STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING:

APPLICATION OF POGO PRODUCING COMPANY

CASE NO. 10,870

ORIGINAL

REPORTER'S TRANSCRIPT OF PROCEEDINGS

EXAMINER HEARING

BEFORE: DAVID R. CATANACH, Hearing Examiner

January 20th, 1994

FEB 22 1994

Santa Fe, New Mexico

This matter came on for hearing before the Oil Conservation Division on Thursday, January 20th, 1994, at Morgan Hall, State Land Office Building, 310 Old Santa Fe Trail, Santa Fe, New Mexico, before Steven T. Brenner, Certified Court Reporter No. 7 for the State of New Mexico.

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I N D E X

January 20th, 1994
Examiner Hearing
CASE NO. 10,870

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E X H I B I T S

Applicant's	Identified	Admitted
Exhibit 1	9	13
Exhibit 2	11	13
Exhibit 3	12	13
Exhibit 4	15	24
Exhibit 5	16	24
Exhibit 6	18	24
Exhibit 7	19	24
Exhibit 8	19	24
Exhibit 9	21	24
Exhibit 10	21	24
Exhibit 11	22	24
Exhibit 12	29	44
Exhibits 13A-B	30	44
Exhibit 14	32	44
Exhibit 15	32	44
Exhibit 16	33	44
Exhibits 17A-K	34	44
Exhibit 18	34	44
Exhibit 19	38	44
Exhibit 20	40	44

E X H I B I T S (Continued)

Applicant's	Identified	Admitted
Exhibit 21	41	44
Exhibit 22	42	
Exhibit 23	61	66
Exhibit 24	62	66
Exhibit 25	62	66
Exhibit 26	62	66
Exhibit 27	62	66
Exhibit 28	62	66
Exhibit 29	62	66
Exhibit 30	63	66
Exhibit 31	63	66
Exhibit 32	77	

* * *

Kaiser-Francis	Identified	Admitted
Exhibit 1	85	88
Exhibit 2	87	88
Exhibit 3	99	116
Exhibit 4	99	116
Exhibit 5	102	116
Exhibit 6	106	116
Exhibit 7	107	116
Exhibit 8	109	116
Exhibit 9	113	116
Exhibit 10	115	116
Exhibit 11	116	116

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A P P E A R A N C E S

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* * *

WHEREUPON, the following proceedings were had at 11:12 a.m.:

EXAMINER CATANACH: At this time we'll call Case 10,870.

MR. STOVALL: It's the Application of Pogo Producing Company for special pool rules for the Los Medanos-Delaware and West Sand Dunes-Delaware Pools, Eddy County, New Mexico.

EXAMINER CATANACH: Are there appearances in these cases?

MR. BRUCE: Mr. Examiner, Jim Bruce from the Hinkle law firm of Santa Fe, representing the Applicant.

I would also like to enter an appearance on behalf of Santa Fe Energy Operating Partners, L.P.

I have several witnesses from Pogo.

EXAMINER CATANACH: Additional appearances?

MR. CARROLL: Mr. Examiner, I'm Ernest Carroll of the Artesia law firm of Losee, Carson, Haas and Carroll, and I'm appearing today on behalf of Yates Petroleum Corporation.

Yates Petroleum has no witnesses and does not intend to examine any of the witnesses, but it is making its appearance.

EXAMINER CATANACH: Okay. Additional appearances?

MR. KELLAHIN: Mr. Examiner, I'm Tom Kellahin of the Santa Fe law firm of Kellahin and Kellahin, appearing on behalf of Kaiser-Francis Oil Company, and I potentially have two witnesses.

EXAMINER CATANACH: Additional appearances?

Okay, there being none --

MR. STOVALL: Recess until whenever.

EXAMINER CATANACH: Okay, we'll go ahead and recess at this point till about 12:30 or so.

(Thereupon, a recess was taken at 11:13 a.m.)

(The following proceedings had at 12:30 p.m.)

EXAMINER CATANACH: Okay, at this point we'll call the hearing back to order, and I believe we've already called for appearances in this case, Case 10,870, so at this point in time I guess we need to swear the witnesses in.

Let me do that.

MR. BRUCE: Okay, before we begin, Mr. Examiner, I've been informed there's a gentleman here from American Energy, and he'd like to enter his appearance.

EXAMINER CATANACH: Okay.

MR. DIEM: My name is Fred Diem. I'm general counsel at Merit Energy Company.

EXAMINER CATANACH: I'm sorry, your last name, sir?

MR. DIEM: Diem, D-i-e-m.

EXAMINER CATANACH: Merit Energy --

MR. DIEM: -- Company, yes, M-e-r-i-t.

EXAMINER CATANACH: Okay. No witnesses?

MR. DIEM: No witnesses.

EXAMINER CATANACH: Can I get all the witnesses to stand at this time to be sworn in?

(Thereupon, the witnesses were sworn.)

EXAMINER CATANACH: Mr. Bruce, you may proceed.

MR. BRUCE: Call Mr. McDaniel to the stand.

R. SCOTT McDANIEL,

the witness herein, after having been first duly sworn upon his oath, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. BRUCE:

Q. Will you please state your name and city of residence, please?

A. Yes, my name is Scott McDaniel, and I live in Midland, Texas.

Q. Who do you work for and in what capacity?

A. I'm employed by Pogo Producing Company as a landman.

Q. Have you previously testified before the Division as a landman?

A. Yes, I have.

Q. And were your credentials accepted as a matter of record?

A. Yes, they were.

Q. And are you familiar with the land matters involved in this Application?

A. Yes, I am.

MR. BRUCE: All right, Mr. Examiner, I'd tender Mr. McDaniel as an expert landman.

EXAMINER CATANACH: He is so qualified.

Q. (By Mr. Bruce) Briefly, Mr. McDaniel, what is it that Pogo seeks in this case?

A. Pogo seeks an 8000-to-1 GOR in both the Los Medanos-Delaware and the West Sand Dunes-Delaware Pools.

Q. What is the depth bracket allowable in both pools?

A. The depth bracket allowable for both pools is currently 187 barrels a day.

However, because of the 2000-to-1 GOR that currently exists in both pools, many of the wells that are located within the pool may be or have been restricted.

Q. Okay. Would you refer to Exhibit 1 and identify it for the Examiner?

A. Yes, Exhibit 1, here to my left, is a plat on which is shown the Los Medanos-Delaware Pool, there in red, and the West Sand Dunes-Delaware Pool there in blue.

However, I might point out that it's my understanding that some additional acreage has been added to both pools recently. And the outline in green there, the darker outline around it, represents the notice area which extends out one mile from each of the pools.

But even with the additional acreage that has been recently included in both pools, proper notice has been given to all of the pertinent operators there.

Q. The recent additions to the pool boundaries would require you to notify, if I'm correct, the people in Section 6 in the northwest corner of this map; is that correct?

A. Yes, that's correct.

Q. And then Section 10 in the southeast corner of this map?

A. Yes, that's correct.

Q. Okay, and we'll get to that a little bit more in a minute.

A. Okay.

Q. What are the discovery wells in those pools?

A. For the Los Medanos-Delaware Pool, the discovery well was the Yates Madonna VA Well Number 1, which is located in the northeast of the southwest of Section 16. And the West Sand Dunes-Delaware Pool, the discovery well is the Pogo-operated Mobil Federal Well Number 1, which is

located in the northwest of the southeast of Section 29.

Q. Okay, looking at Exhibit 1, does this identify the operators or lessees within a mile of the pool and within the pool boundaries?

A. Yes, it does. The operators that -- The operators with the largest number of completed wells within the pools are currently Pogo, Yates, Santa Fe and Merit.

Q. Okay. Now, did you give notice to all of the people identified on Exhibit 1?

A. Yes, we did.

Q. And is Exhibit 2 your affidavit of notice containing the letters and return receipts?

A. Yes, it is.

Q. Now, you mentioned these additional notice areas. Who owns Section 6, 23 South, 31 East?

A. Section 6 is operated by Bass Enterprises.

Q. And you had given them notice regardless?

A. Yes, that's correct. Bass Enterprises operates other acreage there within the notice area that's indicated on the map.

Q. Okay. And then in Section 10 of -- Is it 24 South, 31 East?

A. That's correct.

Q. Who does that belong to?

A. Bettis, Boyle and Stovall out of Graham, Texas.

Q. And you had given notice to them too?

A. That's correct.

Q. Do any operators in the pool support Pogo's Application?

A. Yes, in fact, Exhibit 3 contains copies of the various letters of support that we have obtained, and they include all operators within both the pool and the notice area, except for three, one of which was Enron, who provided us with a letter stating that they do not object to our 8000-to-1 GOR Application, another being Meridian, who operates no wells within either of the pools, and they have little or no data to evaluate the situation, and the last being Kaiser-Francis.

Q. Okay. In this general area, your notice area, what type of acreage do you have? Who owns it?

A. Primarily it's federal and state.

Q. Okay.

A. The majority of the acreage is in fact federal.

Q. What type of royalties do we have on the federal leases?

A. The federal leases, some -- Well, in fact, the majority of the federal leases in this area provide for a step-scale royalty, which basically means that anything 50 barrels or less would provide for a royalty of 12 1/2 percent, and anything 400 barrels or more, 25 percent, and

there's increments there in between.

Q. What -- At the depth bracket allowable for these pools, 187 barrels a day, what is the royalty rate?

A. The royalty is 20 percent. That extends for a production arrangement from 150 barrels a day up to 200 barrels a day.

Q. Were Exhibits 1 through 3 prepared by you or compiled from company records?

A. Yes.

Q. And in your opinion is the granting of this Application in the interests of conservation and the prevention of waste?

A. Yes.

MR. BRUCE: Mr. Examiner, I would move the admission of Exhibits 1 through 3.

EXAMINER CATANACH: Exhibits 1 through 3 will be admitted as evidence.

Mr. Kellahin?

MR. KELLAHIN: No questions.

GARY HOOSE,

the witness herein, after having been first duly sworn upon his oath, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. BRUCE:

Q. Would you please state your name for the record?

A. My name is Gary Hoose.

Q. Who do you work for and in what capacity?

A. I work for Pogo Producing Company as division geologist in the Midland office.

Q. Have you previously testified before the Division as a geologist?

A. I have.

Q. And were your credentials as an expert geologist accepted as a matter of record?

A. They were.

Q. Are you familiar with the geology involved in this Application?

A. I am.

Q. And your area of responsibility includes southeast New Mexico?

A. Yes, it does.

MR. BRUCE: Mr. Examiner, I would tender Mr. Hoose as an expert petroleum geologist.

EXAMINER CATANACH: Could you spell your last name for me please?

THE WITNESS: H-o-o-s-e.

EXAMINER CATANACH: Mr. Hoose is considered qualified.

Q. (By Mr. Bruce) Mr. Hoose, would you refer to Pogo's Exhibit 4 and describe the interval that we're

looking at in these two pools?

A. Exhibit 4 is a type log for the West Sand Dunes area. It is the Pure Gold "D" Number 4 located in the southwest of the southwest of Section 28 of 23 South, 31 East of Eddy County.

We've located at the intersection of two cross-sections, which we'll be showing just a little bit later here. Also, it's located in the thick trend of what we consider to be the main Brushy Canyon Reservoir, as will also be shown.

In this particular well and in the area, there's approximately 3800 feet of Delaware Mountain Group section, which is primarily sand and shale, though there are some interbeds of lime and dolomite. The formations in the Delaware Mountain Group in descending order are the Bell, the Cherry and the Brushy Canyon.

In this particular well, the Bell Canyon is located at 4160, Cherry Canyon 5062, Brushy 6365. And also marked on this type log are the overlying basal anhydrite at 3935 and the underlying Bone Spring formation at 7966.

We are in this hearing primarily concerned with the Brushy Canyon formation. I would note that all three of the Delaware formations are currently producing in the field, with most of the production coming from the Brushy, and we'll touch on that briefly from time to time during

this hearing.

Q. Okay.

A. I'll move on, I think, to the Exhibit 5, if I might, which is this east-west cross-section hanging here. I will make mention that the next two exhibits are the most cumbersome ones we have, so it ought to go a little more smoothly after that.

If I might, this cross-section goes from the lower part of the Cherry Canyon down to the upper part of the Bone Spring, and one thing I would ask you to note is that there are perforations here in this Pogo Mobil Federal Number 7, in the bottom Cherry Canyon zone, and I'll refer to that later, so you might just keep that in mind.

On this cross-section in the Brushy Canyon, we have subdivided it, and this is based on regional correlations of the entire New Mexico portion of the Delaware Basin, subdivided it into seven units which we've labeled A through G, A being at the bottom, and climbing up through G at the top of the Brushy.

We are primarily concerned with the lowermost Brushy Canyon, which is the A unit. Within that unit we have further subdivided that into what we call the BC-1 through the BC-6, again with the BC-1 being at the bottom part of that A sequence and the BC-6 being at the top.

And one further note on that. On these two

cross-sections which I'll show today, the BC-1 is not labeled. We have not tried to split that out from the BC-2. So on this exhibit and others that follow where it just says BC-2, that is BC-1 and -2 lumped together.

In this area, a lot of perforations are in that BC-1/2 interval. That is one of the producing units. We believe that the primary producing unit is in what we call the BC 4, which overlies that unit.

You might notice that some of the wells have been perf'd in both the BC-2 and in the BC-4 and have been frac'd. Other wells have just been perforated in the BC-2; however, the frac designs have taken into account frac'ing into the BC-4. So although they're perforated in the BC-2, the fracs have been designed to reach up into the BC-4, and we expect in these wells that both the -4 and the -2 and perhaps some of these other units are producing. And I say that because probably all of the BC-2 through the BC-6 are capable of production.

I mentioned a moment ago that these wells were frac'd. All of the wells in the pools have been frac'd, and it's necessary. I'm not aware of any Brushy Canyon wells that are commercially productive that have not required a frac to produce.

This is a fairly tight reservoir. It may be difficult to see. Certainly between some of these

reservoir units the porosity is lacking, and there are very -- It's a very tight section, even within what we consider the main reservoir units. Permeability is not very high.

In fact, there are several things that are restricting permeability. Laminations within the formation, shale interbeds within the formation, cementation varies from place to place within the formation, and this can be seen in cores that have been taken through the particular interval.

Q. Is the Lower Brushy Canyon continuous across these two pools?

A. It is.

Q. Could we move on to your Exhibit 6?

A. Exhibit 6 is a north-south cross-section through the area. I may mention that on both of the cross-sections the red which has been colored in and the reservoirs -- and it's only been colored in for the BC-2 and the BC-4 -- but it represents those areas, those sections that have porosity greater than 14 percent as seen on the density log.

I do not suggest here that porosity lesser than 14 percent will not contribute. I merely show this to illustrate where the thickest reservoir is, and in this case the reservoir is thicker and better developed on the north end with diminishing quality as we come down to the

south end.

Also, I might point out that the next couple of exhibits which I show will be structure maps, and there will be a structure map on the top of the BC-2 interval and another structure map on the top of the BC-4 interval.

Q. Is there any geological basis to treat these two pools separately?

A. There's not.

Q. Okay, let's move on to your Exhibit 7 and 8. Just a second while we put those up, Mr. Examiner.

Go ahead, Mr. Hoose.

