this cross section is the Jerome McHugh No. 1 Loddy, which was completed, again, last September. It is the Gavilan Mancos Pool, which is currently spaced at 320 acres per well. It was completed only in the Gallup zone for an IP of 420 barrels of oil per day.

The next well on the cross section is the Northwest Exploration Gavilan No. 1, which was the discovery well for Gavilan Mancos Pool. It was completed in 1982. It was completed in the Dakota, the Graneros, the Sanistee, and the Gallup interval. It had an IP of 40 barrels of oil per day but I produced at higher rates than that during its production history.

Again, that's in Gavilan Pool and that's also spaced with 320 acres per well.

The next, the last two wells on the cross section are both in West Puerto Chiquito Mancos Pool, which is spaced at 640 acres per well. Both of these wells are completed in the Gallup or the Mancos. The Canada Ojitos Unit No. 25 was completed last fall, actually in January of

1985. It had an IP of 234 barrels of oil per day. The well is currently producing about 500 barrels of oil per day. It's a high volume well.

And the last well on the cross section, the Canada Ojitos No. 7, was completed in 1965. It had an IP of 145 barrels of oil per day.

There are a couple of things on here I'd like to point out. One is that if you sit down and strictly correlate sands across this cross section, you can do it. As you can see, I've correlated the Niobrara A and the Niobrara C Zones all the way across the cross section. The dpositional environments and lithological characteristics, at least stratigraphically, of the rocks through out this entire area, are the same, and there are four different spacing sizes out here, and that's related to different amounts of productivity of the wells, and as Al Greer has shown in Puerto Chiquito, that the reservoir in there is fractured, the drainage is greater because of the fracturing, and therefore the spacing is 640 acres per well, whereas in West Lindrith we see lower productivity and smaller spacing because there is less fracturing in the Gallup zone.

Q Anything else which you believe it's appropriate to discuss with the Commission at this time with regard to Exhibit Number Two?

A One more thing I'd like to point out is

on the Northwest Exploration Gavilan No. 1 the interval that's spaced at 320 acres per well in the Gavilan Mancos Pool is noted. The interval that we would propose spacing at 160 acres per well on the Jicarilla 118 Lease is also indicated on our Jicarilla Apache A-118 No. 14. It's correlative with the same zone that's spaced at 320 acres in Gavilan Pool.

Q All right.

A Do you want those depths?

Q Yes, it may help the record. Why don't you go ahead and give those at this time, please, sir?

A The depths would be from 6873 to 7923, as noted on the dual induction log in the Jicarilla 118 No. 14.

Q All right, Mr. Bottjer, you've indicated that stratigraphically you are unable to differentiate between the producing zones from the West Puerto Chiquito Mancos, Gavilan Mancos, your Jicarilla 118, the Ojito Gallup, and the West Lindrith Gallup-Dakota Pool.

If you would at this time, please, sir, turn to your Exhibit marked Number Three, which is a structure map.

A Exhibit Number Three, as you indicated, is a structure map. It covers approximately the same area as Exhibit Number One. It's also built at one inch equals 4000 foot scale and the contour interval, the contour inter-

val is 50 feet.

The marker that was mapped structurally is the top of the Graneros, the same marker that we used to hang -- the same datum that we used to hang the stratigraphic cross section that was Exhibit Number Two.

I'd like to again point to a couple of things here.

The West Lindrith and Ojito Gallup-Dakota Pools are in the west central portion of this map and, as you can see, structurally there's not really a lot going on. It's relatively flat.

As you get towards the high volume wells on our Jicarilla 118 Lease, you start to get on the flank of a structural nose, there's a structural high, and there appears to be a fault between the No. 14 and No. 15 Wells.

A similar structural feature is present at Gavilan where we see high volumes wells producing at the south end of that structure.

There have been some recent wells completed on the north end of that structure, as well, that are also high volume wells. Now those Gavilan wells are spaced at 320 acres per well.

We would propose that the structure that we see next -- near our Jicarilla 118 lease is enhancing fracturing in the Gallup just as it has been testified to be

doing in Gavilan Pool, and therefore we feel that the wells will probably drain more than 40 acres because of the fracturing in the reservoir.

Q All right, sir. Is it an accuracy summarization to say that you believe that the differences between the Ojito Gallup-Dakota Pool and your 118 Lease are geologic to the extent of the fracturing caused by structural differences similar to those found in the Gavilan Mancos and West Puerto Chiquito Mancos Pools?

A That is correct. Stratigraphically, the rocks, as I showed on Exhibit Two, are the same in all of these pools but structurally they're very different because the fracturing in different areas is of different degrees. So we see a higher degree of fracturing on our lease than we do in the rest of the Ojito Pool.

Q Are you able to find any stratigraphic difference between the West Puerto Chiquito Mancos Pool and the Gavilan Mancos Pool?

A No.

Q All right, sir, anything else you'd like to address to the Commission with regard to this exhibit?

A I believe I'm finished with this exhibit.

Q All right, sir, let's put that aside and please go to what we've marked as Exhibit Number Four. Everybody can see it's lovely; explain that to the Commis-

sion, please.

A Exhibit Number Four is a photograph of a section of core taken from our Amoco Jicarilla 118 No. 14 Well, which was the same well shown on the cross section, Exhibit Number Two.

The interval shown in 7179 to about 7180-1/2 and as you can see on the photograph, the lithology of the rock is basically a dark gray to black silty shale. It's got some carbonaceous material; just below 7179 there's some calcareous material in there, and basically it's dominated by a steeply dipping fracture that starts at about 7179 and continues most of the way through the photograph.

Numerous fractures similar to this were seen in the core and we believe that these fractures are what's causing our wells to have such high rates, that they are higher permeability than the rest of the matrix, which there is virtually none. There's no permeability in the rest of the matrix.

There is some calcite, partial calcite fill along that fracture point and you can see that on the photograph, and that suggests to us that the fracture is natural and not induced during the coring process.

MR. STAMETS: Would you like to come up here and mark that on our copy of Exhibit Four?

A Certainly. Here's some calcite. You can see it's white along here and there's a little bit of calcite on the edge (not clearly understood).

MR. STAMETS: Thank you.

Q Returning briefly, Mr. Bottjer, if we may, to what was previously marked Exhibit Number Three, you discussed the occurrence of a structural nose in the area of your Jicarilla A-118 Lease. You believe that the kinds of fractures shown in Exhibit Number Four result from the occurrence of that structural nose, is that correct?

Q Yes, that is correct, sir.

A All right, sir, I'll try not to interrupt. Go ahead. Is there anything else you need to say about Exhibit Number Four?

A One final comment about Exhibit Number Four, when we examined these pieces of core soon after they were retrieved from the subsurface, there was fluorescence and some oil stain along the fracture planes.

Q And that fluorescence and oil staining would ordinarily not be present later when this photograph was taken?

A It would evaporate.

Q All right, sir, Exhibit Number Five, please.

A Exhibit Number Five is also a photograph

of core from the same well, Jicarilla 118 No. 14, from a deeper zone, 7514 feet.

It basically shows a fracture with more calcite fill on it than was shown on the shallower fracture, and the piece on the lower half has just been removed from the whole core piece in the top of the photograph.

Basically, you can see all the white material on that fracture point is calcite fill. This suggests to us that our fractures may not be completely open, that they are partially calcite filled, and that part of the natural permeability of the fracture system is being decreased of this partial calcite fill.

Q All right, sir, in your expert geological opinion do you believe that the wells found in the Amoco Jicarilla A-118 Lease exhibit different geologic characteristics due to natural fracturing than wells presently found in the Ojito Gallup-Dakota Pool?

A Yes, that is correct.

Q All right, sir, do you have anything further to add at this time?

A No, I do not.

Q All right, sir.

MR. PEARCE: I tender the witness, Mr. Commissioner.

MR. STAMETS: Are there ques-

tions of the witness?

MR. KELLAHIN: Yes, sir. Do you want to admit your exhibits at this time?

MR. PEARCE: Sure, we'll do them one at a time.

Mr. Commissioner, I'd move the admission of Exhibits One through Five.

MR. STAMETS: Without objection these exhibits will be admitted.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Bottjer, while we're looking at the photographs, let me direct your attention to Exhibit Number Four.

A Okay.

Q By examining this photograph as a geologist, Mr. Bottjer, can you identify any of the natural fracturing that you've discussed? Can I look at this and see natural fracturing in the core?

A Yes.

Q Okay. I'll show you my copy and give you my yellow marking pen and have you outline for me what you are describing by the natural fracturing in the core sample.

A The core sample has broken apart so that

part of it has been induced open but the calcite fill that we see along here suggests that it's natural, so this is all natural and these pieces have fallen off. There's no way to hold them on there.

Q Let's use Exhibit Number Three as a reference point for my questions. Do you have a copy of that?

A I want to confine your attention to the 4-section area that's depicted on the exhibit and to Sections 1, 2, and 3 immediately to the south in the Ojito Gallup Pool.

You've identified the core sample as being from the Amoco 14 Well in Section 36?

A That is correct.

Q Have you examined cores of any of the other Amoco wells in the 4-section area?

A No, I have not. We have not cut any other cores.

Q With regards to the core samples in the No. 14 Well, can you tell me how long are those fractures in that well?

A Fractures range from probably a quarter of an inch to two feet in the core. Now that is only what we see in the core and chances are those fractures are a lot bigger than that.

Q Can you determine the horizontal extent of the fractures that you've encountered in the core sample in the 14 Well at this time?

A There's no way to determine how far out in the formation those fractures go from a core. From a core the only data you have is the core itself.

Q From any other information available to you at this time as a geologist can you determine the direction that these fractures are moving?

A Yes.

Q All right, and what, in your opinion, is the direction of the fracture system?

A I believe these fractures are oriented northwest/southeast.

Q And what is the basis for that opinion?

A Based on the borehole televiewer log (sic) that we ran in the well.

Q The orientation of the fracture is which way?

A Parallel to the fault that's shown on Exhibit Three.

Q Have you examined any other geologic data with regards to any other well to determine the presence of the natural fracturing and the orientation of those fractures?

A In this particular area?