A. Okay, thank you. Exhibit 7 is the structure map on the BC-2. Exhibit 8 is the structure map on the BC-4. I would point out that they are essentially similar. Also on each of the maps, the contour interval is 20 feet and the lines of cross-section have been posted.

The other thing I might note is, development continues in this area and so there are some logs which I do not have.

Over in the Ingle Wells area, which is not the subject of this hearing and discussion but is off to the east, there are one or two logs that I don't have that are not, therefore, posted on this map.

Similarly, at the very north end of Los Medanos there may be a well or two that's been -- or several wells

that have been drilled in Section 9, in particular, I believe, that I don't have logs for. And in the Quahada Ridge field I know there are several logs that I don't have.

However, I would point out that there's an abundance of control on here and that with those logs I do not expect the picture to change appreciably.

Further, in the main area of discussion and interest today, from the north end of Sections 16 and 17 on to the base of the map in the field areas, I believe I have all of the logs for all of the wells drilled, and they're all posted and all of the information from those is posted on these maps.

The main points from the structure map, on both, updip is to the west, downdip is to the east. The rate of dip across here is generally less than or equal to one degree across the area.

Prominent features include structural nose, east-west structural nose coming across the mid-part of the map here and across the two fields with a probable closure on the west side of the Sand Dunes field.

Q. Okay. Have you seen any geological evidence of an oil/water contact in these two pools?

A. I have not.

Q. Is there any log evidence of a gas cap?

A. Not that I'm aware of, no.

Q. Okay, let's get your Exhibits 9 and 10 put up and discuss those, please.

A. Exhibit 9 is an isopach of the BC-4 interval. This is net sand with a porosity, again, greater than 14 percent, based on the density. It corresponds to the cross-sections that were hung moments ago.

Exhibit 10 is similarly an isopach of the BC-1 and -2 net sands with similar parameters. The sands are again shown to be continuous north to south.

I will start with a discussion of Exhibit 10 first, being BC-1 and -2. This section was a little bit difficult to map; there's room for varying interpretations. I think the interpretation that I'm most comfortable with and that's reasonable shows two main trends of sand, again coming north to south with some sand in between those two main trends. If I was to map this on a slightly lower porosity cutoff, say 12 percent, the sands would be continuous with no zero points, as far as I'm aware, anywhere on the map.

The BC-4 was very easy to map, and it's very consistent, down across the area shown in very thick section to the north as we've seen on the cross-section a few moments ago, thinning down as we come to the south. And again, the type log was at the intersection of these

two cross-sections.

Q. Now, you've got on the east side of each map wells from the Ingle Wells-Delaware Pool. What zone does that pool produce from?

A. On this map I have, again, only contoured the areas of the fields in question. However, not only with this Ingle Wells but with the Quahada Ridge area, I have posted the isopach values. The sands that produce from the Los Medanos-Sand Dunes areas are also the sands that produce in Quahada Ridge, which is a fairly new field, and in the Ingle Wells-Delaware field.

I don't know much about the GOR up in Quahada Ridge. It's very new. We don't have a working interest there, and I don't have information on that.

In the Ingle Wells field, we do have a working interest; we're one of the primary operators there. Those wells start out near the 2000-to-1 GOR. Similarly, they have climbed up to 4000 to 5000-to-1 at this point. We have not -- We don't consider this to be a problem in Ingle Wells. Most of those wells are not top-allowable wells, and as they stand, both the gas and oil volumes are within legal limits.

Q. Okay. If you could put up your next exhibit, Exhibit 11, and just briefly discuss the Cherry Canyon in this pool.

A. I mentioned earlier that both the Bell and the Cherry Canyon produced in these fields. This particular map is mapped on the top of the lowermost Cherry Canyon unit.

Really, all I want to do here is illustrate the nature of the Bell and Cherry Canyon production, that this green shaded area here is the best pod of Cherry or Bell Canyon production that we could find, and it's limited in extent. And that's really the point that I wanted to get across here, is that while there are several wells that will probably -- either are producing or may be capable of producing from the Bell or Cherry, and while it may be significant on an individual well basis, relative to the field it's a very minor amount of production.

In this particular case -- and again, this is the best one that we could find, and this is based on having porosity in a well greater than ten feet of porosity -- there were five wells in this pod, of which three of them already are completed in the Cherry Canyon, which are represented by these large orange dots. One of them had shows in the Cherry and perhaps will be capable of production, and the other one had no shows, and we think is probably wet.

The reason I bring this up is, regardless of what GOR we end up with after this hearing, we feel like the

current state rules should continue to apply wherein we produce at our discretion Bell, Cherry, Brushy together. Otherwise, I think it will be cumbersome and inefficient. And as things stand, we're able to do so and we desire that regardless of how this turns out that we would continue to be able to do so.

Q. Is it common in the Delaware in southeast New Mexico to produce from more than one Delaware zone?

A. Yes, absolutely.

Q. Were Exhibits 4 through 11 prepared by you?

A. They were.

Q. And in your opinion, is the granting of this Application in the interests of conservation and the prevention of waste?

A. It is.

MR. BRUCE: Pass the witness, Mr. Examiner.

EXAMINER CATANACH: Shall I admit the exhibits, Mr. Bruce?

MR. BRUCE: Oh, thank you. Move the admission of Pogo Exhibits 4 through 11.

EXAMINER CATANACH: Exhibits 4 through 11 will be admitted as evidence.

Mr. Kellahin?

MR. KELLAHIN: No questions.

EXAMINER CATANACH: Hang on a second.

EXAMINATION

BY EXAMINER CATANACH:

Q. I just want to make sure I understand the nature of the pool here. It's -- You've got seven different intervals within the Brushy Canyon --

A. Yes.

Q. -- that you've identified?

A. That's correct.

Q. Within the seven intervals, you've broken down the A interval into six additional intervals?

A. That's correct, and in this pool we are again primarily concerned with the A, and that's what's open in these various wells across the pool.

That's not to suggest that in perhaps one of the upper intervals there might not be some additional production, but I think it's going to fall in the nature of the Bell and Cherry that it will be limited -- the vast amount of production is coming from that lower A interval, and again we believe that most of it is coming from that BC-4 interval within the A unit.

Q. But there is probably production in other than the A interval in the Brushy?

A. I would expect that in several wells -- and I can't point to an example, but I could probably find one if need be -- that there would be some additional behind-pipe

zone that hasn't been opened.

Q. And on a fieldwide basis, the area you've identified in green there is probably the best Bell or Cherry Canyon producing --

A. I think so. In those three wells that have been completed there was a fairly thick section with good shows. It was DST'd, recovered a fair amount of oil on the DST in at least one well. And again, they're already producing and contributing to production.

Q. And the BC-4 is, as you've said, probably the main producing interval within the A zone?

A. That's correct, and that's based on the thickness of the interval, the continuity across the area, the relatively better reservoir quality within that zone.

Q. The BC-2 would be the next best producing interval, in your opinion?

A. That is more difficult to answer. I would say yes, but we frac'd these things and hooked them together. There are other zones. The BC-5 has tested oil, we have tested oil in it. I believe we have a test in the BC-6, though I'm not as comfortable with my memory on that.

In any event, there are shows throughout that entire A section. The 1 and 2, I would believe, are the next best intervals, and again, I've lumped them together as an interval.

Q. And you see no evidence to suggest that these two pools are not -- or are two common sources of supply? I mean, they're just one pool, in your opinion?

A. They're one, yes.

Q. There's no barrier of any kind to separate them?

A. No, not that I'm aware of, and I don't believe that to be the case.

Q. Were they -- Well, I won't get into that.

Where did you say -- Or there's been some testimony that the pool has been expanded since the maps were drawn. You don't know anything about that?

A. I'm not familiar with that.

EXAMINER CATANACH: Okay, that's all right.

I believe that's all I have, Mr. Bruce.

MR. BRUCE: If you want to know the exact acreage that's been added, Mr. McDaniel did check out and he has the exact boundaries of the pool.

EXAMINER CATANACH: Okay, yeah, if he's got that, why don't you leave me that information.

MR. McDANIEL: There's 23 South, 31 East. You have the southeast quarter of Section 8.

EXAMINER CATANACH: Southeast quarter of Section 8, okay.

MR. McDANIEL: The northeast quarter of Section 16.

EXAMINER CATANACH: 16.

MR. McDANIEL: And then to the south and the west you've got the Sand Dunes-Delaware Pool. In 24 South, 31 East, we've added the southwest quarter of Section 33. Oh, I'm sorry, that's still in 23-31.

Then in the south, the northwest quarter of Section 4 and the east half of Section 5.

EXAMINER CATANACH: Thank you.

MARK STOUFFER,

the witness herein, after having been first duly sworn upon his oath, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. BRUCE:

Q. Would you please state your name and city of residence?

A. Mark Stouffer, Houston, Texas.

Q. What is your occupation and who is your employer?

A. I'm a senior reservoir engineer for Pogo Producing Company.

Q. Have you previously testified before the Division?

A. No, I have not.

Q. Would you please outline your educational and employment background for the Examiner?

A. Yes, I have a BS in petroleum engineering from

the University of Tulsa in 1983. I have a master's in petroleum engineering from Texas A&M University in 1988.

I have three years' experience with Schlumberger as a field engineer from 1983 through 1986. I had three and a half years' experience with British Petroleum as a drilling, reservoir and production engineer, from 1988 through 1991. I have two years' experience with Pogo as a senior reservoir engineer, from January, 1992, through the present.

I'm a registered professional engineer in the State of Oklahoma, and my area of responsibility for Pogo does include southeast New Mexico.

Q. And are you familiar with the engineering matters related to these pools?

A. Yes, I am.

Q. And have you conducted an engineering study and are you ready to present those results today?

A. Yes.

MR. BRUCE: Mr. Examiner, I would tender Mr. Stouffer as an expert engineer.

EXAMINER CATANACH: Mr. Stouffer is so qualified.

Q. (By Mr. Bruce) Mr. Stouffer, first would you identify Exhibit 12 and discuss the status of the wells in the pool?

A. Okay, Exhibit 12 is a well information table for

the Sand Dunes West-Los Medanos fields. It lists the sections with the wells in each section, the unit location, the operator of each well, the date of first production from the Delaware, the perforation interval, the interval name, the initial GOR when the well was first completed, the current GOR through September or in some cases August of 1993, the current barrels of oil per month, the current MCF of gas per month, and the cumulative production in thousands of barrels.

There are 72 wells in the two fields combined. Information on this table was taken from data and information received directly from the operators in the field.

Q. Okay. Have you detected an original gas cap in this pool or these pools?

A. No, I have not.

Q. How did you make that determination? And I refer you to your Exhibits 13A and 13B.

A. Exhibit 13A is a summary of PVT data taken from the Pogo Pure Gold "D" 8 well, which is located in the southeast of the southwest quarter of Section 28.

Exhibit 13B is a summary of PVT data from the Kaiser-Francis Pure Gold "A" 2 well, which is located in the southwest of the southwest of Section 21.

Both wells were sampled by Core Laboratories, and

both wells were sampled at approximately the same time, early in 1993.

The Pure Gold "D" 8 well had a saturation pressure -- which is in the second block down the page -- saturation pressure of 3173 p.s.i. Based on a bottomhole pressure buildup taken immediately after the PVT data was taken, the reservoir pressure was 3175 and still building. So the reservoir pressure was greater than the bubble-point pressure.

The Pure Gold Number "A" 2 well on Exhibit 13B again shows a saturation pressure of 3220 p.s.i., which is in good agreement with the Pure Gold "D" 8, within 50 pounds, which is considered good agreement.

The Pure Gold "A" 2, based on an extrapolated reservoir pressure from an 86-hour buildup following the PVT data, had an initial reservoir pressure of 3292 p.s.i.

Since both wells in this initial reservoir pressure is greater than the bubble-point pressure, there will be no free gas present in the reservoir initially, and therefore no original gas cap.

Q. Have you tested your conclusion with other well data?

A. Yes, I have.

Q. Would you move on to your Exhibits 14 and 15 and perhaps discuss those together?

A. Okay, Exhibit Number 14 is a structure map of the BC-2 zone, which is the same structure map that our geologist presented. The map has initial GORs plotted at each well location. The GORs are color-coded, the pink dots from 250 to 500 standard cubic feet per barrel, blue dots 500 to 1500, and black dots 1500 -- greater than 1500.

As you can see, the GORs are scattered throughout the plot or throughout the map, and there's no definable trend relating the GOR to the structural position. If there were an initial gas cap present, I would expect the wells high on structure to have high GORs and the wells low on structure to have low GORs, and that's not the case here.

Q. And what does Exhibit 15 show?

A. Exhibit 15 is a plot of initial GOR versus structure. This plot portrays the same information as shown on this map, Exhibit 14.

Once again, you can see that the -- there's a random scatter of the initial GORs. If there were an initial gas cap present, I would expect high GORs on the left side of the plot and low GORs on the right side of the plot, and that's not the case here. The GORs trend more in a horizontal direction.

Q. Okay. Have you detected a water drive in this pool?

A. No, I have not.

Based on the wells drilled to date, there is no evidence of a downdip oil/water contact, as our geologist discussed. Also based on bottomhole pressure data, there is no evidence of pressure support, which you would expect in a water drive.

For example, the initial reservoir pressure on the Mobil Federal Number 1 in Section 29 which is the discovery well, was 3274 p.s.i., and a recent pressure taken on that well in November of 1993 shows a bottomhole pressure of 1615 p.s.i. So there's no evidence of pressure support.

Q. Have you determined the drive mechanism for this pool?

A. Yes, I have. It's a solution gas drive reservoir.

Q. What is the primary characteristic of that drive mechanism?

A. Exhibit Number 16 is an excerpt from Slider's reservoir engineering text. This figure shows the GOR behavior for a solution gas drive reservoir.

As you can see, the GOR which is plotted on the Y axis and cumulative production plotted on the X axis, the GOR remains constant until the bubble-point is reached. At this time, the GOR may actually decline slightly until the

critical gas saturation is reached. After that, the GOR increases rapidly due to relative permeability effects. And in late time, the GOR actually levels off and decreases due to changes in formation volume factors.

Q. Does production from this pool -- or I should say these two pools -- conform to Slider?

A. Yes, it does. Exhibit 17A through 17K are plots of GOR versus cumulative production for the first Brushy Canyon well in each section of the field. The first well in each section was chosen, since there was more history available. These plots are plotted in the same format as the previous exhibit from Slider's text.

As you can see as you flip through those exhibits, the majority of the wells have shown an increasing GOR trend, which is indicative of a solution gas drive reservoir.

Q. Now, if you would refer to Exhibit 18, are there areas of the pool which have not yet shown a high GOR?

A. Yes, Exhibit 18, which I'll discuss in more detail later, is a map of current GOR versus structure. Sections 9, 16, 17, 20 and 21 have not yet shown high GORs, above 2000 to 1.

Q. Okay. Well, let's look at these a little differently here. Would you look first at Exhibits -- or excuse me, Sections 20 and 21 and discuss the reasons in

your opinion for the low GORs in those two sections?