Q Yes, sir, I'm confining our discussion to the immediate 4-section area.

A Okay. We have a borehole televiewer log in the No. 9 Well.

Q We'll come back to the No. 9 Well in a minute.

Apart from the 14 and the 9 Well, do you have any other geologic data that causes you to believe there is natural fracturing and the orientation of those fractures?

A We infer geologically that there are fracturing in other wells based on the high productivity of the wells.

Q All right, I'll come back to what you've inferred.

A Okay.

Q My question is what geologic data do you have other than on the No. 9 and the No. 14 Well?

A We don't have any cores from any of the other wells.

Q How would you compare the fracture system in the No. 9 Well versus the 14 Well?

A The fractures in the No. 9 Well were a lot fewer than the fractures in the No. 14. There about a

quarter to a fifth of the number of fractures, so the fracturing seems to be decreasing away from the structural nose, which is exactly what you would expect based on what the production is doing. It's decreasing in the same direction.

Q What is the initial potential on the No. 9 Well?

A That will be admitted as a later exhibit.

Q Yes, sir. Do you know what the initial potential of that well was?

A The initial potential was something about 40 or 50 barrels a day.

Q And how does that compare to the initial potential on the No. 14 Well?

A It's much lower. The No. 14 Well had an initial potential of 492 barrels a day. It also had a lot more fracturing.

Q With regards to Section 36, the Amoco Section 36, there is the No. 11 Well in the southwest quarter? Do you have that one?

A Uh-huh.

Q Immediately to the south in Section number 1, who operates that well?

A Minel.

Q And is that also a Gallup oil well?

A Yes, I believe it was also completed in

the Dakota.

Q The Minel well, do you have a copy of the log on that well?

A Not with me, I do not.

Q You've examined it, have you?

A Uh-huh.

Q How does the log of the Minel well correlate to the log of the Amoco No. 11 Well in the section immediately to the north in the Gallup interval?

A The -- stratigraphically the logs correlate just as well as they would if you correlated the No. 11 to the Jerome McHugh No. 1 Loddy that is shown on the cross section before. As indicated before, there's no problem correlating these logs.

Q So that I specifically understand your testimony, the log correlations of the Amoco wells in the 4-section area are correlative to any of the logs for the wells immediately to the south in the Ojito Gallup Pool.

A That is correct, but the logs do not -- are not fracture indicators so fracturing is different but stratigraphically the wells are the same.

Q Let's look at any structural differences, would you, please?

First of all, let's look at the fault line that you have interpreted running northwest to south-

east through one of your sections.

In your opinion is that a significant enough fault feature or structural feature to isolate out the Gallup interval on the Amoco acreage northeast of that line versus the wells southwest of that line?

A Are you -- exactly what are you asking?

Q I'm asking you if that fault is sufficient enough to isolate out the Gallup reservoir on either side of that fault line.

A Well, I don't think the fault is isolating anything. I think it's enhancing fracturing around it.

Q The structural nose that you have interpreted on the exhibit, would you take my yellow pen and on my copy of Exhibit Number Three would you outline for me the extent of the structural nose in the Gallup as you have interpreted it?

You can start on any of the contour lines and start where you think a contour line is affected by the structural nose and stop it on that contour line when you think you're beyond the nose, and do that with each of the contour lines.

A I would guess the structure would affect (not clearly understood) something like this; however, there is very little information to the east to indicate how much

fracturing is occurring there.

Q When we look at the arrow just to the east of the interpreted fault line, there is a egg-shaped circle. Do you find that contour line?

A Yes.

Q What's the geologic data upon which you conclude that that circle ought to be there?

A You can map that structure on the Mesaverde interval. This is a base map showing the Gallup and Dakota penetrations. There are a number of Mesaverde gas producers in the western half of Township 26 North, Range 2 West, and you can map that structure quite well on Huerfanito Bentonite, and so I've just projected that structure down to a deeper horizon.

Q Would it be consistent with the disciplines of your profession to interpret the structure not to include that little closure on that contour?

A You don't have to close it off, no, but the nose does have to be there, so you could attache the southeastern part of that structure to this -- it's the -550 contour line at the northwestern part of Gavilan Pool.

Q Would it also be consistent with the range of geologic interpretation of the structure to also draw the contour lines so that no fault is interpreted as you have shown on your exhibit?

A You could do that but it's easier to draw the fault, because otherwise you have to really play the close the contour interval a lot and you could do that, but it still suggests that you have a flexure there, so even if it's not faulted there's still a flexure and you'd probably have fracturing on that flexure.

Q Is the information depicted on this structure map the same information, in fact is this the same exhibit that you used back in the February hearing?

A I believe it is.

Q With the addition of the Minel Well in Section number 1, have you recontoured your structure map to take into consideration the data from that log?

A No, I have not used the structural data from the Minel Well. The map was created before I received that log.

Q Other than identifying a structural nose that I understand you believe contains an area in which production is enhanced with natural fracturing, do we find any structural feature or any significant structural evidence to structurally isolate out the 4-section area from any of the sections south of the 4-section area?

A Well, we don't know exactly how far out from that structure fracturing is going to be enhanced. Fracturing is a variable thing and we don't completely

understand the controls on fracturing. All we know is that we have fracturing in our area; therefore, we would propose spacing that at this time alone.

Q I understand that. Apart from the evidence of fracturing in some of your wells --

A Uh-huh.

Q -- is there any other geologic information to indicate to you that structurally that portion of the reservoir underlying the four sections that Amoco has under lease is separate and isolated from the balance of the Ojito Gallup Pool?

A Stratigraphically it is isolated but fracturing causes there to be more oil in place there.

Q All right, my question is structurally.

A Okay.

Q Is the structure so significant that it isolates itself out and separates the ability of the Amoco wells to drain wells in the same pool that are in the balance of the reservoir?

A I don't think the Amoco wells are going to drain any of the wells in Ojito because there's no fracturing in Ojito to be drained.

Q All right. Have you examined the balance of the wells in the Ojito Gallup to determine whether any of those wells production is enhanced by fracturing?

A We have looked at those. As far as I know there's no fracture identification tools that have been run in there that at least were successful in identifying fractures. There aren't many good logs that you can use.

The production in Ojito, for the most part, is low volume. low rate, so we feel like the fracturing is not as dense as we have in our lease.

Q My question is geologically is there any data available that you have examined to show you whether or not, either way, there is natural fracturing occurring in any of the wells in the balance of the pool?

A We had a borehole televiewer log in our Fred Phillips "G" No. 1.

Q And where is that well?

A It's in the northwest quarter of Section 10, Township 25 North, Range 3 West, and it showed no fracturing in the Gallup.

Q All right, now which quarter section is --

A It's the northwest quarter.

Q Okay, the one at the -701 contour line?

A That is correct.

Q All right.

A And that well is in Ojito Pool.

Q Okay, and what's the initial potential on

that well, do you recall?

A It was about 80 or 90 barrels a day.

Q Other than that one, is there any other geologic data available to you to determine the presence or absence of natural faulting occurring in the balance of the pool?

A No, we infer that fracturing is absent based on the productivity of the wells.

Q When we look within the 4-section area itself, geologically you have concluded that the Section 14 well's production is aided by natural fracturing.

A The Section 14 well? We don't have any well --

Q The No. 14, I'm sorry, the No. 14 Well within that section.

A We, yeah, we do conclude that the production in the No. 14 Well is controlled by fracturing.

Q When we look at the No. 9 Well, however, that well is more typical of the wells in the balance of the Ojito Gallup Pool, is that not true?

A That appears to be correct, yes.

Q When we look a the No. 8 Well, the east offset to the No. 9 --

A Uh-huh.

Q -- how would you geologically character-

ize that well in terms of wehther it's more typical of the 14 Well or more typical of the wells in the balance of the pool?

A The No. 8 Well produces more similarly to the No. 9 Well than it does to the other wells in our lease.

Q When we get to the No. 11 Well, continuing on to the east, geologically how would you quantify that well in terms of whether it's more typical of the base of the Ojito Gallup Pool or of the No. 14 Well?

A The No. 11 Well has a higher production rate and appears to be more fractured. It's closer to the No. 14 than the other two.

Q Other than it's initial potential rate being higher, is there any geologic data available to you from which you conclude that it geologically is more typical of the No. 14 Well than the balance of the pool?

A We infer the presence of fracturing in the 11, based on a correlation with the presence of fracturing in the No. 14 and high rates in the No. 14.

Q As we move then to the No. 19 Well --

A Okay.

Q -- what is your geologic opinion with regards to whether that well is more geologically typical of the Ojito Pool or the No. 14 Well?

A I believe that the No. 19 Well will be

more typical -- more similar to the No. 14 Well than it will be to the rest of the Ojito wells.

Q And what is your basis for that opinion?

A It's closer to the structural nose, closer to the fault, and had a higher IP.

All right. All these IP's will be admitted as a later exhibit.

Q You as a geologist have not done any work with analyzing the initial potentials in terms of drainage areas, reserve calculations, any of those kinds of things, have you?

A In general that's an engineering job.

Q With regards to economics have you made any economic studies with regards to this project?

A Our next witness will present economics.

Q And that was not your work?

A That is correct.

Q Geologically, Mr. Bottjer, are you able to quantify for us the number of nature of the fractures that are necessary in order to have a well spaced upon 160 acres?

A I don't think we can quantify the amount of fracturing in the reservoir. We can just say qualitatively that there's more fracturing in some areas and less in others.

Q In your opinion, Mr. Bottjer, is the fracturing going to be localized and confined just to the four sections within the Amoco leases?

A I would guess that it probably will not be, but the only way we can find out is to do some more drilling.

Q Do you have any more plans for drilling any additional wells in your 4-section area?

A That will depend -- it depends on whether we are allowed to produce the wells or not.

We do have other permitted locations out there and eventually we would like to be able to drill those wells.

Q In examining the geologic data do you find any of the wells within the Ojito Pool and/or the 4-section Amoco area that experienced lost circulation while drilling?

A Most wells drilled in this area experience lost circulation while drilling through the Gallup.

Q Do you reach any geologic conclusion by having that occurrence happen during drilling?

A In many cases the lost circulation is related to natural fracturing.

Q Have you made a tabulation of the wells that you've examined to determine which of these wells in

the pool and the Amoco 4-section area have experienced lost circulation?

A I have not done that.

Q Have you constructed any structural cross sections with regards to the Ojito Pool and the Amoco 4-section area?

A No, I have not.

Q In summary, then, is it your geologic opinion that the Amoco 4-section area is in fact in the same common source of supply or the same reservoir as the rest of the Ojito Pool to the south?

A Oh, yes, it's the same source of supply as West Lindrith and Gavilan and West Puerto Chiquito. They're all the same source of supply.

Q When did you commence your study of this area, Mr. Bottjer?

A Oh, I started working the San Juan Basin and in particular this area about a year and a half ago.

Q Were you the exploration geologist that did the geology for Amoco's drilling of the 4-section area?

A I did not recommend the drilling of the first well. That was the person before me and I worked with the Production Department on drilling the rest of the wells.

MR. KELLAHIN: May I have a few minutes, Mr. Chairman?

MR. STAMETS: Yes. Do you want to shut down altogether or can the rest of us ask a few questions?

MR. KELLAHIN: That would be fine, if I might have a moment to see if there's any more questions.

CROSS EXAMINATION

BY MR. STAMETS:

Q Mr. Bottjer, I presume that you did not use an oil base drilling fluid on this well that you had fluorescence on.

A No, that was a water base drilling mud.

Q All right. What -- what do you anticipate the produtive potential is for that acreage which lies between the Gavilan Pool and the four sections in question here today?

A That's hard to say. We know that in the northeast -- well, in Section 17 of Township 25 North, Range 2 West, Mesa Grande has completed a well in there that's fairly high potential and I think McHugh has completed a well in there that's also high potential.

In between there and our No. 19 Well I am not aware of any production test at this time. I would guess that you could easily get a low production potential

area in between the two structures. It depends on how far southeast that fault projects.

Q No dry holes in there at the present time?

A Not that I know of.

Q Okay. In the Ojito Gallup, looking at your Exhibit Number One, even though I realize that that's 40-acre spacing, I don't see any section that has more than four wells on it, is that correct?

A Oh, yeah, that is very correct. The Ojito Pool has been drilled on 160-acre spacing to date.

Q As a matter of fact, one of those sections, looks like Section 10 that you referred to earlier --

A Uh-huh.

Q -- is an Amoco section, as well as the north half of Section 15 below. Amoco has only drilled one well for every 160 acres in there. Why is that?

A Because economically we can't justify drilling any more wells in Ojito Pool.

Q Why did Amoco not bring an application for 160-acre spacing in the Ojito Gallup Pool?

A I think because there's not really a spacing problem there. The wells do not have a problem with allowables. They will not produce over 100 barrels a day, so there was really no reason to change it.

I think it's the same reason nobody else in Ojito Pool has ever tried to change the spacing.

Q Apparently the leases are large enough so that you don't run into any offet obligations.

A In our case at least that is true and I believe that's true for most of the other operators in that pool.

Q So based on Amoco's experience, your knowledge of the area, is 160 acres the largest spacing unit or the smallest spacing unit which can be efficiently and economically drained and developed by one well in the Ojito Gallup Pool?

A That's probably correct. I think economically we wouldn't -- at least Amoco, speaking from our standpoint, we wouldn't drill anything less than one well per 160, anything more than that. We wouldn't drill anything on eighties or forties.

Q And that's basically the same spacing, then, or is the same spacing in the West Lindrith Gallup-Dakota.

A That is correct.

MR. STAMETS: Are there other questions of this witness?

MR. KELLAHIN: Just a few, Mr. Chairman.

MR. STAMETS: Mr. Kellahin.

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q You've responded to Mr. Stamets' question about the economics are such that you wouldn't recommend drilling on less than 160 acres but I just asked you if you did any economics and you said you didn't do them.

A Well, that's based on the economics that Mr. Boyce has prepared for later testimony.

Q And you're simply referring to what work he has done.

A That's correct.

Q You of your own independent knowledge don't have any economic opinion, do you?

A I have not generated my own set of economics.

Q Let me see if I understand something about the general geology within the 4-section area. Am I correct in understanding that the Gallup interval, the productive interval, is generally of the same or similar thickness as we move throughout the 4-section area?

A In general that is correct. It may vary some but in general it is about the same thickness.

Q And what is that general thickness within

the 4-section area?

A It depends what you define as Gallup as to how thick you want it to be.

Q Well.

A Do you pick the top as soon as it goes above 10 ohms resistivity or do you pick it at the first sandstone or do you pick it at the top of the Niobrara A. Where do you want me to start and stop?

Q You're the geologist, you pick it.

A Okay. I would guess that what we call the Gallup interval is about 400 feet there.

Q All right. As we move into the Ojito Gallup are we still talking about the same general 400-foot thickness in the Gallup?

A Yes. The thickness stays fairly constant, plus or minus 50 feet.

Q Within the Ojito Gallup in the 4-section area, geologically is it fair to conclude that the oil reserves underlying any given portion of that pool are approximately the same?

A I don't think that's fair to say at all.

Q All right. Tell me why you would not think that's a fair characterization.

A I think that we may have more oil in place where there is more fracturing because there is more

volume, pore volume, to hold the oil in the fracture porosity and we don't know what the fracture porosity is. There's no way to measure it.

Q Is there any geologic way to determine the parameters by which the engineering people can calculate the reserves in place under any given tract?

A No, that's been a real problem in this reservoir. You can't calculate fracture porosity. You can't calculate water saturation in the fracture system so you can't do pore volume calculations.

Q Geologically, then, the productivity of the wells and ultimately their ability to produce the oil reserves in the Gallup in your opinion are affected by the natural fracturing that occurs.

A Yes.

Q All right. And geologically there is no way to quantify the volume of reservoir that would contain the Gallup oil underlying any given tract.

A That is correct.

MR. KELLAHIN: I have nothing further.

RECROSS EXAMINATION

BY MR. STAMETS:

Q One further question, Mr. Bottjer.

Geologically do you see any reason that the West Lindrith Gallup-Dakota, the Ojito Gallup-Dakota, and the Amoco 4-section area shouldn't be all classified as being in the same pool?

A I would say that I -- I think geologically Ojito and West Lindrith should probably be in the same pool.

Our lease appears to be more comparable structurally to Gavilan, but I think eventually all of these may end up being in the same pool.

Q Okay.

MR. STAMETS: Are there other questions of this witness?

MR. PEARCE: Just a few, if I may, Mr. Chairman.

REDIRECT EXAMINATION

BY MR. PEARCE:

Q Mr. Bottjer, from your review of the core and log data that you have seen, looking back specifically towards anything you may know about permeability and porosity, do you find, if you know, permeability and porosity differences between the West Lindrith Gallup, the Ojito Gallup, your Jicarilla 118 Lease, the Gavilan-Mancos Pool, and the West Puerto Chiquito Mancos Pool?

A Well, according to porosity logs that are run in the wells, the porosity in the Gallup or the Mancos appears to be similar in all those areas.

Q Based on your geologic education and experience, what would you expect the productivity of any of those wells to be if productivity depended solely on permeability and porosity?

A Of the matrix?

Q Yes.

A They should all be similar.

Q And would that be high or low, sir?

A Should be relatively low like what we see in Ojito and West Lindrith.

Q And that is part of the reason you base your opinion on the occurrence of natural fracturing as being a primary production mechanism in your lease.

A That is correct.

Q All right, sir. We had some discussion about the fault which you have interpreted running northwest and southeast. What's the throw of that fault, do you know?

A About 120 feet.

Q Thank you.

MR. STAMETS: Mr. Chavez.

QUESTIONS BY MR. CHAVEZ:

Q Frank Chavez. I'm District Supervisor of the Oil Conservation Aztec Office.

Mr. Bottjer, did you review previous studies done on the fracturing in the Mancos and Gallup areas of northwestern New Mexico and use any principals there in your study?

A I have reviewed the testimony that was given at the Gavilan hearing and also some of the testimony that Al Greer has given on West Puerto Chiquito Pool and, yeah, we feel like we have a very similar system to what they described in those hearings.

Q Except for your presumed faults and fractures, is the formation quality as far as permeability -- I'm sorry, as far as porosity in contribution the same throughout this area into the Ojito Gallup-Dakota?

A I think it probably is, yes. The matrix, you mean?

Q Yes.

A Yeah, the matrix is probably comparable in all these areas.

Q Is there one production volume potential that you would say would be the rule of thumb you'd use or the point you'd use at which you start looking for fractures in this area?

A I'd say anything over 60 to 80 barrels a day, I think you're starting to get some fracture contribution.

Q Mr. Bottjer, would you please on your Exhibit Number Three in Township 26, 2, look at that and tell us what -- if you could, the contour interval for that oblong shaped contour that you drew there?

A Okay, the structural nose in the southwestern corner, is that --

Q Yes.

A That's a 50-foot contour.

Q Okay, what depth is that?

A This particular, the closed contour, I believe, is -550 feet.

Q -550?

A Yeah.

Q Okay. The one to the north of that, then, is what?

A That would be -600. You can see that that's offset on the fault.

Q Okay, what is the contour directly to the southeast?

A Okay, that's also a -550 and that's the point that you could bring those closed part of the structure, you could just wrap it into that.

Q Okay, but you interpreted it was closed rather than showing it was (not clearly understood).

A That's correct, but it could be either way.

Q Okay. Thank you. That's all.

MR. STAMETS: Are there any other questions of the witness?

MR. LYON: May I ask one?

MR. STAMETS: Mr. Lyon.

QUESTIONS BY MR. LYON:

Q Just a matter of housekeeping, Mr. Bottjer, on your Exhibit Two I notice that beneath each of the logs for every single well you have initial potential shown as IPF, most of them, but in -- in your second well from the right, the Benson-Montin-Greer it's IPS.

A Uh-huh.

Q What is the IPS?

A That's a swabbing IP.

Q And I think you testified that the well was producing what, 500 barrels a day?