A. In Sections 20 and 21, all six wells have cum'd less than 25,000 barrels. Also, Kaiser-Francis, the operator of the sections, did not have the ability to test the wells individually until December of 1993. This could average a high-GOR well with a low-GOR well.

Q. Now, if you look at your -- move back to your exhibit 17, 17H and -I, those are wells in Sections 20 and 21; is that correct?

A. That's correct.

Q. And they don't show the inclining GOR, do they?

A. No, they do not.

Q. What does the recent well data, the recent test data on these wells show?

A. As I mentioned before, Kaiser-Francis the operator of these wells, did not have the facilities to individually test the wells until December. A few days ago, we did receive some updated test data from Kaiser-Francis that shows the Pure Gold "B" 4 well in Exhibit 17H to have a 2600-to-1 GOR, and the Pure Gold "A" 2 well, Exhibit Number 17I, shows to have a 2375 GOR.

If you were to plot these updated GORs on this plot -- and again, I don't know what the actual cumulative production is, but if you were to plot those new numbers out to the right somewhere, both of these wells would show

the increase in GOR trends, as the other wells in the field have.

Q. In your opinion, as these two wells accumulate more production, another 10,000 to 15,000 barrels, will the GOR continue to incline?

A. Yes. As a matter of fact, of the seven wells that Kaiser-Francis operates in Section 20 and 21 at the time of this exhibit preparation -- Well, excuse me, based on the recent test data we acquired from Kaiser-Francis, four of the seven wells are in excess of 2000 to 1.

Q. What about the north end of the pool, really the Los Medanos Pool, Sections 9, 16 and 17? What is the reason for the low GORs there?

A. Based on our isopach maps, the net pay is thicker in the north portion of the field. This would lead to less reservoir pressure drop for the same amount of production, simply due to the larger reservoir volume.

Also, with the exception of two wells in Section 16, all the wells in 9, 16 and 17 have cum'd less than 20,000 barrels, and I would expect GORs in these sections to increase with further production.

Q. The cutoff is generally around 20,000 or 25,000 when the GOR starts to increase?

A. That's right, that's what we've seen so far.

Also, as for the well in Section 16, which is

Exhibit 17K, the Medano VA State Number 3, this well is completed in the Bell Canyon and maybe -- possibly several other members of the Delaware. Therefore, I would not expect it to show an increase, a high GOR, since those other zones are probably a lower GOR.

Q. Have you detected a secondary gas cap in these pools?

A. No, I have not. First of all, to have a secondary gas cap, you need significant structural relief, which does not occur in this case. The dip rate is approximately one degree or less.

Secondly, this is a low-permeability reservoir, and the wells require fracture simulation to flow. The combination of no structural relief with the low permeability rock matrix is not favorable to secondary gas cap formation.

Q. Would you anticipate the only area of high conductivity is around the wellbore?

A. Yes, I would.

Q. What data do you have to support your conclusion?

A. Exhibit Number 18, which I've talked about earlier, is a structure map on the BC-2, with the current GORs plotted as of September, 1993.

This map, again, shows there is no definable trend towards high GORs on the top of the structure and low

GORs low on structure.

For example, starting with the Yates well in the southwest of the southwest of Section 32, this well right here, if you follow around the structure between the 4580 contour and the 4560 contour, this area right here, follow around structure, you'll see dots of every color, which means that you have high, moderate and low GORs at the same structural position around the structure.

Also starting with the Mobil Federal Number 8 well, which is this well here --

Q. In Section 29?

A. In Section 29. -- if you head directly south downstructure, follow this line of wells down, you go from high to moderate to low to high and back to moderate. So there's no trend to a decrease in GORs as you head downstructure.

Starting with the Mobil Federal 8 again and heading straight east downstructure, you go from high to low to high to low to moderate. So there's no trend in either direction towards high GORs high upstructure to low GORs downstructure.

Q. Okay. What does Exhibit 19 show?

A. Exhibit 19 is a plot of the current gas-oil ratio versus structure. This plot portrays the same information as the map.

Once again, the plot shows a random scattering of GORs with no relation to structure.

If you'll notice the eight wells to the lower right side of the plot which are deeper than 4520 feet subsea, those eight wells have cum'd less than 20,000 barrels, and two of these wells are open in the Bell Canyon. Therefore, the lower GORs shown by these wells are not a function of structure but are a function of cumulative production --

Q. Okay.

A. -- and I would expect these wells to increase with further production.

Q. The GOR to increase?

A. The GORs.

Q. Yes. What is the permeability of this reservoir?

A. The permeability ranges from two to five millidarcies, based on a combination of pressure buildup data and core data.

Also, as our geologist stated, there are laminations between and within the producing zones.

Q. What's the practical effect of this low permeability?

A. Due to low permeability, the wells do require fracture stimulation to produce. Once they are stimulated, they flow at a high rate, due to a high-conductivity region

around the wellbore. I would therefore expect free gas in the reservoir to be produced through this high-conductivity region around the wellbore, rather than migrate updip through a low-permeability rock matrix.

Q. Let's move on to a slightly different subject, production from other Delaware zones. Could you refer to your Exhibit 20 and discuss production from zones other than the Brushy Canyon?

A. Yes, Exhibit 20 shows that there are three wells that have Brushy Canyon and Cherry Canyon combined, two wells that have Brushy Canyon and Bell Canyon combined, and one well that has Brushy Canyon and Upper Bone Springs combined.

Yates received a commingling order for the Pauline ALB State Number 6 early in 1993.

The three wells that have the Brushy Canyon/Cherry Canyon producing together, what I've done is taken the before and after producing rates and come up with an estimate of the contribution of each zone.

In the case of the Yates well with the Upper Bone Springs commingled, this data, the 94 percent Brushy and 6 percent Bone Springs, is based on Yates's testimony from their commingling order.

The two wells with the Brushy Canyon and the Bell Canyon combined in Section 16, I had no data available on

those. I don't know if they were separately tested in the Bell Canyon and the Brushy Canyon.

Q. Okay. What is the drive mechanism in the Bell Canyon and the Cherry Canyon?

A. Based on the apparent limited areal extent of these other zones, I would expect them to be solution gas drive.

Q. Do they also appear to be tight?

A. Yes, they do.

Q. Do you favor the current rule allowing operators to produce simultaneously from all Delaware zones?

A. Yes, I do. The ability to commingle zones together is more efficient from a development standpoint. It allows the operator to produce to a lower abandonment pressure and abandonment rate. It also allows for maintaining production rates with less administrative requirements.

Q. Pogo has requested a higher GOR, which would allow at least certain wells to produce at a higher rate without curtailment. Will ultimate recovery be adversely affected by the increased production rate?

A. No, not significantly, and I would like to show a couple of exhibits to illustrate this.

Exhibit Number 21 is an excerpt from *Craft and Hawkins* which is considered to be the standard reservoir

engineering text by most practicing engineers. I won't read it, but I will summarize each paragraph.

Paragraph one states that the recovery from solution gas drive reservoirs is essentially independent of production rate.

Paragraph two states that the GOR of a solution gas drive reservoir is not a function of pressure -- or, excuse me, is not a function -- is a function of pressure and depletion and is not a function of producing rate.

This is the same principle as shown by Exhibit 16 from Slider's text.

Paragraph --

Q. What -- Go ahead.

A. Excuse me. Paragraph 3 states that to have a rate-sensitive reservoir, another drive mechanism must be present, such as partial water drive or gravity segregation. And we've shown that we have neither one of those in effect here.

Q. Okay, and what about Exhibit 22?

A. Exhibit 22 is an equation from Slider's text. This equation gives the GOR at any time for a solution gas drive reservoir. I'll just explain the terms a little bit.

The R is the instantaneous gas/oil ratio at any time during the life of the well.

R_s is the solution gas/oil ratio.

And the third term is a ratio of gas/oil permeabilities, viscosities and formation volume factors. This term represents the flow of free gas in the reservoir.

The significance of this equation is that both terms on the right-hand side of the equation are a function of reservoir pressure or fluid saturation, which in turn are functions of cumulative production.

None of these terms are a function of producing rate. Therefore, the GOR is independent of producing rate.

Q. What GOR does Pogo request?

A. 8000 to 1.

Q. What do you base this on?

A. Based on the individual well plots in Exhibits 17A through 17K, the GOR trend is increasing, and it's currently at an average of about 4000 to 1. We believe the ultimate average poolwide will be approximately 8000 to 1.

Also, the GORs for other Delaware pools -- for example, East Loving -- have been increased to 8000 to 10,000 to 1, which appears to be adequate.

Q. Were Exhibits 12 through 22 prepared by you or under your direction?

A. Yes, they were.

Q. And in your opinion, is the granting of this Application in the interests of conservation, the prevention of waste, and the protection of correlative

rights?

A. Yes, it is.

MR. BRUCE: Mr. Examiner, I move the admission of Exhibits 12 through 21.

This is all I have of Mr. Stouffer at this time. He does have one final exhibit which is dependent upon our final witness's testimony. I'd like to recall him for two three minutes right at the end.

EXAMINER CATANACH: Okay. Exhibits 12 through 21 will be admitted as evidence.

Mr. Kellahin?

MR. KELLAHIN: Yes, sir.

CROSS-EXAMINATION

BY MR. KELLAHIN:

Q. Mark, do you say your last name "Stouffer", or is it "Stouffer"?

A. "Stouffer".

Q. "Stouffer", with an "o"?

A. Like the frozen foods.

Q. Yeah, okay. What are the two most important factors, Mr. Stouffer, that control or affect gas recoveries in a solution gas drive reservoir?

A. Gas recoveries or oil recoveries?

Q. Oil recoveries.

A. Oil recoveries?

Q. Yes, sir.

A. I would say permeability, porosity, pressures, initial pressures, abandonment pressures, saturations, economic limits, a variety of things.

Q. Of those, which are the most important?

A. In this particular case?

Q. Yes, sir.

A. I wouldn't say that any one is more particularly important. I would say they all have the same effect, basically.

Q. Would you turn to your Exhibit Number 12?

A. Yes, please.

Q. Does Exhibit Number 12 contain all the current producing wells in either of these two pools?

A. It only contains the wells that were in the two pools at the time of preparation, which is approximately September, October of 1993, somewhere. There may have been some wells drilled in the pool that are not on this Exhibit.

Q. All right. The current pool rules, 40-acre spacing, depth bracket oil allowables 187 barrels of oil a day, you've got a 2000-to-1 gas/oil ratio limit, right?

A. That's correct.

Q. Using that basis, what is the maximum volume of gas that you're allowed to produce from any of the oil

wells?

A. That would be 187 times 2000, or 374 MCF per day.

Q. When we look at the distribution of the wells and find a display that illustrates that, perhaps the one on the board now -- what is that, 18?

A. Yes.

Q. 18, the one that's got the colored dots on it, maybe that's the way to help us locate some of those.

Can you show me the wells, or is there a way to look at Exhibit 12 and find the wells that are currently subject to the limitation? In other words, they are being restricted because they are exceeding the gas limitation for that spacing unit?

A. Yes, if you look at Exhibit 12, what you can do is go to the column for current MCF per month.

Q. Multiply by 30? Is that how you can do it?

A. Well, or divide by 30 to get the daily rates.

Q. Well, let's do the month. You've already got months --

A. Okay.

Q. -- tabulated here.

A. Okay.

Q. So if we take 374 times 30, it gives you 11.22 million a month?

A. That's right.

Q. Okay. And if we look down that column, then, and we find any of those wells that are exceeding 11.22 million a month, those wells are being overproduced?

A. Yes, for that particular month.

Q. Okay. What have you been doing about the wells that you operate that are exceeding the current 2000-to-1 gas/oil ratio?

A. We have not made an effort to curtail, as far as I'm aware.

Q. Do you know which of your wells is the well that is most overproduced of the current gas/oil ratio?

A. I'm sorry, I do not.

Q. Okay.

A. I don't have that information.

Q. This tabulation on Exhibit 12 would only show -- It says current MCF per month. I guess I need to know what month that refers to.

A. Okay, the current MCF per month corresponds to the current date on the column two columns to the right. So the current date, September, 1993, for Sections 28, 29 and, for example, Section 20 and 21, that current date would be August, 1993. So there are three of those months shown there.

Q. I don't have enough information on Exhibit 12 to find out which of your wells is overproduced and how much

they are overproduced?

A. That's correct.

Q. Okay. The operation in the field for your wells, is it such that you have measured and reported all gas production from each of those wells?

A. Yes.

Q. Was there any gas flared from any of these wells that wasn't measured?

A. I cannot answer that. I do not know if there was gas vented or not.

Q. Okay. What reports are you working with to generate a spreadsheet like this when we're concerned about the accuracy of the gas numbers being used on the spreadsheet?

A. All of the gas and oil rates were taken from either C-115 data or data supplied -- furnished to me directly by the operator of each section.

Q. You have a map that shows the initial GOR for the wells. I think there was a color code.

A. Yes, there was.

Q. Do you have that display handy, that we might put it up at the same time as we look at 18 so we can draw some comparisons?

The PVT data, we've got two sources, two fluid samples taken from two different wells. I think there was

one of your wells and one of Kaiser-Francis's wells?

A. That's correct.

Q. Have you examined that PVT data?

A. Yes, I have.

Q. Are you satisfied as an engineer that there are no glitches in how that -- those fluids were analyzed and processed and samples taken?

A. Yes, I am. I believe the Kaiser-Francis well was sampled downhole. Our well was sampled at the surface and recombined. However, as a quality-control check, the bubble-point pressures on the two PVT studies are within 50 pounds, which I consider excellent agreement.

Q. What is the bubble-point pressure of the reservoir?

A. The bubble-point pressure of the reservoir, based on PVT data from these two wells, would be somewhere in the range of 3173 to 3220.

Q. Okay. The initial reservoir pressure was what, sir?

A. The initial reservoir pressure on the Pure Gold "D" 8 was 3175. However, that was not an extrapolated reservoir pressure, so I would consider it to be somewhat higher than that.

The initial reservoir pressure, extrapolated reservoir pressure from the Pure Gold "A" 2 was 3292 p.s.i.

Q. Have we drawn down reservoir pressure in the reservoir that now the wells are producing below the bubble point?

A. It depends on the well and also the cumulative production.

In, for example, the Mobil Federal Number 1 well, which was the discovery well in the field, has produced approximately 100,000 barrels, I would say we are without a doubt below bubble point in that particular well.

Some of the other wells that are brand new may not be below bubble point at this time, but it will happen very quickly.

Q. Can you go to one of the displays and help me find the Mobil Federal Number 1?

A. Yes.

Q. Show it so we're all clued in as to where that is.

A. It's this well right here.

Q. It's the one in Section 29; you're in the northwest of the southeast of 29?

A. That's correct.

Q. Okay. Stay there for just a second. When you look south of that location in the same section, there is a well with a black dot?

A. Yes.

Q. Okay, what's that well name?
A. That's the Mobil Federal Number 8.
Q. And if you'll look at the Mobil Federal Number 8 on display number 18 just next to you --
A. Yes.
Q. -- it's got a black dot?
A. Yes.
Q. Its producing current GOR is between 4000 and 6000; is that correct?
A. That's correct.
Q. Look at the east of it. There's a red dot. Do you see that?
A. Yes.
Q. What's that well?
A. That's the Mobil Federal Number 7.
Q. And it's less than 2000 to 1?
A. That's correct.
Q. And then you continue east and we have another black dot?
A. Yes.
Q. And you continue east one more time, and we've got a red dot?
A. Pink.
Q. I'm sorry, pink?
A. Yes, sir. Yes.

Q. What's the explanation as to why in 40-acre offsets you get a well that's less than 2000 to 1, side by side with one that's more than -- 4000 to 6000 to 1?

A. The explanation is that the GOR is a function of cumulative production. Some of these wells have been producing longer and therefore have produced more, so their GORs would be higher. Other wells have come on more recently and produced less, so their GORs may be less.

Q. Will that point hold true to all the wells in the reservoir --

A. As a general trend, yes.

Q. -- that we can find in the older portions of the pool, the well that has produced longer has a higher GOR?

A. I would say that's a good general statement.

Q. Okay. What is the vintage of the discovery well?

A. The discovery well was discovered, I believe, in March of 1992.

Q. Okay. You've got what? Eighteen months of production from that well now?

A. Approximately.

Q. Please return to your seat.

Have you done any kind of drainage studies, Mr. Stouffer, to determine whether or not wells are having any effect on the recoveries of their adjoining wells?

A. No, I have not.

Q. Have you done any type of engineering analysis to determine what is the oil in place for any of the 40-acre spacing units?

A. Yes, I've done some initial volumetrics.

Q. Have you taken the isopach that the geologist prepared and done any further calculations, volumetric or otherwise, to determine oil in place?

A. For a particular well or for the field?

Q. For either.

A. Well, I've not used the geologist's most recent isopachs. I've used my log-derived porosity, water saturation and net pay and used those numbers.

Q. Did you create your own ϕh map?

A. No, I didn't.

Q. Do you have an estimate or an engineering projection as to what percentage recovery you would anticipate out of this reservoir?

A. Typical recovery efficiency for a solution gas drive reservoir of this nature, I would say, would be in the range of 10 to 12 percent.

Q. Do you know whether any of the wells that are in the pool have already recovered their share of recoverable oil from underneath their spacing unit?

A. No, I have not made any drainage studies, so I cannot say that.

Q. Have you made any pressure studies to see if there's any pressure effect among the wells in any portion of the reservoir?

A. No, I have not.

Q. Initial reservoir pressure is slightly over 3000 pounds?

A. Approximately 3300, yes.

Q. Okay. Do you have any newer wells in proximity to some of the older producers to see if they were still coming in close to original reservoir pressure or whether they had been pressure-depleted by the prior well?

A. We may have some pressure data, but I -- Like I say, I have not conducted a drainage study, I have not compared pressures from one 40-acre unit to the next.

MR. KELLAHIN: Just a moment, Mr. Examiner.

EXAMINER CATANACH: Sure.

Q. (By Mr. Kellahin) Let's go to Exhibit 32 for a minute, Mr. Stouffer.

A. Okay, we've not yet presented Exhibit 32.

Q. I'm way ahead of you then, I'm sorry. I thought this was -- You saved that, didn't you?

MR. BRUCE: Yes.

MR. KELLAHIN: Okay, we'll come back to it.

Q. (By Mr. Kellahin) I've lost track of your development on Pogo tracts. Are you fully developed for

40-acre within the reservoir? And when I say "reservoir", I'm combining the two pools.

A. "Fully developed" to mean a well in each 40 throughout the section?

Q. Yes, sir, and I understand there's limitations on the reservoir and where you're going to pick to drill wells, but if you'll look at Section 32 it looks fully developed. You get up into 29 and there's just a few wells, and -- You know, the map speaks for itself.

In terms of your acreage position, do you have further locations that you want to drill?

A. I do not decide which wells to drill and where.

Q. Okay.

A. That's a decision made by the geologist. I can tell you that I know in Section 29 we do have some problems with locations due to potash. Beyond that, I can't speculate any further.

Q. Okay. The lack of development in 29 is a condition other than something in the reservoir, apparently?

A. Yes.

Q. It's a potash issue?

A. Yes.

Q. Have we drilled this reservoir in the wrong spacing?

A. As I said before, I have not conducted drainage studies, so I cannot say.

Q. Okay. It doesn't matter, we're committed to 40-acre spacing. But I was curious as to whether or not in hindsight we may have drilled this too densely.

A. I don't think I can make that statement at this time.

MR. KELLAHIN: All right, sir, thank you. No more questions.

EXAMINATION

BY EXAMINER CATANACH:

Q. Mr. Stouffer, is there any correlation between GOR and what zone a well is producing from, or have you examined that question?

A. All of the GORs that you see on both of these plots, and all of the GORs that are used in the exhibits, are wells producing primarily from the Brushy Canyon, which would be the BC-2 and the BC-4 members.

We do believe that even though some wells have only been perforated in the BC-2, that we -- with our fracture stimulations, we are communicated upwards to the BC-4. But I have not made a GOR breakdown by itself.

Q. Is there any possibility of an existence of just a gas-bearing interval anywhere in that producing interval?

A. Not that I'm aware of, no.

Q. It's your opinion that GOR is strictly a function of cumulative production?

A. Yes, it is.

Q. And you've cited numbers 20,000 to 25,000 barrels of oil is the point where GOR begins to increase?

A. It's the point where, as you can see if you look at Exhibits 17A through -K...

For example, the Mobil Federal Number 1, the first plot, begins to increase at about 30,000 barrels.

The Pure Gold "D" 2, the next plot, begins to increase at about 25,000 barrels.

The next well, the Pauline State Number 4, begins to increase at about 22,000 barrels.

So roughly 20,000 to 30,000 barrels, we start to see an increase in GOR.

Q. On your Exhibit 17B, do you have an opinion as to why that GOR dropped at about 40,000 barrels?

A. 17B?

Q. Yeah, Pure Gold "D" Number 2.

A. Okay. No, I do not have an explanation for that. However, it does continue back up after that.

Q. Was it your testimony that the average GOR is approximately 4000 to 1 at this point?

A. Yeah, that was an average number, more or less taken from the wells in Sections 28, 29 and 32.

Q. Okay. So that's not the whole average, that's just --

A. No, that's not the entire field. By that I meant the wells that are above the 2000 to 1, the average is probably close to 4000 to 1.

Q. You don't know what the average poolwide is?

A. No, I don't, but it would probably be less than 4000 due to all the low-GOR wells in the north part of the pool.

Q. How do you arrive at a proposed 8000-to-1 GOR?

A. The 8000 to 1 was based on similar Delaware fields.

For example, East Loving-Delaware, which Pogo Producing Company came to a similar GOR hearing earlier this year.

It produces from the same stratigraphic intervals, the same general producing characteristics as the Sand Dune-Los Medanos, and we were granted an 8000-to-1 GOR in that pool. And we feel that due to similarities in the two pools, that 8000 to 1 will be adequate.

Q. The GOR in this pool should at some point in time peak out and then gradually start to decline somewhat?

A. Yes, I would expect to see that in the latter portions of the field.

Q. There's no way to tell at this point in time what

that peak GOR would be?

A. Not at this time, no.

EXAMINER CATANACH: I think that's all I have of the witness.

REDIRECT EXAMINATION

BY MR. BRUCE:

Q. I just have a brief follow-up question to something Mr. Kellahin asked you, Mr. Stouffer, about Pogo's development in the pool. 29 is essentially all Pogo, isn't it?

A. That's Pogo-operated, yes.

Q. Pogo-operated?

A. Yes.

Q. And that is a lot of undeveloped acreage; is that correct?

A. Yes, that's correct.

Q. And Pogo also has undeveloped -- has nonoperating working interests, substantial working interests in Sections 20 and 21?

A. Yes, we do.

Q. So there are a number of undeveloped units that Pogo has in this pool yet?

A. Yes, there are.

MR. BRUCE: I have nothing further, Mr. Examiner.

EXAMINER CATANACH: The witness may be excused.

CHARLES R. VANORSDALE,

the witness herein, after having been first duly sworn upon his oath, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. BRUCE:

Q. Would you please state your name for the record?

A. Charles Vanorsdale.

Q. Where do you reside?

A. Midland, Texas.

Q. Who do you work for?

A. I work for T. Scott Hickman and Associates.

Q. What is your capacity there?

A. I'm senior evaluation engineer.

Q. What is your relationship to Pogo in this case?

A. Pogo asked me to develop a reservoir simulation model to assess the impact that a higher GOR allowable would have on the ultimate recovery of the Sand Dunes West Delaware field.

Q. Have you previously testified before the Division as an engineer?

A. Yes, I have.

Q. And have you had your credentials accepted as a matter of record?

A. Yes.

Q. And are you familiar with your model and the

input from this pool into that model?

A. Yes.

MR. BRUCE: Mr. Examiner, I would tender Mr. Vanorsdale as an expert engineer.

EXAMINER CATANACH: Mr. Vanorsdale is considered qualified.

Q. (By Mr. Bruce) Would you please describe your model? And I'll refer you to your Exhibit 23.

A. Yes, Exhibit 23 represents a five-well reservoir model, which was constructed as a three-dimensional, three-phase model using a state-of-the-art commercially available simulator.

Five wells were selected to be representative of the field and include some of the oldest producers in the field. The Mobil Federal Number 1 is the discovery well for the Sand Dunes West.

In addition to this particular grouping of wells, I was concerned with the structural impact. The Mobil Federal Number 1 and the Mobil Federal Number 8 are located near the structural high of the reservoir. There has been some concern in the past as to the possibility of secondary gas cap formation due to structure, and so I wanted to assess that likelihood in the reservoir simulation.

And if you'll notice on the model, there are two zones represented, the BC-4 and the BC-2. I have those

separated by a barrier. The two zones, as has been discussed already, are in communication due to hydraulic fracturing. I have incorporated that in my simulator. The BC-4 and the BC-2 are not in communication anywhere else in the simulator except at the wellbore.

Additionally, you will also notice that around each of those five wells there is a rather thin layer which represents a frac wing. We have incorporated the hydraulic fracture around each wellbore to accommodate a rapid pressure drop and fluid saturation change in order to make the model accurate.

Q. Okay. Would you move on to Exhibit 24 and discuss the parameters you used in your model briefly?

A. Exhibit 24 represents information which was gathered across the field from PVT analysis, special core analysis, some volumetric work, pressure buildup tests, and core analysis primarily.

The PVT data comes from primarily the Pure Gold "D" 8, which is a well just east, offset east to my "D" 4, Pure Gold "D" 4, which is in the reservoir model.

Some additional information came from the East Loving-Delaware Pool, specifically gas and oil relative permeability data, which was modified for this model.

Q. Would you move on to your Exhibits 25 through 29 and discuss actual production from the field in comparison

to your model?

A. Exhibit 25 represents the reservoir model's attempt to match the actual cumulative oil and gas production from the Mobil Federal Number 1. This represents 19 months of production. The overall match is excellent. The actual data is shown as a solid line. The simulated results from my model are shown as a dashed line.

Likewise, Exhibit Number 26 is the same type of information for the Mobil Federal Number 8. This represents 12 months' worth of data, and I should point out that all of these matches utilize data through the end of September of 1993.

Q. What is Exhibit 30?

A. Exhibit 30 represents the composite for all five wells in the model. And the overall results, as shown here, indicate that the cumulative oil produced is within five percent of the simulated cumulative oil produced. And the cumulative gas produced in the field, five-well field, is within six percent of the simulated results.

Q. Is that a good match?

A. This is considered an excellent match.

Q. Would you refer to your Exhibit 31 and discuss for the Examiner what that exhibit shows?

A. Exhibit 31 represents the results of taking the simulator's history match of those five wells and then,

assuming two different gas/oil ratio allowable scenarios, forecasting what the ultimate recovery would be, in order to assess the impact on overall reserve recovery.

The two cases presented assume 2000 to 1 GOR versus the proposed 8000 to 1. The simulator forecast the producing rates for the five wells down to a production limit of ten stock tank barrels per day per well.

As you can see by comparing the two columns, the oil recovery and the gas recovery are almost identical.

Likewise, the cumulative gas/oil ratio is almost identical.

And finally, the oil recovery factor, as a percent of the oil in place, as calculated by the simulator, is likewise almost identical.

Q. Now, looking at the cumulative GOR, is that different, 200 -- about a 200 difference between the two figures, is that significant?

A. It's insignificant. No, it's about a 2.7 percent difference between the two. In the event that a secondary gas cap had formed, assuming an 8000 to 1 GOR allowable, we would have anticipated the cumulative GOR to be significantly higher than this.

Q. What about the recovery factor? What does that indicate?

A. The magnitude of the recovery factor is something

on the order of 11 percent in both cases. It is indicative of a solution gas drive reservoir.

Had this been a gas cap expansion reservoir, the recovery factors would have been significantly higher, as pointed out in some statistical studies that have been done in the past.

Q. Is there any additional evidence you have to negate the formation of a secondary gas cap?

A. Yes, I have also monitored the gas saturation throughout the five-well area, both vertically and areally, to assess whether or not any significant gas migration has taken place toward this structural high. In other words, forming a secondary gas cap. This was not accomplished in the model. There was no secondary gas cap forming. The highest gas saturations that occurred were in the near-wellbore area.

Q. How confident are you in your model?

A. I'm very confident in the model. I have modeled the Delaware before for the East Loving-Delaware Pool and presented the results in 1991 and again in 1993, again representing the reservoir simulation.

I presented testimony which, in the 1993 hearing, matched what I had forecast within about three or four percent of the actual oil production rates and gas production rates, and pressure history was within six

percent of the actual pressure data.

Additionally --

Q. Go ahead.

A. Additionally, with respect to the validity of this model, there was a pressure buildup test taken on the Mobil Federal Number 1 in late November, early December, a 14-day duration. The results of that pressure buildup indicated a bottomhole pressure on the order of 1615 pounds. I verified the results in my model for the Mobil Federal Number 1, and the bottomhole pressure predicted by my model was 1633 pounds.

Q. And that's a pretty good match?

A. That's an excellent match.

Q. Were Exhibits 23 through 31 prepared by you or under your direction?

A. Yes.

Q. And in your opinion, is the granting of this Application in the interests of conservation and the prevention of waste?

A. Yes.

MR. BRUCE: Mr. Examiner, I would tender Pogo Exhibits 23 through 31.

EXAMINER CATANACH: Exhibits 23 through 31 will be admitted as evidence.

Mr. Kellahin?

MR. KELLAHIN: Yes, sir.

CROSS-EXAMINATION

BY MR. KELLAHIN:

Q. You testified before the Division in that East Loving Pool case, did you?

A. Yes, sir.

Q. Who was your client in that matter? Do you remember?

A. Bird Creek.

Q. The East Loving Pool, I've lost track of where that is in relation to this reservoir. Can you orient me as to where we are to go to the East Loving Pool?

A. I do not know the specific mileage away.

Q. That was not a contested case before the Division, was it, sir?

A. Yes, it was.

Q. Who were the other parties involved?

A. Pogo was involved; the opponent was Oryx energy.

Q. The model simulation, the software, if you will, the program used for the model, you didn't tell me what that specifically was. What program did you use?