A Yeah, it's 500 or 550, something like that.

Q In connection with your Exhibits Four and Five, you have described the lithology of the Mancos here.

Do you find the lithology different to the southeast in your lease in Section 10? I mean to the southwest?

A No. Lithologically it appears to be similar but we don't have any cores from that lease, but based on log correlation with the wells that we do have cores in, it does appear to be similar.

Q So that the primary difference between the formation in your area of interest and the rest of the field is this fracture.

A It appears to be, yeah, that's correct.

Q And do you have any evidence from any of your porosity measurements that the porosity is higher in your 4-section than it is in the rest of the field?

A Based on the density logs and neutron logs, sonic logs, the porosity in the matrix is similar. We would guess that there would be a slight increase in porosity due to the fracturing.

Q Well, wouldn't you agree that the primary difference is not a matter of porosity but of permeability?

A That's probably true.

Q So that would not necessariy indicate that you had more oil in place.

A That's correct.

Q In your (not clearly understood.)

MR. STAMETS: Any other ques-

tions of this witness?

He may be excused.

Mr. Pearce, how long to you anticipate your next witness taking?

MR. PEARCE: Probably an equal amount of time, sir.

MR. STAMETS: Well, let's take about a fifteen minute recess.

(Thereupon a recess was taken.)

MR. STAMETS: The hearing will please come to order.

Mr. Pearce, you may call your next witness.

MR. PEARCE: Mr. Lund is going to handle this witness, Mr. Chairman.

MR. LUND: Mr. Chairman, we would call Charles Boyce to the stand.

CHARLES BOYCE,

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

DIRECT EXAMINATION

BY MR. LUND:

Q Would you please state your name?

A Charles Boyce, B-O-Y-C-E.

Q And your business address.

A It's Amoco Production Company, P. O. Box 800, Denver, Colorado, 80201.

Q You're employed by Amoco Production Company?

A Yes.

Q In what capacity?

A As a petroleum engineer.

Q Have you made an engineering study of the area of the Northeast Ojito Gallup-Dakota Pool that we are discussing today?

A Yes, I have.

Q Is that area within your job responsibilities as a petroleum engineer for Amoco?

A Yes.

Q Have you prepared exhibits or have exhibits been prepared under your supervision to be utilized at this hearing today?

A Yes.

Q Have you ever testified as an expert wit-

ness in the field of petroleum engineering before this Commission or its examiners?

A Yes, I have.

Q Have your credentials been accepted?

A Yes, they have.

MR. LUND: We would offer Mr. Boyce as an expert in the field of petroleum engineering.

MR. STAMETS: Without objection the witness is considered qualified.

Q Just as a quick summary, Mr. Boyce, what does Amoco seek by its application today?

A Basically to recognize that an area generally encompassed as we see it now by the 4-section Jicarilla A-118 Lease is characterized by the fairly high level of natural fracturing in the -- in the otherwise very low porosity and low permeability Gallup matrix; that that natural fracturing allows for quite high natural productivity, sustained productivity, and provides the capability for these type wells to drain much wider areas than in a similar unfractured Gallup interval.

Throughout the area that we see on the map varied areas have been spaced on varied spacing, in each case based on testimony concerning the relative amount of fracturing, relative dip, structural noses. In our particular area we believe that 160-acre spacing is probably, pro-

bably most appropriate at this time.

Q Let's turn to Exhibit Number Six. Would you identify that and explain its significance to us?

A Exhibit Six basically consists of a copy, copies of two orders previously issued by the Commission, cases in which I personally testified.

Discussions have -- have centered around the Ojito Gallup-Dakota Pool and I think perhaps the word "pool" may be a misnomer in relation to other pools that we see on the map.

The West Lindrith, the Gavilan, and the West Puerto Chiquito really were -- were formed at public hearings where testimony was presented concerning the capability of the wells to produce; the capability of the wells to drain certain areas; the economics thereof; and proper spacing was established.

In the case of the Ojito, this never really was the case. I think these two orders are -- are indicative of that.

What prompted these two orders, the first was to gain approval of the Commission to commingle the Gallup-Dakota on our Fred Phillips Lease. That's Section 10 and the north half of Section 15 in Township 25 North, Range 3 West. We didn't present any evidence concerning the drainage or the fact that the Gallup-Dakota underlay those

areas.

The Commission, however, extended the pool to those areas solely for the purpose of commingling.

Q So I take it that Amoco did not request an extension of the pool to include the four sections which are the subject today?

A That's correct. We requested only commingling approval. At that time we had drilled one well and had expectations of drilling others.

The -- the second order, which is Order R-7650, related to the sections that are central to this particular case, the Jicarilla A-118 area.

Again, at that time when we were first planning to drill in those sections, we realized that economically we could not develop the Gallup and Dakota separately.

As the order says, we requested approval to commingle the wells that we planned to drill. We presented no evidence concerning the occurrence of the Gallup-Dakota, the economics of drilling, the probably drainage. The Commission actually dismissed our application; in lieu of that extended the Ojito Pool to cover those sections.

I think the point I'm trying to make is this pool and our (not clearly understood) never been spaced. It's in a pool in name only and our application, I

think, is the first that recognizes a part of the pool as being economic to develop on a specific spacing.

Q And I believe these are the -- well, let me ask you that. Are these the only two prior proceedings with respect to this 4-section area that probably Mr. Kellahin was referring to earlier?

A Well, these are the only two proceedings that we have initiated. The field has been expanded several times through the routine nomenclature procedures of the Commission. Also, I believe in at least two cases, individual operators have -- have extended the pool quite extensively, as shown, I think, on Exhibit One, I believe, which is our base map.

More recently it was extended along the southern boundary of Ojito for several miles to the east. In fact I believe at that time the original proposal was to extend it to butt up against the Gavilan Pool. That was recognized as being a problem. We could have 40-acre spacing next to 320-acre spacing. It's a problem we face in this entire area and as drilling proceeds, as Mr. Bottjer indicated, I think we'll see that we're going to perhaps merge some of these pools and having -- having different spacing I don't see as a problem. What we have to recognize is that there are unique areas and that in each area there can be different drainage characteristics.

So the same spacing in a pool, if indeed Ojito is a pool, is not inconsistent in my -- my opinion.

Q Before we turn in some new exhibits, why don't you turn back to Exhibits Four and Five that were introduced by Mr. Bottjer and discuss those.

A The core that we cut in No. 14, as Mr. Bottjer indicated, is one of the few rare cores cut in this area. They're quite expensive. They generally provide little information other than a look at the very low porosity, low permeability matrix which is characteristic of this massive Mancos section.

We were fortunate in this well to actually see vertical fractures. As Mr. Bottjer pointed out, we saw several of these.

This, I think, really points to the core of our recommendation that natural fracturing enhances the drainage potential of wells in the Gallup.

I think, if I may use an example, let's -- let's assume this is any very tight formation, characteristic of much of the San Juan Basin. Without fracturing we know from past experience that productivity and drainage and econmics are poor. In may cases they're unacceptable.

With the advent of hydralic fracturing some 25 years ago, industry was able to produce both oil and gas reservoirs of this character by initiating one fracture,

one massive, hydraulic fracture, which might extend for several hundred feet. That enhanced the productivity and the drainage.

What we see here is the natural occurrence of multiple fractures which is really the key to -- to the development of this area and to the drainage we can see.

As we see later on, I'm not going to present some positive pore volume calculations. It's impractical in this type reservoir.

What we do is by inference with other known areas try to speculate on what the probably drainage is.

I think this core is a classic and it shows us what really defines production in this area.

Q And that's what distinguishes the 4-section area from the rest of the area?

A That appears to be the fact, yes.

Q All right. Let's turn to Exhibit Number Seven. Would you identify that, please, and explain it to us?

A Number Seven is kind of a basic data sheet which describes the ten wells that we have drilled on our lease. Shown by the well the date of initial completion, the initial report of potential, both oil and gas, the zones that the wells were completed in, Gallup is G, Dakota

is D; G-D means a commingled completion.

In two particular wells we've shown a separate test was taken on the Dakota. Those are the only two wells that were able to produce, really, any hydrocarbons from the Dakota. As you can see, four of the last five wells that we drilled, we didn't open the Dakota. It's -- it's generally very marginally productive, and I think the point to be made there is that the production that we see from these wells is -- is predominantly Gallup production, in my opinion, in this area.

The three columns on the right show the current production of the wells that we have on stream. It's, I think, interesting to note that the current production is not the same as the initial potential but I think they're related. Low initial potentials generally in this area imply a poor quality producer on sustained production. High initial potentials generally indicate natural fracturing and in most of our cases we've seen sustained production that bears that out.

The Well Nos. 10 and 11, as we see on our exhibits have gone on production since October of 1985 and the GORs that we currently measure approximately 1000 are even lower than initial potential GORs. This is perhaps solution gas/oil ratio levels and even with restricted rates, we haven't seen any -- any indications yet of

increasing GORs.

The remaining wells, as you can see, four are currently shut in and have been for several months. We've had an extremely difficult time with gas connections and gas sales in this area, periods of up to a year.

I must admit it's rather discouraging after a year of delay in production due to the gas marketing that we're restricted to 142 barrels a day. That is the case, though.

The cumulatives on these wells are not shown on Nos. 8 and 9. They're both less than 10,000 barrels, quite poor quality wells.

Nos. 10 and 11 have basically produced at or near allowable level, being shut in for periods each month, so their -- their cumulatives are approximately 30,000 barrels, are really not indicative of what they could produce.

Nos. 13 and 14 were just put on last week; are still recovering quite a bit of load water and I don't have any -- any relevant tests on those.

Based on the IP's and quite extensive initial testing, I would suspect that they will be outstanding producers.

One --

Q A couple of quick cleanup questions on

that. Obviously, the numbers on the left correspond to the numbers on our Exhibit Three, right, so that --

A That's correct, yes.

Q -- the well can be located. And on Number 13, the initial potential of 223, is that the correct figure you've got? I think there's been some indication that it was lower?

A On that particular well I think it was pointed out at the last hearing that the -- that the initial potential on the Commission's records was 36 barrels a day, which is what it was.