A. It's called Eclipse, and the software is through an outfit known as Intera, I-n-t-e-r-a.

Q. If my engineers want to try to duplicate our work effort, I'd like them to be able to use the -- a similar

program. Is that a commercially available program?

A. Yes, sir.

Q. All right. Let me understand some of the assumptions in the model, and perhaps the first page of the Exhibit 23 serves that purpose.

The model will assume a reservoir of this size?

A. Yes, sir.

Q. When we get to the boundary of this container, what does the model do? It assumes that's the reservoir limit, does it not?

A. Yes, sir.

Q. All right. Is there -- Did you run any simulation to determine what the ultimate recovery would be for an individual well within the simulation?

A. There are -- Yes, we do have ultimate recoveries on a per-well basis.

Q. Does the model assume the historical producing chronology of the five wells in the model?

A. That's how we obtained the history match. That gives us an indication as to the productivity of the individual wells.

Q. Okay. So the model is programmed such that whatever the first well was -- I don't think it matters, but you've got five wells in your model. You'll take the first well that is first producing?

A. Yes, sir.

Q. You will take that plot of production. Are you trying to match historical production for the oil production, or on all fluids?

A. I match all fluids on each well.

Q. Okay. And that's a part of what we see in the run here, is an attempt to match the gas production and then attempt to match the oil production; did I read that right?

A. Well, not an attempt but an achievement at matching the oil and gas production rate.

Q. Okay. Well, I don't want to quibble with you over how close that line comes, but -- The input parameters, reservoir pressure, we've got initial reservoir pressure, 3300?

A. Yes.

Q. Bubble-point pressures from the PVT data?

A. Yes, sir.

Q. Where did the reservoir pressure come from?

A. The reservoir pressure came from a series of buildup tests that were taken throughout the field at various points in time. They are what we would call P* values, which from pressure buildup data indicates the so-called infinite reservoir.

Q. Had you attained P* in all the buildup data

that's utilized for the model?

A. What?

Q. Maybe I didn't say that right. Have you attained pressure that was stabilized?

A. Are you asking me if all of the pressure buildup tests achieved a stabilized pressure from which to obtain a similar P*?

Q. Bingo. Yes, sir.

A. Okay. No, not all wells achieve the same P*. That's a function of the amount of time that each well built up.

Q. How did you deal with that?

A. Well, those wells were ignored. We had about three or four wells which had sufficient time to reach what we call pseudo radial flow and then obtain a P* value.

Q. All right. Which wells did you choose to utilize?

A. Let's see. Of course the Mobil Federal Number 1 was the first well, and from that the P* value taken in March, 1992, was about 3275 pounds.

The Pure Gold "A" 2 P* value, taken exactly one year later, was 3292 pounds.

And the Pure Gold "B" 4 P* value, taken in April of 1993, was 3278 pounds.

All certainly within the range that the tests

could have provided.

Q. Okay.

A. From that, I simply rounded to 3300 pounds.

Q. I'm looking for areas that you may differ with my simulator engineer, and I want to understand where parameter choices were made by you so that if he conducts a similar simulation I at least know where yours came from. All right?

A. (Nods)

Q. In order to get your history match, what parameters did you have to adjust in order to make the match?

A. Of course, gas/oil relative permeability was one. As I have already mentioned, we took data from the East Loving-Delaware Pool and had to make some corrections to account for the relative liberation of gas with the production of oil.

Q. Do you remember what relative permeability value you used in order to attain the match that you were satisfied with?

A. Well, relative permeability varies as a function of the gas saturation, so I would have to provide that in the form of a table.

MR. KELLAHIN: Okay. Mr. Bruce, would you do that for me, is to give me the table so I have the relative

permeability values that were used in the simulation so that we can --

MR. BRUCE: We'll do that.

Q. (By Mr. Kellahin) All right. Anything else that my engineer is going to need in order to check your work, sir?

A. Well, there is a lot of information that is very specific to the individual wells. If we need to go into this, there are such things as transmissibility multipliers around the wellbore, which approximates the conductivity achieved by hydraulically fracturing the wellbore.

Additionally for each well and for each zone within the well, both the BC-2 and the BC-4, there are values of productive capacity, KH, the product of permeability times the net pay thickness, which has to be incorporated.

Likewise, for each zone there is a skin factor which needs to be incorporated.

Q. How did you then generate the KH? Did you utilize the Pogo geologic interpretations?

A. It was derived both from pressure buildup tests and from data derived from core analysis. Again, there was considerable adjustments necessary in order to obtain the match.

Q. Are there any geologic interpretations that

you've relied on in order to run the simulation?

A. With respect to the vertical permeability, yes. Due to the laminations within the Brushy Canyon, the vertical permeability was reduced above and beyond the horizontal permeability.

Q. Did you account for the fact that in the reservoir these wells have to be frac'd or otherwise stimulated in order to make them productive? That's going to induce a fracture system, if you will, at least around the near wellbore?

A. Yes, sir.

Q. And is that a component of the simulation?

A. Yes, sir.

Q. How many runs or separate adjustments did you have to make in order to get a match that you were satisfied with?

A. Well, that's a good question. I would say that --

Q. Did you get a unique match the first time?

A. No, no.

Q. Okay.

A. Not to this data, anyway.

Q. All right.

A. I would estimate that in order to obtain a match, given the amount of individual zone contribution that had

to be taken into consideration, we're looking at on the order of 50 to 75 simulation runs.

Q. Having achieved a match that's acceptable to you, what then do you do with the simulation?

A. At that point, I forecast the production, assuming the gas is restricted to the 2000-to-1 GOR, or to the 8000-to-1 GOR allowable.

Q. That assumption is made at what point in time? During the entire productive life of the wells in the simulation?

A. Well, you can do it from the beginning or at any point that you choose.

Q. Did you try to vary the point in time at which you made the adjustment to 8000 to 1?

A. Well, originally, the data with which I was working, which had been revised subsequently, did enable me to make some runs which were at a different point in time from which the results are displayed on my exhibits.

The results obtained using the old information at a different point in time did not vary significantly from the results that are shown on my Exhibit 31.

Q. Okay. I'd like to ask you, on the input parameters, it's Exhibit 24, the initial solution GOR, 1130 --

A. Yes, sir.

Q. -- where did you get that number?

A. That came from PVT analyses.

Q. Do you happen to have Exhibit 13A and -B that the previous witness used? We'll get you one if you don't have it.

Do you have another one of those, Jim? Yeah, there it is. Go ahead and look at these two.

A. Okay.

Q. On 13A that I've handed to you, there's a solution GOR ratio of 1383. Do you see that number?

A. Yes, sir.

Q. If everything else in the model is the same and I change that initial solution GOR you've got from 1130 to 1383, what happens to the end result of the run? Do you know?

A. Well, I would imagine that the gas production would increase slightly, but probably not without the normal parameters of an excellent match.

Q. Okay. When we go to the next page, 13B, the solution GOR for that well on PVT analysis was 1425?

A. Yes, sir.

Q. It's higher than the initial solution GOR you used in the model? Give me a sense of what happens. If I use a higher solution GOR than you did, what is going to be the end result?

A. Well, again, it could very well be that there would be an increase in the overall gas recovery. However, that might also necessitate my going back and changing the gas/oil relative permeability data.

Q. Because now you've changed a component, it's going to affect the match, and you're going to have to adjust another parameter to bring the match back -- the simulation line back to the historical line you're trying to match?

A. Yes, that's the whole purpose behind simulation.

MR. KELLAHIN: Thank you, Mr. Examiner.

EXAMINATION

BY EXAMINER CATANACH:

Q. Just one question, Mr. Vanorsdale. In your opinion, can you extrapolate the results of the model to the whole reservoir?

A. Typically, the purpose of simulation is to take a small area of the reservoir or a field and then extrapolate the results to the entire field.

I would say that the results obtained from this simulation would be representative of what the entire field would do. In other words, should the entire field be enabled to go to the 8000-to-1 GOR, the ultimate recovery for the field would not be adversely affected.

EXAMINER CATANACH: Thank you.

Mr. Bruce?

MR. BRUCE: I don't have anything further from Mr. Vanorsdale.

Like I said, I'd like to recall for a very brief period of time Mr. Stouffer.

EXAMINER CATANACH: Okay.

MARK STOUFFER,

the witness herein, having been previously duly sworn upon his oath, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. BRUCE:

Q. Now, Mr. Stouffer, you've been listening to Mr. Vanorsdale testify, and he on his final exhibit had a -- had oil recovery and gas recovery under a couple of different scenarios. Have you seen that exhibit?

A. Yes, I have.

Q. Let me hand it to you, just in case. And then refer to your Exhibit 23, and could you just briefly explain why you prepared this exhibit?

A. Refer to my Exhibit 23?

Q. Or 32, excuse me.

A. 32?

Q. Dyslexia here.

A. Okay, Exhibit 32 is a reserves and economic comparison for the five-well model area at the 2000 versus

the 8000-to-1 GOR allowables. Mr. Vanorsdale's simulation model was used to predict the recovery factors and the production volumes in each case.

As you can see, the oil recovery, gas recovery, cumulative GOR and oil recovery factor on his Exhibit Number 31 are identical to the numbers that I used in my comparison on Exhibit 32.

Q. Now, the 8000-to-1 GOR shows a slightly lower, one or two percent, less oil recovery at 8000 to 1 GOR, does it not?

A. Yes, it does. That difference is very small. It's a minor difference. If you apply that .2-percent difference to the original oil in place in the model area, the five-well model area, the difference amounts to approximately 2000 barrels per well. Considering these wells in the model area have ultimate recoveries of approximately 120,000 barrels per well, the 2000 compared to the 120,000 is a relatively minor loss.

Q. But nonetheless, Pogo, like most operators, doesn't want to cause waste, does it?

A. No, we certainly do not.

Q. And what does this exhibit show?

A. This exhibit shows the -- was intended to show the economic benefit from the 8000-to-1 GOR versus the 2000-to-1 case. As you can see, the bottom three rows, the

8000-to-1 case, results in a two-year shorter well life, 8.3 years, as opposed to 10.3 years. So you can get your reserves faster.

There's also a $230,000 savings in operating costs, and there's also a $340,000 improvement in net present value.

This translates to a benefit for the working interest and the royalty owners due to the decreased cash flow and high revenues received up front in the 8000-to-1 case.

So by going to the 8000-to-1, we're maximizing the value of the assets for both the working interest owners and the royalty owners.

Also, the small amount of oil not recovered by the 8000-to-1 case could be recovered at a later date under secondary recovery.

Q. Now, you mentioned operating costs before. They're kind of steep in this field, aren't they?

A. From what I've seen on lease operating statements on our wells, they average anywhere from $3500 to $4000 per well per month.

Q. Thank you. And -- Now, Mr. McDaniel also mentioned a sliding-scale royalty. Is there any benefit to producing these wells at a higher rate for the royalty owners?

A. Yes, I believe there is. Several of the leases have the sliding-scale royalty. By having the 8000-to-1 GOR increase, the operators will be able to produce at top allowable for a longer period of time without having to curtail production. Therefore, the increased production rates will translate to higher royalties.

For example, at top allowable, the royalty is 20 percent compared to 12 1/2 percent at less than 50 barrels a day.

Q. Now, one final question. Mr. Kellahin had referred Mr. Vanorsdale back to your Exhibits 13A and 13B. Do you have any comment on the initial GORs or solution --

A. Yes, I do. The -- Mr. Kellahin, I believe, asked Mr. Vanorsdale what impact or what number -- where he got the solution gas/oil ratio to use in his model. He said he got it from the PVT data, which is correct.

If you'll look at Exhibit 13A, the number of 1130 that he used, if you look at the -- in the bottom box, under "Separator Test Results", the total solution gas/oil ratio of 1130 corresponds to what Mr. Vanorsdale used.

The other number in the box under "Differential Vaporization Data" is a higher number. However, the more accurate number to use in this case is the separator test results, so he did use the correct number, based on the PVT data.

MR. BRUCE: Thank you. Pass the witness, Mr. Examiner.

EXAMINER CATANACH: Mr. Kellahin?

CROSS-EXAMINATION

BY MR. KELLAHIN:

Q. Mr. Stouffer, you told me a recombined sample -- based upon a surface sample, the 1130 is more accurate than a bottomhole?

A. No, I did not say that.

Q. Did I misunderstand you?

A. I did not say that. What I said was, the separator test results are more accurate to use in this case. They are a flash process, which is more representative of what we have going on at the separator, as opposed to differential vaporization data, which will be higher, since it's taken down to residual oil saturation or residual dead oil.

Q. The Kaiser-Francis PVT data, how was that taken?

A. I believe that was taken by a bottomhole sample.

Q. Yeah. Isn't a bottomhole sample going to be a better sample than this recombined effort at the surface?

A. No, I don't believe so.

Q. Why not?

A. Recombination is used commonly, and it's considered just as accurate in many cases as bottomhole

data.

Q. Okay. Exhibit 32, is this an economic analysis made for the five wells, or does this represent what is the economic comparison for each of the wells in the five-well simulation?

A. These results shown here are for the composite five wells.

Q. Okay. When I look at the difference in the two columns, about 338,000, and that's for the five wells --

A. Yes, that's correct.

Q. -- 67,000 per well?

A. I don't have a calculator, but I'll trust your math.

Q. Okay. If you look back up here and we look at 2000 to 1, ultimate oil recovery is higher than it is under the 8000 scenario, right?

A. That's correct.

Q. Okay.

A. However, it is a relatively insignificant reduction in oil recovery.

Q. I can't figure out the last line, "Net Present Value". What were you using for your oil price?

A. I utilized a price forecast that I generated on my own, starting initially at $15 per barrel, escalating at four percent per year. I used a gas price at $2 per MCF,

also escalating at four percent per year.

Q. For the life of --

A. For the life --

Q. -- of the operation?

A. Yes, sir.

Q. Okay. The net, what did you take out to get a net? Did you take out royalties?

A. Yes, I did.

Q. Okay, and you took out what? Taxes?

A. Yes, this net present value number is after tax.

Q. What was the tax rate you took?

A. I believe the corporate tax rate, using the economics model, is 28 percent.

Q. Okay. The lease operating expenses, do you remember what you started at?

A. Yes, they were $3500 per month per well, also escalated at four percent.

MR. KELLAHIN: Okay. All right, sir, thank you.

EXAMINER CATANACH: Anything further, Mr. Bruce?

MR. BRUCE: No, sir. And that finishes my case.

EXAMINER CATANACH: Okay, the witness may be excused.

Let's take a short break here and let Mr. Kellahin get prepared.

(Thereupon, a recess was taken at 2:28 p.m.)

(The following proceedings had at 2:38 p.m.)

EXAMINER CATANACH: Call the hearing back to order at this time.

MR. KELLAHIN: Mr. Examiner, I have two witnesses to present. Alan Benson is my first witness. He is a petroleum geologist, Kaiser-Francis.

James Wakefield is my engineer, and he is the second witness.

Call at this time Mr. Alan Benson.

ALAN BENSON,

the witness herein, after having been first duly sworn upon his oath, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. Mr. Benson, would you please state your name and occupation?