MR. KELLAHIN: I'm sorry, which well are we looking at?

A That was No. 13, I believe.

These wells are given large volume fracs. Some of them flow, some of them intermittently flow, some of them are put on pump.

In that particular case the initial potential of 36 barrels a day, even though it was reported, was felt by our production people to be very poorly representative of what the well's capability was.

We then initiated continued testing just in-house to determine what -- what the capability was, what size pump to put on it, and the figure of 223 barrels a day is our completion potential. So it is a far better well

than the 36 barrels a day would indicate.

Q Is there anything else you'd like to say about Exhibit Seven?

A Well, I think I might point out one thing. I think we can see from the rate, current rate of No. 10 and 11, No. 10, 224 barrels a day; No. 11, 182 barrels a day. As I said, these wells are shut-in each month for about a week and we're losing 120-some barrels a day on a daily average from those two wells.

When you place the remaining five wells on production, pardon me, six, I estimate we perhaps will have an overall restriction of possibly 800 barrels a day, which is, even at current low oil and gas prices, which we'll get to later, is a tremendous financial loss to Amoco, who has, I think, real aggressively developed this area, and to their (not clearly understood), perhaps over $300,000 a month. and based on my opinion concerning reservoirs, the well productivities, drainage, producing these wells at their capacity will in no way create any reservoir damage or waste.

Q Let's turn then to your Exhibit Number Eight. Will you identify that and explain it?

A This -- this is the first of four exhibits, and just by accident the exhibits happened to turn out to be the same numbers as the wells, so they're easy to keep

track of.

The first is just a production since October when the first well went on -- or the well first went on, of our Well No. 8, which is in the southeast quarter of Section 35.

As you can see, the initial potential, of course, we reported as 63 barrels a day. It's declined to the present rate of about, oh, 33 barrels a day. The early time production of this well I think is quite typical, indicative of lowered capacity Gallup wells in the area to the west of the -- of our area and of Gavilan. Perhaps deceptive high IPs due to natural fracture treatment continuing declining production to fairly low levels.

Q Exhibit Number Nine?

A Exhibit Number Nine is a similar plot of Well No. 9, which is in the southwest quarter of Section 35. It again, even though it IP'ed for 28 barrels a day, as we can see during the first two or three months produced slightly higher than that, but has since declined to a current rate of 13 barrels per day, and we see the same continuing decline as Well No. 8, and again indicative, perhaps, and I believe, of an area that has little, if any, enhanced fractures.

Q Number -- Exhibit Number Ten?

A Exhibit Number Ten is the production plot

of Well No. 10. That well is in the northeast quarter of Section 35. I think it's significant to note that this is just a 160-acre step out north of Well No. 8, and yet it's quite easy to see that we're not looking at the same well. We're not looking at the same pool. We're looking at a unique performance and caused entirely by, in my opinion, natural fracturing of the Gallup. The well IP'ed for 334 barrels a day. We can see each month the period of approximately one week when it was shut in to -- to balance production and maintain at 142.

If we look at the curve we can see that even if we look at the peaks, we don't see a decline in production. We see a leveling and in fact I think, perhaps, even a gradual increase in production, not -- not unusual for Gallup wells that are fractured, where clean up of possible mud during -- lost during circulation or during drilling results in improved production over the first few months.

The latest test I showed was 224 barrels a day and you can see that that's well above the 200 barrel line. It's an outstanding well, no sign of declining production, and I think without question this well is in a part of this reservoir that is benefiting from a substantial amount of natural fracturing.

And --

Q Turning then --

A And I think from the continuing high production we're going to see fairly high recoveries here for two reasons: We do have natural fracturing. The well is capable of efficiently draining a much wider area than -- than a typical well to the west in Gavilan and Ojito.

Q Capable of draining more than 40?

A In my opinion, certainly, and certainly one of the reasons on this particular lease, we haven't drilled wells any more dense than 160, it would be wasteful, and in our opinion we would see interference very shortly between wells.

The fact that we have only two wells on production, No. 10, which is in the northeast quarter of 35, and its southeast offset, which is in Section -- the southwest of Section 14, even though these wells -- or pardon me, southwest of Section 36, they're diagonal 160's, basically, they have been on for seven months. Even though somewhat restricted, you can see that they have maintained high rates when on production.

Q You're referring to Exhibit Eleven, now, Well No. 11?

A Yes, Ten and Eleven, but neither one has evidenced any decline in production. If interference were a problem we haven't seen it yet, indicating that these wells

have not yet shown any evidence of interfering with each other.

Q All right, so when you indicated that Well 10, I guess No. 10 was in a different pool. Did you mean that it had different producing characteristics than in the Ojito Pool wells, is that what you mean?

A Well, I don't think I used the word "pool". If I did, please, please back up.

I think we discussed the word "pool" and how it can be batted around. We're talking about a common source of supply here. I think Mr. Bottjer made that very clear. We can't see any differences as we proceed across this area, other than the areas that aren't developed.

The difference is the natural fracturing and the fact we must accept that wells in a common area or even in a common pool, can be capable of different drainage.

It's been accepted on the map in the Gavilan and in Puerto Chiquito that the pools have a common boundary perhaps ten to twelve miles long, and yet -- and at the hearing no evidence was presented in those two fields to show that they were separate pools. They're really not, and yet the spacing recognizes the fact that they're unique.

One has unique structural position, benefits from gravity drainage. That's the Puerto Chiquito.

Gavilan is lesser in dip; perhaps has

somewhat lesser fracturing, and isn't expected to benefit to that extent, anyway, from gravity drainage.

So different spacing in the same common source is what we're really talking about.

Q Let's turn to Exhibit Number Eleven and talk a little bit more about that well because, as was pointed out earlier, that offsets the Minel Well and there was some discussion about possible drainage or an effect of our No. 11 on the Minel Well.

Would you care to comment on that?

A Yes. At the first hearing, what, two months ago, the Minel Well was still in the process of completion and we had seen the log. I believe -- I believe the Minel representative presented a cross section; however, as Mr. Bottjer pointed out, the well was not unique; they all looked the same. So we had no idea what its potential was.

No. 11, which is located 790 feet from the south line, which would be a pattern location for 160 spacing, it is for 40, that's a legal location, that well had an IP of 232 barrels a day. We've seen that it appears to have little, if any, decline for the last seven or eight months. So a fairly good quality well, and compared to others, let's say, poorer quality wells in the -- in the Gallup and Mancos to the west, I think no doubt this is affected by some natural fracturing.

Q Do you happen to know how far the Minel Well is south of that section line?

A The Minel Well, which is, I believe it's the No. 1-NZ, is directly south from No. 11, and its reported location and PI was 1190 feet from the north line, so we're looking at 18-or-1900 feet difference between the two wells.

On a later exhibit I'll -- I'll show the initial potential on that well. It's really the only information we have about that particular well.

Q Based on those figures do you have an opinion as to whether the Amoco 11 Well would drain the Minel Well to the south?

A I don't see that adverse drainage the part of the field we're looking at is significant concern. Certainly the potentials of different wells are going to be different. We'd like to say we control them by the quality of the fracs we give them, but that's not the case. Their sustained production is related to one thing. It's how many of these fractures exist and what their extent is, and a well that has a better potential and a higher capability of producing, in my opinion, has encountered a better fractured part of the reservoir. It therefore is going to have a higher recoverable part of the oil in place. The fact that that well produces higher than an adjacent well does not in-

dicate one will drain the other. I think it indicates that each will produce its fair share of the resevoir naturally.

Q All right, and if a well is capable of draining more than a 40-acre area, is it wasteful to require 40-acre spacing?

A It certainly is. I think that is really the basis of spacing as far as economics and drainage goes.

Q Let's turn to Exhibit Number Twelve, if you would please, and would you identify that and exlain its significance?

A Number Twelve, which of course is subject to revision quite frequently, it's changed three times in the last six months, mainly due to oil prices, is a current attempt at looking at possible economics in this area.

Let me briefly review the basic assumptions. The completed well costs, which would include drilling, stimulation, lease equipment, pumping equipment, whatever might be required, approximately $650,000.

Between wells this can vary as much as 100 plus up or down, depending on particular contracts, extent of lost circulation, the type of frac, size of casing, but I think this is a reasonable average.

We've -- we've not included any sales delay, even though we've seen in our previous wells it has been a problem. A sales delay of several months has an ad-

verse effect on economics. We try to be optimistic here.

The oil price is what we're currently receiving and I have no reason to believe that it will change markedly in the coming months. It certainly has in recent months. At our last hearing we looked at $20.00 a barrel for oil and $2.40 for gas, if we can sell it.

We've also looked at what we call 100 percent success. In looking at the economics of a well we pick a certain initial rate, a certain recovery, and we assume that that's the kind of well we'll drill.

We know that's not the case and we've seen Wells 8 and 9, they're very poor wells. As we step out further to the north, we may encounter similar poor wells. That would -- that would reduce the economics. So these are optimistic.

What we've looked at is three particular production scenarios which I think are representative of perhaps many wells in the general area. The first, an estimated IP of 50 barrels a day and a recovery of 40,000 barrels of oil; not untypical of many of the wells to the west in Lindrith and Ojito.

By any stretch of the imagination today that type of well cannot be drilled economically.

At $29.00 a barrel six months ago, yes, and that's why many of the these wells were drilled. At

$20.00 a barrel two months ago, no, and presently it's not economic.

The second production scheme we've looked at is perhaps an intermediate well, one that is somewhat better than the unfractured Mancos and may be typical of many of the poorer wells in some of the these spaced fields that we're looking at. Again the economics there are quite marginal. We see a present value discounted at 15 percent of -$30,000. Even an undiscounted return on investment of 22-7, quite risky economics for any operator, with the optimism we've looked at, no sales delay, 100 percent success, and hopefully, selling the gas.

The third case that I've used is what I believe is perhaps typical of some of the wells that we have drilled on our lease, where we're looking at perhaps a 200 barrel a day initial potential, ultimate recoveries of 160,000 barrels, and I think obviously very favorable economics.