A. Alan Benson. I'm a geological engineer.

Q. On prior occasions have you testified as a geologic expert before this Division?

A. I have.

Q. Pursuant to your employment as a geologist with your company, have you made a geologic study of the reservoir that has been identified in this case?

A. Yes, I have.

MR. KELLAHIN: We tender Mr. Benson as an expert

petroleum geologist.

EXAMINER CATANACH: Mr. Benson is so qualified.

Q. (By Mr. Kellahin) Mr. Benson, let me ask you, sir, to turn to what we've marked as Kaiser-Francis Exhibit Number 1 and have you identify that display for us.

A. Yes, that's a net sand -- I'm sorry, which one is -- Is that the isopach or the cross-section?

Q. Well, mine is an isopach, but I may have been out of order. I've got what you have.

A. Okay, that's what I --

Q. All right, we're all looking at the same little creature here.

A. Mine aren't marked.

Q. All right. If you'll help me mark it, that's Exhibit 1, and that's your net sand isopach?

A. That's correct.

Q. All right, sir. Describe for us the interval that you're mapping.

A. This is the Lower Brushy Can. sand of the Delaware Mountain Group.

Q. Why would you have chosen to map that particular member or interval of the pool?

A. This is the interval that's productive in this field.

Q. How do you construct a map like this?

A. You use well logs and obtain the feet of pay from the well logs and then post those wells to a map. And then based on your interpretation of the depositional environment, you contour that map.

Q. Okay, it's difficult to find all the section numbers on your display, but the Kaiser-Francis acreage, if you'll look three sections down, see Section 19? And then if you go east into Sections 20 and 21, that's approximately where the Kaiser-Francis acreage is located?

A. Well, we operate those two sections, Sections 20 and 21. We also own nonoperating working interest in other sections.

Q. All right, sir. Do you have an opinion as a geologist whether or not this area, which currently is being managed by the Division as two different pools, is in fact one common source of supply?

A. It is one common source of supply.

Q. Have you reached any geologic conclusions with regards to the distribution and continuity of the Brushy Canyon member of the reservoir?

A. It's very continuous.

Q. When we look at the values on the isopach, what cutoff value did you use?

A. I used a density porosity of 14 percent.

Q. With that criteria, and with the data available

for mapping, you have generated this map?

A. Yes, I have.

Q. And what conclusions do you reach?

A. That it's a continuous reservoir, all the way up and down the extent of this map.

Q. If Pogo drills a well in the Brushy Canyon member of the pool in any of their portions of the reservoir, is that going to be the same Brushy Canyon interval that Kaiser-Francis is producing or intends to produce?

A. Yes, it is.

Q. Do you see any breaks or separations between what are now two separate pools?

A. No.

Q. Do you see any reason not to treat those as one common, single source of supply?

A. No, sir, I do not.

Q. Let's turn to Exhibit 2, and I apologize for not marking these, Mr. Examiner. I wasn't sure quite what the sequence would be, but the cross-section is Number 2.

A. Correct.

Q. All right, sir, turn to that and first of all tell us the reason for selecting these particular wells on your north-south cross-section.

A. This is a north-south cross-section that runs the entire length of the field. It's marked with an orange

line on Exhibit 1. It's very similar to the cross-section that's presented by Pogo.

The reason I chose these particular wells was just that it made a nice line up and down the middle of the field and the thickest part of the reservoir and showed off the continuity of the reservoir, north and south, to a very dramatic extent.

Q. Do you see any relationship to the pay thickness for the Lower Brushy Canyon and the productivity of wells that penetrate various portions of the pool?

A. I haven't examined any of the productivity of any of the wells.

Q. All right. We can conclude and agree, then, with the Pogo geologic presentation to the extent that in principle you believe in one common source of supply, and whatever rules are developed and adopted by the Division ought to be applied throughout the pool?

A. Yes, I find the Pogo geologic presentation to be very effective and that any rules adopted for one field should be adopted for both.

MR. KELLAHIN: Okay, that concludes my examination of Mr. Benson.

We move the introduction of his Exhibits 1 and 2.

EXAMINER CATANACH: Exhibits 1 and 2 will be admitted as evidence.

MR. BRUCE: Very briefly, Mr. Examiner.

CROSS-EXAMINATION

BY MR. BRUCE:

Q. Mr. Benson, your Exhibit 1 is a map of the entire -- what Pogo called the A interval, the Lower Brushy Canyon zone?

A. I believe they called it BC-2 and BC-4.

Q. This is the BC-2 plus BC-4?

A. That's correct.

Q. Okay, I just wanted to clear that up.

And you're showing a continuous deposition on this map. Does the continuous deposition mean continuous permeability throughout that area?

A. In my opinion, yes.

MR. BRUCE: Nothing further.

EXAMINER CATANACH: I have no questions of the witness. He may be excused.

MR. KELLAHIN: Call at this time Mr. Jim Wakefield.

JIM WAKEFIELD,

the witness herein, after having been first duly sworn upon his oath, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. KELLAHIN:

Q. All right, sir, are you all ready? Would you

please state your name and occupation?

A. My name is Jim Wakefield. I'm a petroleum engineer with Kaiser-Francis Oil Company.

Q. Mr. Wakefield, on prior occasions have you qualified as an expert petroleum engineer before the Division?

A. I have.

Q. And pursuant to your employment in that capacity, have you made an engineering study of what we're describing here as the Delaware Pools, the Los Medanos and the West Sand Dunes Pool in Eddy County, New Mexico?

A. Yes, sir, I have.

Q. What is the position of your company with regards to Pogo's Application in this case?

A. We recommend that it be denied.

Q. Describe for us what is your activity in the pool.

A. We are an operator of Sections 20 and 21. I believe Pogo, from an early exhibit that showed a pink portion and a green portion, with the pink, I guess, being Los Medanos and the green or blue portion being the West Sand Dunes-Delaware fields, and the interval in between there was white in Sections 20 and 21, and then a little part of it was blue.

Q. Have you made a study of the request that Pogo

has made to the Examiner to increase the GOR in these two pools?

A. I have.

Q. Have you shared and exchanged data with Pogo concerning information in this reservoir?

A. I have.

Q. Based upon that study, do you have an opinion as to whether or not it is timely to increase the GOR in this reservoir above the current 2000 to 1?

A. I believe it is not a timely event to have occur.

Q. Why, in your opinion, Mr. Wakefield, is it premature to increase the GOR to 8000 to 1?

A. We have a very large reservoir being developed. I say "being developed" because it's approximately six or maybe as much as seven miles long in a north-south direction, as evidenced by the many maps that have been entered into exhibits here today, and as much as two miles wide. There could be potentially as many as 170 wells drilled in this reservoir. Presently there's somewhere around 80. It's kind of a moving number as people move rigs in and drill. Maybe a little bit less, maybe a little more than that, but somewhere close to that number.

There are plans to drill a number of wells currently. Kaiser-Francis, for instance, is planning to drill additional wells, Pogo is drilling additional wells.

Yates, I haven't heard their plans; I don't know what they plan to do. I know that Santa Fe plans to drill additional wells. Merit may be drilling some additional wells. So it's an ongoing field development.

And what's interesting to look at, beyond just the model studies and the numbers that are being quoted by Pogo, is that this reservoir has had a huge amount of gas in place.

The information obtained from PVT data indicates that this reservoir is to the high end of being a black oil. It's not a volatile oil; it's to the high end. It shows an initial formation volume factor of about 1.75 in the reservoir in terms of -- I mean -- Excuse me, I'm getting confused here, ahead of myself.

Formation factor initial was 1.754 on the Kaiser-Francis PVT data, which indicates a high-shrinkage oil. I think they used a 1.5 in his model study.

The gas in solution in the reservoirs, in the 1425 range for our PVT data, indicates a huge amount of gas in place. This is an energy factor in the reservoir, a large energy factor, which will result in, we think, significantly higher recoveries than Pogo is postulating at 11 percent. In fact, we think that out of the reservoir as a total there may be as much as 20 million barrels of oil and 130 BCF of gas produced. A significant reservoir, one

that, at this point in time, where we've only produced maybe 1.7, 1.8 million barrels to date, it's too early in the life of the reservoir to start tampering with increasing gas/oil ratios, particularly with the variety of gas/oil ratios present in the field today.

Q. Do you have an approximate volume for the reservoir in terms of ultimate oil recovery from the entire pool?

A. Somewhere around 20 million barrels, we think.

Q. And at this point in the life of the reservoir, we've captured how many barrels of oil?

A. Approximately 1.7 million. And that's through, I believe, about October 1st, maybe November 1st. I'd have to go back and look.

Q. Have you examined the geology that Mr. Benson has generated for this reservoir?

A. I have.

Q. And are you familiar with his information and with the geologic data?

A. Yes, I am.

Q. What is your concern about allowing those older wells in the pool to produce at a higher gas/oil ratio?

A. We have a -- The field has essentially been developed in two different ways.

The southern edge of the field, if you take the

inner section or the dividing line between Sections 20 and 21 and 28 and 29, essentially that southern half has been extensively developed and is -- outside of Section 29, is on 40-acre spacing. As it extends to the south that's still developing.

If you go to the north, due to a variety of reasons, most of which is potash, and some just preference by some of the operators in that area, it hasn't been developed as rapidly. And as you saw from some of the exhibits, the gas/oil ratios were quite different between the north and the south.

And at this point in time with still additional development being planned, particularly in sections 20 and 21 where we cannot drill or are prohibited from drilling straight holes and have to drill either directionally or perhaps even horizontally, I guess, to develop our lease under the potash, it seems inappropriate to not only continue the current gas production in excess of the state-mandated allowables, but to ask for an increased gas allowable which allows them to further reduce pressure and create a pressure sink in the south end of the field that potentially could drain through the numerous fractures.

All these wells have been fracture-treated. There are high-permeability conduits that exist through the core analysis -- you can see them -- could easily create a

conduit from the north to the south and drain gas from the south end to the north end -- pardon me, from the north end to the south end, due to the pressure sink, which would in fact reduce recoveries, particularly for Section 20 and 21 where we're not able to develop and compete on a well-to-well basis.

Q. In a solution gas drive reservoir, there is only so much energy to drive the oil production that's within the reservoir?

A. That's correct, the --

Q. When you look at a solution gas drive reservoir as an engineer, what are the most important factors for you that affect ultimate recovery?

A. The two factors that are most important are pressure and oil/gas ratio.

Q. Why are those important?

A. Because they drive everything else. Everything else in the equation for recovery is a function of PVT. The only variables are pressure and gas/oil ratio.

And if you drain off pressure, i.e., by either being late in the development, and the field has good perm. and is in excellent communication, then you drain off pressure. And if you're late in developing, you have lower reserves.

If you permit gas to be drained off through high-

perm. sections or in other ways produced, then you again have reduced recoveries in areas of the field.

Q. Give us a perspective, if you will, about the engineering presentation that looked at *Craft and Hawkins* or any of the other published treatises on the concept that ultimate oil recovery from a solution gas drive reservoir is not a function of rate.

Did I say that right?

A. Say it again.

Q. All right. Pogo commented a while ago on the fact that they had concluded it was a solution gas drive reservoir.

A. I agree with that.

Q. All right, and that it did not matter in terms of ultimate recovery that we produced the oil at any limitation. In other words, lower rates of oil recovery is not going to increase ultimate oil?

A. Actually, what my opinion of that is, based on my understanding of the reservoir mechanisms involved, is that given the fact that Kaiser-Francis is in an area of the field that is being prohibited from being developed, essentially in a competitive manner, we are going to, by increasing the gas/oil ratio, be subject to drainage of pressure, pressure that is very precious to us in the recovery of hydrocarbons in our lease.

It's an issue more, in my opinion, of equities across -- and correlative rights across lease lines.

Q. I asked the Pogo engineer if he had any pressure information between or among wells so we could examine with him this drainage issue. He said he had not done that work.

Have you done any kind of work like that to talk about drainage?

A. I have done some of that. There's very few pressures that actually give you an accurate determination of the current reservoir pressure. There's maybe three or four wells, maybe five in total, that actually gives a good snapshot view of what's happening in the reservoir.

If we had better pressure data, then the question that we have to answer here about harm to the reservoir and ultimate recovery would be much easier. Because you don't have that information, it makes it much more difficult.

Q. When you look at the field as a total, have you examined whether or not the field as a total is up against or exceeding the gas/oil ratio of 2000 to 1?

A. It's not. The south end, because of its more rapid development, its high competition for reserves, I believe are interfering with each other, first of all, to a large extent. I think that that is creating a high gas saturation in that area of the field. That is causing your

high gas/oil ratios.

If you look at the field as a whole, the field as a whole does not need an increased gas/oil ratio. We are well under the limit for the number of wells we have, versus the amount of gas that can be produced on a field basis.

What we have a problem with is that inappropriately, at least in my opinion, and for state-mandated gas allowables, we have a number of leases that are producing in excess of the state gas/oil ratio.

Q. Does the current 2000-to-1 GOR for the wells in the pool serve as a useful conservation means by which to limit the gas and the energy withdrawal from the reservoir?

A. Yes, it does. Again, we have a significant amount of gas in the reservoir. The equities with respect to gas are equally important, in our opinion, as it is for the oil.

Q. Do you have an opinion as to whether or not it is a more efficient use of that drive mechanism in the reservoir to restrict the high-GOR wells until the entire field exceeds the GOR?

A. I don't know that I would go that far. I would say it would be in the interests of conservation, in the interest of equities to maintain the current GOR until the field is developed.

Q. Let's look at your Exhibit Number 3; it's captioned "PVT Data". Describe for us what you're showing here.

A. I believe this data has already been entered into testimony through Pogo. It's just a comparison on a line-by-line basis of the information from the PVT analysis.

Q. Did you prepare a tabulation of bottomhole pressures?

A. Yes, I did.

Q. I'm marking that as Exhibit Number 4. Would you turn to that now, Mr. Wakefield?

A. Okay.

Q. Describe for us what you're showing here.

A. This is a list of all the known bottomhole pressures available to me at this time. There may be some taken by Yates, but they -- and my questioning of their personnel didn't have any to give me. Enron operated the wells that Merit now operates. They had no bottomhole pressure data. Perhaps Yates has taken some recently I don't know about, but this is -- I tried to make the universe of known bottomhole pressures.

Q. To what purpose have you utilized this information?

A. What I was trying to do was to find the initial bottomhole pressure in conjunction with the PVT data to

determine at what point the reservoir went through bubble point and what the current reservoir pressure in the field is.

Q. What is your opinion on those issues?

A. My opinion is that the DST data on the Mobil Fed 29 Number 7 indicated a DST pressure of 3570, and I think that's probably pretty close to the initial bottomhole pressure of the reservoir. That was taken 9-92, and it could be lower than the original, because at 3-92 the Mobil Fed 29 began producing. I'm not sure what the effect would be in total for that.

The Pure Gold 4 well -- I think it should be Pure Gold "D" Number 4 -- on 10-16-92 had a DST of 3430.

And then on 3-26-93 the Pure Gold "A" Number 2 well had a bottomhole pressure that was built up adequately to extrapolate to a P* of 3292, as testified earlier.