If -- if we look at spacing in a given area, whatever the geologic factors dictate, we still have to look at the legal definition of what, what area can a well efficiently and economically drain. Economics are -- are really a key in here and I think perhaps one of the reasons that the Ojito Pool, if it is a pool, has never been spaced. No operator has ever come forward recommending

spacing it. That's one of the reasons why.

MR. STAMETS: You're -- you're not casting doubt on the orders of the Division which have issued which declare this a pool and outlined the boundaries, are you?

A No, it's defined as a pool, yes; no question about that.

MR. STAMETS: Well, what do you mean when you continue to say "if it is a pool"?

A Well, if it's a pool as defined in the surrounding pools where we've -- we've seen geologic evidence that it is underlain and that some area is a reasonably spaced area. It's an unspaced area, basically, as far as evidence; that's really the only point we're making.

MR. STAMETS: Okay.

Q All right. There's been some discussion why we don't have any decline curves or pore volume figures. Why is -- why is that?

A The -- the Gallup itself, and I think there's probably real evidence in the core, it doesn't lend itself to simple pore volume calculations. The porosity of the matrix is extremely poor, perhaps in the range of 3 percent.

We're unable to calculate water saturation so it's really, I would say, impossible to present a

pore volume calculation of -- of what is the recoverable oil under 160 acres.

The other common way to relate to recoverable oil is by extrapolating a decline curve and we see the problem here on our wells, even though the Nos. 10 and 11 have been on for eight months, we don't see any decline, so I'm unable at this time to project from the decline what they will produce.

By correlation with wells that have produced two or three years in the Gavilan Pool, I believe that the 160,000 barrel figure that I've shown on Exhibit Twelve is perhaps reasonable. The determination then of what the drainage is going to be is the problem. The problem we face is really no different than the space in Gavilan. They also were unable to present any pore volume calculations. They had no decline curves on xisting wells. That's why they selected 320 acres as being what appeared to be most reasonable based on its relation to Gavilan and the pools to the west and asked for a temporary period of three years to develop the field, to drill wells, to gether pressure data, and performance data to -- to be assured what the proper drainage would be. I think that initial order was issued two years ago and the operators are still in the process of trying to answer that question.

In this pool I cannot present precise

testimony to say one well will drain 160 acres and this is the recoverable oil. Using much of what Mr. Bottjer has pointed out, we appear to see good fracturing in our area. We don't appear to see evidence of fracturing to the west. There appears to be better fracturing to the east. We feel that 160-acre spacing is perhaps more realistic.

Q Can you say with certainty that 140s are inappropriate?

A As far as 40 acre spacing, I think it would be quite inappropriate with this type of natural fracturing.

We considered the possibility of 320 drainage. The only basis we had was we have two very pool wells here, 8 and 9, so we're -- we don't know how big the area is. We haven't fully developed the area. We don't have enough history on the wells and we think that 320 spacing at this time would be too wide for this area.

Q Is there anything else you'd like to say about Exhibit Twelve before we move on?

A No, I believe that's -- that's perhaps it.

Q All right, let's turn to Exhibit Thirteen and ask you to identify that and explain it.

A In Exhibit Thirteen what we've done is just looked at the five wells to the south and west in Ojito

that are within a mile of our lease to get an idea of what types of performance they exhibit.

These are four Union Texas wells. I've indicated below each well the location. These are in Sections 1, 2, and 3 of Township 25 North, Range 3 West.

We can see from the initial potentials of the first four Union Texas wells, they were -- range from 20 to 93 barrels a day, a total of 196 barrels a day. The current production from these wells, the latest I have available, January, '86, totals 82 barrels a day, so again the wells I -- I have looked at the decline curves. They appear to be either level or declining slightly but at fairly low rates in comparison to the Nos. 10 and 11 and that we've just looked at.

The fifth well is the Minel NZ-1. That's the one that was just completed in the northwest quarter of Section 1, and its reported potential was 153 barrels a day. Quite obviously, at least a level of magnitude better than some of the others. It appears that it's perhaps getting into an area of some natural fracturing. If -- if we just go from the south to the north on this map, the well in the southwest quarter of Section 1, which is the Fred Davis No. 1, IPed for 20 barrels a day; it's currently producing 29 barrels a day.

The one to the north in Section 1, the

new Minel Well, IPed at 153 barrels a day. We don't know what its production will be but I would assume perhaps somewhere between 100 and 150 a day stabilized.

Our well to the north, the No. 11 Well, we've seen its performance. It's about a 200 barrel well.

The well one more step to the north, our No. 14, was the one that was cored and its initial potential was over 400 barrels a day.

So we -- we don't see a clear -- a clear line, but as we proceed from south to north, we go from what I see as very marginal wells to just truly outstanding wells, and I think that's related to the structural nose that Mr. Bottjer pointed out.

So the exact line is -- it's not an exact line. It's an increase in level of fracturing, in my opinion.

Q Let's turn to Exhibit Fourteen and identify that, please, and explain it.

A Basically Exhibit Fourteen was presented to give a look at what some of the older wells in the West Lindrith Gallup Pool are producing. The reason that I picked this Continental lease, it's one of the older leases, one of the larger ones, and it consists of fifty wells which have been drilled over the past 25 yearss.

The cumulative production through January

1, '85, averaged nearly 37,000 barrels per well. At the end of 1984 they were averaging 4-1/2 barrels a day, obviously nearing depletion economically. The average rate of those wells during January, 1986, was 4 barrels a day.

I've noted the gas/oil ratios on here. It's a characteristic of fractured reservoirs, as with essentially any depletion type reservoir, perhaps more with fracturing, that gas/oil ratios do increase fairly rapidly. I think the high level of these gas/oil ratios plus the low rates mean that they've essentially, they are reaching the depletion stage and perhaps 40-to-50,000 barrels of oil max will be it, and typical of the wide area to the west; currently uneconomical to drill.

Q All right. Let's try to -- let's try to hit a few points that were raised earlier and try to move along.

With respect to calculating oil in place, why don't you just sum up your thoughts on that with respect to the 4-section area?

A Oil in place in this massive Mancos section is nearly impossible to calculate. If we use 600 feet of gross section and (not clearly understood) 3 percent of porosity, we can come up with many hundreds of thousands of barrels of oil in place.

Oil in place really isn't significant be-

cause in this -- this real tight matrix we're not going to produce a lot of it.

With -- with these natural fractures the oil in the matrix doesn't have to move 1320 feet or 660 feet to the well through this very tight rock. It it can move laterally a foot or two to one of these fractures, then it can reach the wellbore, so the oil in place is not what's critical. There's plenty of oil in place in the Mancos. It's a source rock for the entire Central Rocky Mountain area. it's really what can be recovered and that's dictated by fractures and that's how we have estimated that these wells certainly will be capable of draining a wider area than 40 acres.

Q Is that what you'd call fracture porosity?

A That's correct. Fracture porosity adds to the recoverable oil. We don't know what the fracture porosity is; the more fractures, the more percentage of frac porosity.

Q All right. Why didn't Amoco space the Ojito on 160's and why have we drilled on the patterns that we have?

A I believe for the reason that none of the other operators have. There was never really enough factual information to show, one, that they would drain any particu-

lar area, or two, that they would be highly economic. It would be a difficult thing to bring in to a Commission and I think it developed like many, let's say, undesignated pools in the -- in Rio Arriba of the Gallup-Dakota. Operators drilled the wells that were required based on the size of a lease, many cases uneconomical, to hold the lease, and haven't had any incentive to drill on more dense spacing.

So neither we nor any other operator has attempted to space this pool.

Q Why did Amoco drill Wells 8 and 9 where they did?

A They were the, as is obvious, the closest wells to any known production to the southwest. The only reason they were drilled is at that time oil was essentially $30.00 a barrel and the expectations of selling gas at perhaps $3.00 an MCF. We proceeded with that drilling program and found better production to the north. So we drilled 8 and 9 basicallyl to establish some production on those leases and with the higher prices, hopefully, finding commercial production.

Q Let's try to conclude. Do you have an opinion as an expert in petroleum engineering as to what the spacing should be on Amoco's 4-section lease?

A Based on the information we have now, and I think subject to confirmation from future production, I

believe 160-acre spacing is the minimum that should be allowed now.

Q So in reaching that conclusion you considered the economics and protection of correlative rights and prevention of waste?

A Yes.

MR. LUND: I would move the admission of Exhibits Six through Fourteen and tender the witness for cross examination.

MR. STAMETS: Without objection these exhibits will be admitted.

MR. KELLEY: I'm sure the Jicarilla Reservation extends into this area but it's not identified on this map.

A Township 26 North, Range 3 West, is the only part of this map that's on the reservation. Well, all of 4 West is on the reservation also, yeah. I haven't shown the boundary on the maps.

The reservation boundary comes here. This is on the reservation and shoots across and comes down this way, so this is all the reservation.

MR. STAMETS: Are there other questions of this witness? Mr. Kellahin?

MR. KELLAHIN: Thank you.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q Mr. Boyce, the, as I understand your testimony, the criteria by which you determine if a well is to be in the 160-acre spaced area is its high initial productive rate.

A That and where we have a high sustained production on two wells, yes.

Q At this point for all but two of your wells all we have is the initial potential for those wells to determine how to space them.

A As far as production that's correct.

Q We don't have any interference tests run to determine communication between wells at varying distance, do we?

A We don't. We hope to have, and if I may comment, and that was a point that I made at the previous hearing, that certainly it was something that we had planned, and as the operators in Gavilan have planned.

In talking to our people that are expert in this field, I'll be very honest, they took one look at these two curves and said, well, we've got -- we've got two wells that produce intermittently and erratically. Interference testing is extremely expensive, the equipment and the monitoring and the calculation, and what they basically

recommended is until we get several of these wells on production and can produce them steadily so that when we want to shut a well in we can do it the way we want to, they didn't recommend any testing.

So, no, we don't have any.

MR. LUND: For clarification of the record, Mr. Boyce, when you said looking at these two curves, you were referring to your Exhibits Ten and Eleven?

A Exhibits Ten and Eleven, yes.

MR. LUND: I apologize.