And the Pure Gold "A" Number 4 well, we ran a -- what's called a V-tool by Halliburton, which is essentially a DST-type mechanism, which measured about 3328 pounds, bottomhole pressure, which is fairly close in agreement to the Pure Gold "A" Number 2 pressure.

And then more recently, there was three pressures taken.

11-26-93, the Mobil Fed 29 was shut in for 335 hours and measured a final pressure of 1613. It had not

built up adequately to be extrapolatable to a P*.

The Pure Gold "A" Number 3 well, when it was drilled on 11-30-93, had a bottomhole pressure of 2762.

And then the Pure Gold "B" Number 4 had a bottomhole pressure measured most recently of 1447 pounds after 117 hours. Again, it was still in the transition period, and we could not translate that to a bottomhole pressure.

The point being, the last three pressures, is that there's a gross difference between wells that are producing at or close to their capability versus wells that are being drilled in offsetting 40-acre spacing units, and that new well, being the "A" 3, has seen significant pressure depletion, i.e., drainage.

The bubble point of 3220 and the PVT data that Kaiser-Francis obtained in the Pure Gold "A" Number 2 well will indicate that shortly after 3-26 or 5-18, somewhere, probably the summer of 1993, the reservoir went through a bubble point, at least in those areas of the field where they're developed.

Q. What in your opinion is the solution gas/oil ratio for the reservoir initially?

A. The -- Producing through the flash process, as was testified, was probably 1240, 1130 to 1240, depending on which of the PVT data you look at. However, for

purposes of estimating the gas in place you would use the flash liberation, which is the 1425 or -- I think it's the 1280 number from the PVT data.

Q. Put the pressure information in perspective for us. What concerns are you expressing with regards to the pressure information that you now have?

A. This pressure data indicates to me, at least the last three points in particular, that the areas in Sections 20 and 21 that we haven't been able to drill yet are being drained, that there's a pressure sink existing to the south which is significant, and -- in terms of a 1000-p.s.i. differential pressure.

That pressure sink, in our opinion, due to the way we view the core analysis and the way we view the way the well's been fracture-treated, provide a conduit that can permit gas to migrate from the north to the south with this kind of pressure differential.

Q. Let's turn to your Exhibit Number 5. It's the illustration that's got the color code on it.

A. Uh-huh.

Q. Identify that for us.

A. This is very similar to the -- There was two, actually two exhibits proposed by -- or presented by Pogo, one showing the initial GORs on an isopach map -- or I guess it was a structure map, actually -- and one with

current GORs on the same structure map.

The intent of their exhibit was to show that it doesn't really matter where you're at in the reservoir; GOR is a function of something else besides the wells after the test and with respect to its structural position.

And I think it was alluded to that in their opinion it was a function of the amount of production recovered to date, and -- at each individual well, not necessarily its relationship to when the well was drilled or anything, just total number of barrels produced.

In other words, you've got a well that was drilled today and made 25,000 barrels a month, and it had the same GOR as one that produced for five months and had that.

Q. Is there a relationship that you see where the older wells in fact have higher GORs?

A. I haven't studied it from that viewpoint to that extent, to make that determination.

What I have seen, though, is that, essentially, as I said before, the field is a north-south development situation. To the north in Sections 20 and 21, up in 2, 8, 9, 17 and 16, those wells developing later have a significantly lower GOR. The wells to the south have a significantly higher GOR. That GOR difference is a result of reservoir pressure.

Depletion at those wells -- Some of those wells are thin. You can play games with the thinness of the well. You could play games with the number of feet of pay in one zone versus another, things like that, or permeability difference, if you knew the permeability. In fact, we don't, because we only have two cores that actually tell us what the permeability is, and they're all -- they are offset wells. So we don't have a spread of data to give us a confidence level to really predict what permeabilities are.

But the indication is that you have a much -- In the pressure and the GOR performance, you have an indication that the southern half is experiencing very high GORs at pressure depletion, and the north doesn't have that same pressure depletion. Therefore, it's at a higher GOR -- pardon me, a lower GOR.

Q. If the PVT data tells you that the solution GOR is in the 1400-to-1 range, and if the rules currently allow you to produce at 2000 to 1, there's a 600-MCF differential. That's simply going to be free gas, isn't it?

A. I'm not sure I can answer the question the way you asked it.

Q. All right, I'll --

A. The solution gas/oil ratio has to do with the

amount of gas in the reservoir and the initial producing gas/oil ratio.

When you look at this field, and particularly early time at this field, you don't see the 1400 or 1100 gas/oil ratio because a lot of the gas is flared, if you look at the production data in the available production books.

Now, some of the operators have kept records, I'm sure, what the gas flared has been during those early times and have reconstructed, as Pogo did recently. I received a packet of information that changed all of their gas rates back to the time they began producing, which I assume they went back and tried to add in all the gas that flared.

And when you do that, you should see initial gas/oil ratios in the terms of the 1000 or 1100 standard cubic feet per barrel, predicted by PVT. I haven't had time to examine the documents today that have been presented, to look at that, but I'm sure that they're probably going to show something like that.

You would not expect wells drilled in this reservoir to have GORs initially in excess of about 1200 or 1300. If they do, then they probably mis-measured the gas, I would think. They didn't share it properly between wells, et cetera.

At later times when wells are drilled,

particularly in areas of development such as 32 and the south half of 29 and the east half of 28, the newer wells should come in -- if they're being drained, they should come in at higher gas/oil ratios, and I think that they did. We're seeing that, I think, in the newer wells. But I haven't made it a direct examination to point those out.

The key point again, as far as what I'm trying to show here with this exhibit, is just that there's a difference in development of the field, which is the main cause of the gas/oil ratio difference and the pressure-depletion difference, and -- and that's it.

Q. Okay. Let's turn now to Exhibit 6. It's captioned "Gas/Oil Ratio Comparison".

A. All right.

Q. What have you prepared here, Mr. Wakefield?

A. This essentially is the data that went into the prior exhibit. And what I did was, just in case there was a question someone had about low rates versus high rates, we could attempt to address that. I don't really think it's important to go into all that at this time. It's just simply the data that goes into there.

Q. All right, sir.

A. And it shows -- More important, it shows that the data for the north end, which was test data from Santa Fe primarily, and then from Kaiser-Francis, is newer data,

therefore at a later point in time in the reservoir than the data from the south end, which is actual production data supplied from operators on the C-115s.

The point being, is that if you have November data that's showing a lower GOR in the north, the GORs will actually be higher for the same point in time for the wells to the south. If you were to move them one month further, you would expect their GORs to go up.

So that the exhibit -- the prior exhibit, Exhibit Number 5, would then show even higher GORs in the south end, if you were to hit the same point in time.

Q. Have you examined the reported information to attempt to identify what leases or what wells were going to be the direct beneficiaries of any GOR increase if the Division should increase the GOR?

A. I have.

Q. Let's turn to Exhibit 7. It's a spreadsheet. First column it says "Operator", and then the second one it says "Lease Name".

A. Yes.

Q. All right, what are you preparing here?

A. This is a tabulation of the number of wells on those leases in these two fields during the month of September, 1993, and the reported oil and gas production.

The next -- That takes care of the first three

columns. The next column is gas/oil ratio and MCF per barrel versus -- In other words, standard cubic feet per barrel would be -- instead of 1.29, it would be 1290. It depends on how you're going to look at that.

The next column, then, should be the 2000-to-1 GOR gas allowable in MCF a month.

And then finally the last column would be a comparison of the allowable versus the amount of gas produced in that month. And the obvious thing, it draws your eyes that there's two leases that are produced in excess of their allowable during the month of September -- or at least reported on C-115s.

Q. Show me how to read it. For example, the first line, it says "Yates", they've got eight wells --

A. Yates operates the Medano VA State well, state lease. They have eight wells that month reported.

Q. They would have been eight --

A. Oil production was 17,101 barrels, gas production 21,096, gas/oil ratio of 1.29 MCF per barrel. Their gas allowable was 89,760 MCF. They actually had room to produce another 67,764 MCF for the month.

Q. That's what I want to draw your attention to. What's the 67,000 number in relation to the allowable?

A. That's the difference between the allowable and the actual production.

Q. All right. They under-used their allowable for gas, if you will, by 67,000?

A. Yes, that's right.

Q. They got that much left to --

A. To produce as a lease.

Q. All right. And you read down, and then we get to a couple of the lines where the number is in parentheses?

A. Right. For instance, the Merit Sundance Federal was the largest overproducer. It produced 150,907 MCF for the month, 5 million a day. And essentially that's 2 million a day over its gas allowable or 72,367 MCF for the month.

The only other lease was the Pogo Pure Gold "D" Federal, which has ten wells on it and produced over its allowable some 10,163 MCF.

Q. Two operators in the reservoir over-producing their allowable?

A. Yes.

Q. Okay, let's turn now to the spreadsheet. The caption says "Kaiser-Francis Oil Company Operated".

A. Okay.

Q. What is this?

A. This is a snapshot view of two things. First, the top part, Kaiser-Francis's operating properties, Pure Gold "A" and "B" lease. We have three wells on the "A"

lease, four on the "B" lease.

It is an attempt to show the individual test data that we have on those wells for the most current month. And then we show they're below it, the December lease average production, it's off the gauge sheets, it's not reported on C-115s yet.

And as you go across the line it will show that, you know, we had -- for the Pure Gold "A" lease, the Number 2, 3 and 4 wells, the gas/oil ratio varied from 1.8 to 2.7 MCF per barrel, and that the Pure Gold "B" lease, the 3, 4, 5 and 6, varied from 1.16 to 2.6.

The absolute gas/oil ratio from the produced oil and gas for the December average would be 2.433 MCF per barrel for the Pure Gold "A" lease and 2.223 for the Pure Gold "B" lease.

The Number 3 well wasn't on much that month, and it's a new well. But these are -- and there's no -- This isn't an attempt to allocate the production for a well during those months; it's just a statement of what the individual tests said, and we don't -- I don't have the data on here that shows the number of wells produced or what you would allocate to an individual well.

Then as you come across the column it says "Monthly Oil Allowable" for the oil and the gas.

Then it says "Additional Gas to Produce (MCF per

day)". For the Pure Gold "A" lease we could have produced 436 MCF more per day, and for the Pure Gold "B" lease we could have produced 431 MCF more per day, which translates to about 13 million more per month on those two leases.

The bottom half of this exhibit, it says "Pogo Operated". Again, this is October production from Pogo's most recent amended C-115s. And what this shows is three leases.

The Pure Gold "D" lease, which is located in Section 28 immediately south of the Pure Gold "A" lease, have nine wells currently producing on that lease.

And these production numbers are exactly the numbers that they report on their C-115A, which shows if -- assuming that they have allocated this properly based on well tests, would give you a snapshot view of October for the Pure Gold "D" lease, which shows a variation in allowable from roughly 3 MCF per barrel up to 5.2.

Q. Again, the numbers in parentheses represent overproduction?

A. And as you come to the right, past the allowables, you come to "Gas Allowable, over/under (MCF per month)", and then the next column, "over/under (MCF per day)".

And you can see that on the lease, if you take the absolute allowable for each well, that of the nine

wells, all but three were over their allowable, for a total of 32,492 MCF for the month. On a daily basis, that's a million cubic feet per day.

Q. Okay. And --

A. And then you go to the Mobil Federal lease where they have four wells currently producing, similar analysis, similar situations here.

One of those wells does not produce over its mandated allowable, the other three do. They produced a total of 26,984 MCF for the month above their allowable, or 899 MCF per day.

And then finally the Federal 29 lease has 353 MCF a day left to be produced to get to their allowable.

If you --

Q. That's not a running total; this is just the month of October?

A. Yeah, just for the month of October.

If you were to go back and then compare Exhibit 7 and 8 and look at the snapshot views of September and October for the Pure Gold "D" lease, the rate of production of gas increased significantly between September and October.

Which is the point of their hearing here, is that they want an allowable to allow them to continue to produce at rates above the 2000-to-1 limit for the lease. And

they're not really asking for -- When they talk about the 2000-to-1 or a 4000-to-1 or 8000-to-1 GOR limit, they're not talking about it versus the actual production of the well; they're talking about it as an allowable. And there's a big difference in that.

I agree that the reservoir should be expected to see significantly higher GORs with time. It's a solution gas drive reservoir.

The difference is that I don't believe the field needs an increase in gas/oil ratio allowable because the field is producing well below the mandated state allowables.

Q. Have you made a study to determine whether there is any other analogies between what you expect to see in this reservoir and what has occurred over the life of other Delaware pools?

A. Yes, I have.

Q. Let me direct your attention to Exhibit Number 9. It's a plot of production.

A. This is a --

Q. At the very top, Jim, it says "Summary Loving-Delaware Summary".

A. Right. I believe this is the East Loving-Delaware field.

Q. Okay.

A. There's about 114 wells in this summary. I've highlighted in red the gas production, history of the lease, and the purple dots are the gas/oil ratio. And then the black line in between that is the oil production.

And if you'll notice, that the gas increases very rapidly, and as the oil hits a peak in the first half of 1991, the gas also hits a peak. The peak for the oil is about 160,000 -- 150,000, 160,000 barrels per month. And the peak for the gas is between 450,000 and 500,000 MCF per month.

And the gas continues on a very flat type of profile. The last two months I haven't been able to determine what they've done there. I don't believe they've drilled any new wells. If they have, I haven't been able to find them, because I'm not sure what the last two months are.

But with 114 wells, the field gas allowable here is about 900- -- I believe 920,000 MCF per month on a two-to-one [*sic*] GOR allowable. So their well -- Here they are, three years into the field, four years into the field, based on the predictive data that was presented earlier by Slider and the performance they expected, and it's matching quite well.

The gas/oil ratio is increasing, and -- beginning to taper off and level, the rate of increase is decreasing.

The oil production is declining about 30 percent for the field, and the gas has been very flat.

Again, the field performance doesn't require a gas/oil ratio increase.

Q. Let's turn and see what's happening in our reservoir. If you'll look at Exhibit 10, what have you plotted, and what do you conclude from this plot?

A. Exhibit 10 shows -- again, the red being the gas, the oil being the black, and the gas/oil ratio being the purple. We're very early in the life of the field. We are at probably the peak production. I say "probably" because we have a lot of wells left to drill and there may be a double peak here, in which case, you know, potentially we'll go even above the peak month of two-hundred-and-about-twenty-five-thousand barrels per month.

The gas allowable from Exhibit 7 says that the gas allowable will be 762,000 MMCF per month. Well, that point, the last production point here on the gas, is only 560 million. So we have a difference of 560- -- 200 million -- That's about 7 million cubic feet of gas per day that's left for the field to produce, and we don't need an increased gas/oil ratio. Increased gas/oil ratio here would only be for a few leases which would benefit by recovering additional gas from other leases that aren't developed.

Q. Let me have you turn to your last exhibit, Exhibit 11. Identify this for the --

A. Exhibit 11 is just a compilation of the production points on Exhibit Number 10. It's just presented so the numbers will be plain to people.

Q. In conclusion, then, Mr. Wakefield, what is your recommendation to the Examiner?

A. Our recommendation to the Examiner is that the Application be denied. At the very best, it should be delayed for at least six months to a year and then reconsidered with hopefully better production -- additional production data and some additional pressure data.