Q When Mr. Greer presented his testimony on the West Puerto Chiquito Mancos spacing, that spacing case in fact was based upon interference tests that he had conducted between wells several miles apart, is that not true?

A I haven't -- really, I don't believe was working in the Rocky Mountains when West Puerto Chiquito was spaced. I'm not -- I don't recall when it was spaced. It may have been several years ago.

Q You made reference to that in your direct testimony about the way the Commission has developed spacing in the area.

A Yeah, I was referring, I think, to the Gavilan here at which Mr. -- Mr. Greer testified. I'm sorry if I mislead you.

Q At the Gavilan Mancos hearing the appli-

cation of Mr. McHugh and Dugan Production to space the Gavilan Mancos on 320 acres, that acreage in that pool was not in an existing pool at that time, was it?

A That's correct.

Q You've made reference to the downhole commingling order that Amoco obtained from the Division, it's Order R-7651, and you have talked to us about the fact that you thought the 4-section area was included in the Ojito Gallup-Dakota Pool in name only. You said that on your direct testimony.

A Yes, I was at the hearing and that was my understanding, that it was included, yes.

Q There was no qualification about the fact that that acreage was to be included in the Ojito Gallup-Dakota Pool.

A Well, maybe I don't understand what the question was.

Q Well, if you'll look at Exhibit Six, Finding Number 5, at the bottom of the page says that the Ojito Gallup-Dakota Pool should be extended to include these sections, these sections meaning the four Amoco sections.

A That's correct.

Q And that occurred by this order, didn't it?

A Yes it did.

Q Did Amoco take any appeal of this order?

A No, we didn't. It served the same purpose, basically, so we certainly didn't object.

Q The Division rules define a pool to mean any underground reservoir containing a common accumulation of crude petroleum ore or natural gas, or both. Do you have any disagreement with that definition of a --

A No, --

Q -- pool?

A -- none whatsoever.

Q Are there any other engineering factors or data available to you, Mr. Boyce, by which you can determine what the well spacing should be for this area, other than the high initial potential rates?

A The high initial potential rates are one indication. The sustained high production of 10 and 11 is another. The comparison of -- of the potentials and sustained production with other areas to the east where there is more performance and there has been wider spacing, and including both Puerto Chiquito and Gavilan, and I guess more -- more positively our one look a the core which really confirms what -- what we and the other experts here suspect, that natural fracturing is present and a naturally fractured reservoir is capable of wider drainage than the same reservoir that is not naturally fractured.

Q If we look at Exhibit Number Seven, the range of initial potentials from your wells that you propose to space on 160 acres varies from 28 barrels a day to 454 barrels a day.

A Yes.

Q And within that range, then, if a well has that initial potential do you propose to space it on 150 acres?

A That would refer to Wells 8 and 9, or let's say No. 9, which was the 28 barrel a day well.

Q Well, I meant the range from 28 to 454.

A Right.

Q That's the whole spectrum, isn't it?

A That's -- that's correct.

Q All right. Within that range then you have proposed that all these wells be spaced upon 160 acres.

A That's correct, and for one reason that overlies that change is that those wells happen to be on -- the two poorer wells on the one particular lease and in our opinion it would perhaps be more realistic to include them since we ourselves would control development and see the economics than to, let's say try to -- try to split hairs and exclude them and possibly go around our lease and -- and only go 160 as far as the boundary goes beyond a proven well. We would have then a spaced area. It would be a very

strange shape and I really don't think that's -- that's appropriate.

By including those wells we don't adversely affect anyone and I would agree those wells are poor quality and I don't believe they will drain 160 acres, and I assure you we won't drill anly other offsets to those on 40's, so that's the reason we did it. It's not an attempt to confuse. It was just a kind of a practical matter.

Q Is your testimony on direct, Mr. Boyce, the same testimony you gave back in February 5th; the same conclusions you reached then you're reaching now?

A I believe so, yes.

Q The only modification that I'm aware you proposed is that you would delete the buffer zone, the half mile buffer zone, only insofar as it affects the sections immediately to the south?

A That's correct. At that hearing we lacked one bit of information. We didn't know the quality of the Minel well. We did have a feeling that the boundary perhaps should be a straight line to the south of our lease, which I still think is practical. Possibly the Minel Well should be spaced on 160's. The only thing I have at this time is an IP. I think they need additional data.

We ran into a tremendous amount of opposition and I can see why. We're talking about a pool --

Q I don't mean to interrupt you, Mr. Boyce, but I think you and I will get throught this quicker if you'll answer my question.

A Okay, I'm sorry.

Q Just confine your answer to the question, which was the change has been a deletion of the buffer insofar as it moves to the south.

A Well, not on the application. We verbally expressed that, that we would be willing to eliminate any buffer to the south.

Q And that's your position right now?

A That's correct.

Q All right. We would still have the half mile buffer surrounding the 4-section lease on the north, south -- I mean the north, east, and west?

A I believe in the interest of preventing the drilling of unnecessary wells that that still should be a recommendation, particularly -- well, I'm answering my own question.

Q Yes, sir, my question was whether or not the application still proposes the half mile buffer on the other three sides and I guess the answer was yes.

A That would be correct.

Q All right. How is the Commission going to determine, based upon initial potentials, whether wells

within that buffer area are going to be included in your pool?

A I don't think that's necessary.

Q You have --

A Whatever --

Q You've classified your wells for the 4-section pool based upon some initial potentials.

A That's correct.

Q That range from 28 barrels a day to 454.

A That's correct.

Q Now, if a new well is completed in the area of influence, that half mile buffer, if it comes in at what initial potential would cause you to classify it either on -- within this pool or not?

A I don't think initial potential really is -- is a factor. It's really not in any buffer zone including the statewide one mile. I guess I would answer by saying any well drilled within the buffer would be spaced on 160, and produced on a 160, regardless of its potential.

That's really not a -- not a fact that's determined in buffer zones.

Q Do you use initial potentials in any kind of reserve calculation?

A If we have nothing else, we have to use them as the only source of information. It's certainly a

weak point to use if that's the only one we have.

Q In your experience before the Commission, Mr. Boyce, are you aware of the Commission ever spacing any other pools based upon initial potential?

A I can't say that they have or haven't. I many new pools that's basically the only information that's available.

Q Do you have a copy of your Exhibit Number Five from the February 5th, 1986, hearing?

A Let me see what -- no, I don't have one with me, no. I think -- was that the well data summary for --

Q Yes, sir, in which you identified for us --

A -- for our pool.

Q -- some current producing rates on the wells?

A Yes.

Q All right.

A That was on our Apache 118 Lease?

Q Yes, sir. Same wells that are on Exhibit Number Seven.

A Yes.

Q You've revised Exhibit Number Seven for today's hearing to update it?

A That's correct.

Q On Well No. 8 you show current production on today's exhibit of 33 barrels a day?

A Yes.

Q On the February 5th exhibit you showed the current production then for that well at 42 barrels a day? Do you have an explanation for the decline in the last two months on that well?

MR. LUND: Could the witness see the exhibit being referred to?

A (Not clearly understood) please. I'd say, let's see, the hearing was in January?

Q February, I believe.

A February. The production data we had was perhaps a month delayed.

This says the current production was 42 barrels a day and if we look a the curve, the current curve, 10, 20 --

MR. LUND: Which is on exhibit number --

A On Exhibit Number Eight. December, 20, 30, 40, it looks like through the -- through the latter part of December the well averaged in the mid-forties, so the best answer I can give is when I prepared this exhibit for the February hearing, I had available the December produc-

tion.

Q All right, sir, for the No. 9 Well what was your testimony in February on its current production?

A Let's see, No. 9, now this is Exhibit --

Q Five?

A -- Five from the previous hearing. It showed 17 barrels of oil per day.

Q And you show that production now at 13?

A That's its -- that's its general range, yes.

Q All right, the No. 10 Well was shown to be what in February?

A And let me look, if I can, on No. 9 where I got that. Again it appeared, probably the latter part of December was the data I had at that time.

I'm sorry, the next one?

Q Yes, sir, the No. 10, what was your February exhibit's indication of current production on that well?

A It said 277 per day.

Q And what do you show to be the current production now on today's exhibit?

A Well, let's see, on -- on Exhibit Seven it's 224.

Q All right, sir, and for Well No. 11 your

February exhibit showed what to be the current production rate?

A Eleven showed 192.

Q And today's exhibit is 182?

A This is 182, yes.

Q Is there any relationship between the initial producing rates and subsequent production or decline, declining productions in these wells?

A The initial potential of these wells is a one day test which is taken out of a period of continuous testing and that's really the only significance. It's not really representative of what a well will produce. It's indicative of a range, so I guess the best I can say is a higher initial potential on these wells will perhaps indicate a somewhat higher stabilized rate; not the initial potential but higher than the -- a comparable well that isn't fractured.

Q Let's look at the Amoco No. 11 Well, if you please, Mr. Boyce. In the immediate 40-acre offset in Section 1, which is the Minel Well?

A Yes.

Q All right, sir. The Minel Well on 40 acres would have what allowable assigned to it?

A The -- the allowable for Ojito Gallup is 142 a day. That was based upon, I think, as the standard

is, the top perforation in the discovery well.

Q Do you have an opinion at this time, Mr. Boyce, as to whether the Minel Well is going to be communicating with the No. 11 Well?

A Based on my estimate right now, will it be communicating?

Q Yes, sir.

A Perhaps over a period of time. I don't have any -- any completion information on that well; don't have any bottom hole pressure. It's in a better part of the reservoir.

Q They're only 40 acres apart.

A Well, not exactly 40 acres apart. The No. 11 is 790 feet from the line which is the maximum distance that a well can be drilled from a line on a 40-acre tract, I believe.

The No. 1 NZ is 1190 feet from the north line. It's -- it's even further south than can be legally drilled, so it must be an exception.

So there's a considerable amount of distance between those wells and considering the fact that they -- they are in the 150 to 200 barrel range, I wouldn't anticipate any -- any adverse communication for a lengthy period of time.

Q What will be the allowable assigned to

the No. 11 Well if that acreage is spaced upon 160 acres?

A I think the top allowable would be 382 a day; of course limited by the well's capacity to produce right now.

Q What do you anticipate to be the gas/oil ratio limitation, if any, that would be applied to the 4-section area?

A I believe the standard that the Commission imposes is 2000 cubic feet per barrel. I -- quite interestingly, I notice that in the Gavilan Pool the -- the parties that -- that proposed the spacing didn't recommend a gas/oil ratio limitation, and I'm certain I don't see one in the order, but it is imposed, I notice, from production, so it may be a statewide standard, if none is requested, 2000 is standard, and I fully agree with that.

Q With regards to the Minel Well and Amoco No. 11 Well, if the Amoco acreage is on 160 acres and the Minel acreage stays on 40 acres, there will be a disparity in the allowables that control the producing rates on each of those wells.

A That's right, if the wells are capable of producing their allowable there would be.

Q Let me ask you with regards to the information on your Exhibit Number Seven, today's hearing, the No. 9 Well once again shows an initial potential of 28 bar-

rels?

A That's correct.

Q Where did you get that number from, Mr. Boyce?

A I took that from the PI report of well completion, which I have copies of here so I could refer to it, and I assume that is -- was taken from the completion report filed with the Commission. We have no reason to suspect it wasn't.

Q Are Amoco's reports prepared at 501 Airport Drive, Farmington, New Mexico, and signed by B. D. Shaw, the Administrative Supervisor?

A Yes, I believe they are.

Q And who is Mr. Shaw?

A He's our District Administrative -- one of our District Administrative Supervisors.

Q And he completes and files on behalf of Amoco the Form C-104?

A Yes. He approves the completion by one of his staff members, yes.

Q I show you a copy of the Commission C-104, which we've marked as Exhibit One-A to this hearing. The second page of that form, Mr. Boyce, indicates potential for this well not at 28 barrels but 275 barrels. I show you that report.

A Yes, it does.

Q Do you have any explanation for the difference between Mr. Shaw and your report of the potential for the well?

A As far as the factual data, right now I can't, but I think I can explain it, and it really refers to something I previously mentioned.

These wells are perforated over a large gross interval. They're treated with a very high volume water fracture treatment propped with sand. They -- they undergo substantial testing; in this well we opened both the Gallup and Dakota. Depending on how long the well has been pump tested, or whether it pumped or flow tested, and I note that this particular well, even though it indicates pumping on this 275 a day test, the -- and that was an 18-hour test -- the casing pressure was 450 pounds, tubing pressure, 150, and the choke size was 32/64ths, a fairly high GOR of 713, this was, I think, an early test, during the early stages of testing when this well was perhaps unloading, pumping, flowing, and I won't say it wasn't representative, it's perhaps much more representative than many initial tests durign that critical period.

I believe that the current production of the well, as we see on the production curve, and that's irrespective of that 275 a day rate, is more indicative of the

true capacity of the well.

So, yes, that does say 275. It was one 18-hour test.

The 28-barrel a day well, let's -- let's look at the dates. That's probably the clue.

This well was reported as being tested on, let's see, 3-10-85. It says the first (not clearly understood) went to tanks in March, so there was a period there of intermittent production, and during any given day that the well might have been produced intermittently, it could have varied from the 28 a day to the 275.

So there are two different rates on perhaps two different days, and I can't explain it further.

Q You'd asked us in --

MR. STAMETS: Excuse me, Tom, how much more of cross do you anticipate?

MR. KELLAHIN: Three or four minutes, Mr. Stamets.

MR. STAMETS: Fine.

Q Mr. Boyce, you've told us in February that you were requesting the Division to make the spacing rules permanent. Is that your request today?

A No, it's not.

Q Do you have a recommended period of time to make these rules temorary?

A Since our first hearing I've had an opportunity to discuss performance in Gavilan with many of the operatorss. They were given a 3-year temorary period 2 years ago. They have continued to develop. They are in the process now of planning much of the gathering of data to really answer that question.

I believe perhaps a 3-year period would be appropriate. If the Commission should determine less, I certainly wouldn't object.

Q What has caused you to change your opinion from February to now?

A We have a little more information about our pool, two or three months more production. As I indicated, we have, both geologically and productionwise, been able to discuss with the Gavilan owners what -- what their data gathering plan is, and I feel now that perhaps a temporary period would be more appropriate. I've changed my mind in that regard.

Q Do you have sufficient information yet available to you to make reliable drainage calculations?

A No, I don't.

Q Would you have any opposition to a provision in the order that would preclude the Amoco wells that are immediately north of the common township line with the Minel and Union Texas acreage, we're looking at Wells 8,

9, 11, and 19. Would you have any objection if, in order to get 160-acre spacing approved, that the allowables for the Amoco wells be set for those wells at 40 acres?

A That would be for the four wells along the southern tier?

Q Yes, sir.

A Or, well, two wells; 8 and 9 are really not capable of that type of production.

At this time I see no reason for it. One reason is the present production of Well No. 11, which even though not declining substantially, is -- is less than 200 barrels a day. I think my latest test was 182 a day. And these rates on 10 and 11 are a little bit higher than they would be if we were allowed to produce full time. Now these wells are shut in for a week each month. Reservoir pressure is allowed to build up so the production the other three months is slightly higher than it would be.

If indeed we are granted 160-acre spacing, and a high enough allowable that this well, No. 11, could produce full time, I would suspect that within a period of two to three months we would not be substantially above the 140 barrel allowable.

Q So you don't see any reason, then, to --

A At this time I don't.

Q You don't see any reason, then, that

those four wells should receive more than a 40-acre allowable.

A No, no, I didn't say that. I said that in the case of No. 11, within a reasonable period of time I don't believe it will be producing substantially over that allowable. So in that one case it wouldn't be an necessity.

We see quite a -- quite a different situation for No. 19, which is in the southeast quarter of Section 36. It's IP is fairlyl high, 310 a day, whatever that means. It indicates that perhaps a good quality well. We expect to have that well on production in three or four months.

In -- in my previous testimony I think I pointed out that the productive potential of a well is indicative of the, in this area, the natural fracturing in that area. No two wells are going to produce equally. The better well is in a better part of the reservoir and it's capable of recovering more oil from its drainage area.

So I don't see that the fact that two offsetting wells have different potential means that they should be allowed to produce the same.

Q I'm suggesting a way to maintain the status quo while we continue to develop further information with interference tests or whatever you want to do.

Would not a restriction on those four

wells that immediately offset the balance of the pool limiting them to 40-acre allowable, at least be one method by which the status quo is maintained?

A Well, it would be one if status quo, meaning the two offsetting wells should produce the same rate, is appropriate. I think we've seen the same thing in No. 19 as we see in 10, a substantial shut-in period each month, a lack of the possibility of gaining any reservoir information, and I really don't believe that drainage is going to result from the two offsetting wells having different production capabilities. It's -- it's not a recommendation of mine.

If the Commission should see fit to equalize that, I can't object at this time, although I think it should properly be a matter of another hearing, really, if that is a request of the owners to the south of us.

MR. KELLAHIN: I've used my time. Thank you.

MR. STAMETS: We'll recess the hearing until 1:15 and if you have trouble with lunch, we won't start before the participants are here, so we'll give you an extra fifteen minute period because sometimes it's hard getting served.

(Thereupon the noon recess was taken.)

MR. STAMETS: The hearing will please come to order.

Mr. Pearce, as I understand it, you have something you wish to inject at this point.

MR. PEARCE: Thank you, Mr. Chairman.

During the recent break the parties to this proceeding have conducted some discussions. Subject to the Commission's approval we believe we have amicably settled this dispute.

The parties propose the creation of a pool to be known as the Northeast Ojito Gallup-Dakota Pool; that for -- that temporary rules be adopted for that pool to include 160-acre spacing; that well locations be specified as being 790 feet from the section lines and 330 feet from the quarter quarter section line; that the temporary rule period be two years; that the four wells which have been previously drilled by Amoco within this area, which are numbered, if I can find them, 8, 9, 11, and 19, which have previously been discussed, will be by agreement of the parties restricted to a production level equal to the 40-acre allowable during the term of these interim rules.

We would propose additionally

that normal statewide rules apply on the north, east, and west sides, so that a buffer of one mile would be adopted for that; that there be no additional buffer to the south, which, if the parties so choose, would allow development on a 40-acre spacing to the south.

The parties have discussed the necessity of the development of additional information in this area. There is general agreement that there is not nearly as much reservoir information at this time as we would all like to have. The parties have agreed to do everything they can during this two year period to share the information developed by any of the parties from wells in that area so that at the end of the temporary period the Commission can be most appropriately advised of the proper spacing on the Northeast Ojito Gallup-Dakota Pool.

As I say, this agreement has been made subject to approval by the Commission. At this time I think it's appropriate for opposing counsel to clarify anything or add anything which he thinks I haven't covered.

MR. KELLAHIN: Mr. Chairman, my clients, Union Texas Petroleum Corporation and Minel, Inc., concur in Mr. Pearce's statement of the proposed settlement of this matter at this time. It's understood and agreed that the Ojito Gallup-Dakota Pool rules, the 40-acre spacing

shall apply to that acreage south of the common township line.

The statements that Mr. Pearce has made are complete and accurate. Apart from those statements the parties have in fact agreed to share reservoir and productiion data so that at the end of the two year period we will come back before you and, hopefully, have sufficient information from which to decide how to share the production and what the spacing ought to be.

MR. STAMETS: Do you have any objection, Mr. Kelley?

MR. KELLEY: I have no objection.

MR. STAMETS: Mr. Pearce, if you will draft up an appropriate order for the Commission which contains those provisions and appropriate supporting findings, the Commission then will approve of an order which does basically that.

I would also note that that order should have the allowable, maximum allowable for the pool to be based on the maximum allowables set out in the rule, I believe it's 505, and the gas/oil ratio should be statewide, 2000-to-1.

This case is taken under advisement pending issuance of such an order.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C.S.R., DO HEREBY CERTIFY that the foregoing Transcript of Hearing before the Oil Conservation Division (Commission) was reported by me; that the said transcript is a full, true, and correct record of the hearing, prepared by me to the best of my ability.

Sally W. Boyd CSR