It's our opinion that if we're right, there's no decrease in ultimate recovery from the field. If they're wrong, there is.

MR. KELLAHIN: That concludes my examination of Mr. Wakefield.

We move the introduction of his Exhibits 3 through 11.

EXAMINER CATANACH: Exhibits 3 through 11 will be admitted as evidence.

CROSS-EXAMINATION

BY MR. BRUCE:

Q. Mr. Wakefield, if you could turn to your Exhibit 5, the plat --

A. Okay.

Q. -- I believe you said that you own interest and operate sections 20 and 21; is that correct?

A. Yes, sir.

Q. Do you own any interest in Section 17?

A. Yes, we do.

Q. South half of Section 17?

A. And the north half.

Q. And the north half. Do you own any interest in Section 28?

A. Yes, sir, we do.

Q. Okay. Now, what about your interests, especially in 20 and 21? When did you acquire those? When did Kaiser-Francis acquire those?

A. In the early Eighties.

Q. So you've had them about a decade?

A. Roughly.

Q. And why didn't you start developing them sooner?

A. Developing what?

Q. Your leases.

A. Our leases -- For Delaware, I assume you mean?

Q. Yes.

A. We hadn't pursued Delaware because we were not offset by anyone and had not cataloged it as anything but possible pay behind pipe.

Q. Now, you're looking at Section 20, you're talking about having your acreage drained, but if you look at Section 20, there's really very little in Section 29 to the south of you, immediately to the south of you, is there?

A. That's correct.

Q. And unfortunately, Pogo has had the same problem as Kaiser-Francis on these potash issues, haven't they?

A. They have.

Q. You have in Section 20, in the southeast quarter, four wells. Kaiser operates those wells, don't they?

A. Yes, sir.

Q. Who proposed those wells?

A. Enron.

Q. So you had to wait until a non-operator proposed them before you drilled them?

A. Actually, we were ready to propose them and went to drill other locations than what they proposed. They submitted them before we could get them proposed.

Q. What about in Section 21?

A. Same thing.

Q. So basically, as I understand your position, you don't dispute that this is a solution gas drive reservoir; you're just saying we want time to develop our lease before we seek an increased GOR?

A. That's correct.

Q. And so the people who drilled out here first and took all the risks should be punished?

A. No, that's not what I said.

Q. Isn't that restricting their ability to produce?

A. No.

Q. Now, the solution gas is an energy factor, right?

A. Yes.

Q. Won't it be used as efficiently at 8000-to-1 GOR as it is at 2000-to-1?

A. On an individual well basis.

Q. Do you expect most of these leases on your Exhibit 5, over time, to exhibit increased GOR?

A. Yes.

Q. Now, you talked about a pressure sink. Do you have any evidence of that?

A. Yes.

Q. What is the evidence?

A. We presented it earlier, on Exhibit Number 4 as well as Exhibit Number 5.

Q. The decreased pressure on Kaiser's operated leases, is that what you're talking about?

A. On Mobil Federal 29 and the Pure Gold "B" Number 4, both taken in -- one in November, one in January, versus the Pure Gold "A" 3, which was taken in November.

Q. And if you had developed your leases quicker, you

wouldn't have that problem?

A. Of drainage? I assume you're saying that --

Q. You wouldn't have this --

A. What problem are you --

Q. Pressure, you're talking about a pressure sink.

A. Yes.

Q. One final issue. The closing argument was that if Pogo is wrong, there will be a decrease in the recovery factor; is that correct?

A. That's correct.

Q. What is that based on?

A. Just based on a simple statement that if indeed they are able to siphon gas from the north end to the south end, i.e., through pressure conduit, the pressure sink, high-permeability streaks and the fact that all the wells are fracture-treated, that we have a continuous reservoir, that we would see reduced recoveries in Sections 20 and 21, which would result in reduced recoveries for the field.

Q. But not poolwide?

A. Yeah, it would for fieldwide. If we have reduced oil recoveries, it's reduced oil recoveries for the field. You're not going to move the oil if you lose the gas, if you're losing pressure.

Q. And you're saying there's high-permeability streaks which preferentially produce this gas?

A. I'm saying that you have all the wells fracture-treated, which puts all the zone in communication, and we know from core analysis that we do have high-permeability streaks, 10, 12 millidarcies versus an average of less than 2, that, once communicated, with a pressure sink of 1000 p.s.i., can easily transport gas from one end of the field to the other.

Q. You don't agree that this is a low-permeability reservoir?

A. I didn't say that. I agreed with your analysis that the -- the average permeability is low, but there are significantly higher perms available.

Q. Looking at your Exhibit 8, do you have any wells that are now producing over the top gas allowable, on an individual-well basis, not a lease basis?

A. In excess of 374 MCF per day, or in view of the 2000-to-1 GOR?

Q. What's that? I'm sorry, I wasn't --

A. The gas allowables, 374 MCF per day? Is that what you're asking?

Q. Correct.

A. We have no wells producing more than 374 MCF per day. On Exhibit 8 we have test information on one-day tests.

Q. Okay.

A. I don't have information if the well produced the next day or not, if it was built up or whatever. That's just tests that were given to me by the field personnel.

Q. These permeability streaks you talked about, are they continuous, all the wells?

A. I think they probably are. If you examine the cross-sections that were presented by Pogo and by Mr. Benson for Kaiser Francis, you'll see a very high correlativeness between individual intervals throughout the field.

MR. BRUCE: I don't have any further questions of the witness, Mr. Examiner.

EXAMINER CATANACH: Just a couple.

EXAMINATION

BY EXAMINER CATANACH:

Q. What kind of time line do you see in developing Sections 20 and 21 at this point?

A. We just recently received permission to drill ten wells out of the 22 we'd like to drill in time, in Sections 20 and 21. Since we're dealing with a fairly new technology, Pogo and I -- Pogo and us have both agreed that we should drill at least one, see how it performs before we jump off and drill all of them.

We're going to have another hearing in a very short time to obtain permits for the remaining wells to be

drilled in those two sections, and would then be able to kick off a program to hopefully complete all those wells that need to be drilled by year end, 1994.

Q. So you believe that all those wells -- or Sections 20 and 21 may be fully developed within the end of the year?

A. I think so.

Q. Once those wells are developed, is it your opinion that maybe then would be an appropriate time to bump the GOR up?

A. I think it would be an appropriate time to come back to this Commission and examine that, and if we can get concurrence to do that, yes.

Q. How long would you -- In your opinion, how long would you estimate that -- before the entire field is fully developed?

A. I think by the end of this year, nearly everyone will have drilled the meaningful wells. There will still be wells drilled on the edges and to the far extents that attempt to either extend the reservoir or make it wider than it is.

But we're limited in doing some of that to the east by potash -- pardon me, to the west by potash -- and to the east. So I think that probably by year-end we'll have most of the wells drilled. Santa Fe indicates they

have a large budget and are going to drill as many wells as they can this year. We intend to drill, Pogo has agreed to drill with us in Sections 20 and 21 to date. Merit is drilling where they have opportunities.

I would anticipate development will be pretty much complete by year end.

Q. Is it your testimony that you think that once you get your wells drilled in Sections 20 and 21, at least you'll be protected -- you'll be more protected than you are now?

A. I think that we would be competitive.

EXAMINER CATANACH: Okay, I don't have anything else.

Anything else? Mr. Bruce? Mr. Kellahin?

MR. KELLAHIN: Nothing, sir.

MR. BRUCE: I would like to ask, if I could, Mr. Hoose one question.

EXAMINER CATANACH: Okay.

GARY HOOSE,

the witness herein, having been previously duly sworn upon his oath, was examined and testified as follows:

EXAMINATION

BY MR BRUCE:

Q. Mr. Hoose, were you here listening to Mr. Wakefield testify?

A. Yes, I was.

Q. And did you hear him testify about these permeability streaks he talked about?

A. Yes, I did.

Q. In your opinion, are these permeability streaks -- What is your comment on them?

A. He mentioned that he thought they were continuous from well to well, and I wondered at the time what he based that on.

The cores that we have seen do not support that. I understand why he would believe that there perhaps some permeability streaks. I have some core-analysis reports here. I do not have extra copies. Kaiser has these reports in their possession as well as core photos and other associated data.

I'll be discussing very briefly two intervals, and you can follow along on any of the cross-sections that you have.

The two wells that were referred to that had the cores were the Kaiser-Francis Pure Gold "A" Number 2, and the interval that I would refer to would be from approximately 7760 down to approximately 7800 feet, and that would be what was earlier referred to as the BC-4 section, which is again what we believe to be the major contributing reservoir.

The similar section in the other well, which is the Pogo Mobil Fed Number 4 -- and these are, I believe, diagonal offsets to each other; they're very close in position -- the section in question there would be from approximately 7726 down to perhaps 7754.

In each well there are porosities -- these are cross-plot porosities, and this is rough, but 17 to 18 percent, perhaps, maximum.

In the Kaiser-Francis well, in that interval, there are indeed some reasonable porosity streaks in there. And mind you, we're not talking about tremendous porosities -- or permeabilities, excuse me. We're not talking about tremendous perms.

By way of example, many of the permeabilities we see in the core data, be it sidewall cores or in plugs taken from the full diameter core, are less than a millidarcy of permeability.

In this particular well, being the Kaiser Pure Gold "A" Number 2, they had in that interval some very reasonable perms by comparison. The highest one was 15.6 millidarcies horizontal perm. That was far and away the highest one. I might even question that one particular data point. Sometimes in the way these things are tested or if they've been fractured or something in handling, you might get a little bit higher, but perhaps that is a

correct point also.

There are several permeabilities of -- in the -- at least two in the seven-to-eight-millidarcy range, another handful of them in the two-to-five. We're not talking about very high permeabilities, even in the high-perm streak.

In the corresponding section, in the Pogo well, by contrast, and this is -- Mind you, both of these wells are in the thick trend of the reservoir and they're very near to each other. The corresponding sections are in general less than a millidarcy. In fact, an average looks to be about .5 to .6 millidarcies.

I would say that I see two of them here -- and these samples are taken every foot in these cores. I see two of them slightly over one millidarcy, 1.12, and 1.24. And towards the bottom and actually below the interval that I had mentioned earlier, down at 7768.4 and 7769.6, there's a -- presumably corresponding to a little bit better porosity -- a 2.8 and a 2.05.

The point being that even in wells that are very close to each other where we have the best data, which are both in the thick portion of the reservoir, we do not see it as a continuation of permeability streaks. And I expect that, yes, there may be perm streaks in the field, but from what we know, they would be discontinuous.

MR. BRUCE: Thank you.

EXAMINER CATANACH: Any cross, Mr. Kellahin?

MR. KELLAHIN: No, sir.

EXAMINER CATANACH: The witness may be excused.

Gentlemen, would you like to give brief closing statements?

MR. KELLAHIN: Oh, sure, why not?

(Off the record)

MR. KELLAHIN: Mr. Examiner, I'd like your permission to prepare for and submit to you a draft order in this case. But in addition to that, I'd like to share some of my comments and concerns with you.

We have a reasonably new Delaware Pool. The conservation rules of the State have established a limiting GOR for that pool. Those were the rules, and those were the procedures that all operators are required to abide by.

Pogo has violated the gas withdrawals. The spreadsheet shows significant overproduction. And rather than get into compliance and figure out how to make up this overproduction, they race in here and ask you to give them a special favor. They want to increase the GOR and thereby excuse themselves from taking more than their share of the gas-drive energy out of this reservoir.

We have done dozens and dozens and dozens of cases like this, Mr. Examiner, and almost always the

applicant is in Pogo's position. They come before you because they have a high-capacity oil well, and they don't want to live with the depth bracket allowable, and they want to take their share and their neighbor's share. Or they come in here and the GOR is restricting their production, and instead of complying and letting the more efficient wells produce and recover their share of the oil in the reservoir, Pogo and others ask for special treatment.

That's not how we practice conservation law in this state. This Division has consistently denied increases in gas/oil ratio unless there is unanimous consent of all operators in the pool to make an increase. You can search all the Delaware GOR cases. The only time you'll see an increase is when everybody unanimously asks for that increase.

You see the GOR increase later in the life of the reservoir, where everyone has exercised their correlative rights and gotten their wells into production, and as you see over time, the GOR increases for the pool.

But that's not the case here. The pool GOR is well below the pool allowable. It is premature to change the GOR for benefit of Pogo.

They have failed to prove their case, Mr. Examiner. You and I and others have -- sit in here and

listen to simulation by till we go nuts.

The simulator wants to rely on what the Division did in the Bird Creek case. Well, that's Order Number R-9501-A. Well, it was a computer war. Bird Creek asked to increase the East Loving-Delaware pool to 5000 to 1. The Commission said no. The Division said no. They didn't get it. I don't know what comfort they take out of citing that to you as an example, but that case represents a finding by this Commission that the drive mechanism in that Delaware pool was solution gas with no indication of extensive gas cap, water influx, formation compaction or connate water expansion. They said, I'm sorry, I don't care if it's solution gas drive or not. You don't get the increase.

What Pogo didn't prove to you today, because they couldn't, they couldn't satisfy the fundamental obligation to show that they're not impairing correlative rights. They cannot tell you and they cannot show you that the high-GOR wells are not affecting the offsetting wells. Mr. Wakefield's proof is to the contrary. They have no defense, no rebuttal. It's a slam-dunk, we win on that issue.

The waste issue is suspect too. After all the fancy simulation, the end result is that in ten years you're going to get more oil out of the reservoir at 2000

to 1 than if you pump it up.

This is a case, Mr. Examiner, that's being begged to be denied, and we ask that you do so. To grant it is to give Pogo a special favor to the expense and to the violation of the correlative rights of Kaiser-Francis.

EXAMINER CATANACH: Thank you, Mr. Kellahin.

Mr. Bruce?

MR. BRUCE: I don't understand Mr. Kellahin's comments about the East Loving-Delaware. Oryx came in here in that case, I believe, represented by Mr. Kellahin, and it was asserted that there was a secondary gas cap. That was the reason that was initially denied, the GOR was initially denied in that case. Pogo did come in later and prove that it was a solution gas drive reservoir and the 8000-to-1 GOR was granted.

I'm not quite sure what Mr. Kellahin is advocating here. I think he's saying that any time a case is opposed, it should be denied. I think that would have far-reaching effects on every operator in the pool. Just because someone doesn't agree with some data doesn't mean that the opponent is right.

As a matter of fact, it's undisputed in this case that there's a solution gas drive reservoir in the Los Medanos and West Sand Dunes-Delaware Pool. GOR is only a function of the amount of production. Waste will not occur

if the GOR is increased.

Kaiser hasn't attacked any of Pogo's data. Rather, they've come in here today to complain about potential drainage.

However, as they admitted up here, they're the last operator in the pool to start developing its acreage. They've had their acreage since the early 1980s. Only now they've started developing it. In fact, five of the six Kaiser-Francis wells in Sections 20 and 21 were proposed by non-operators. Kaiser didn't even want to drill them then, apparently, until it was proposed by other people.

Now Pogo does sympathize; Yates is here, they sympathize; most people sympathize with the potash problems that Kaiser has had.

But Pogo has the same problem in section 29. If you look at the map, there's hardly any wells there, and that's a very excellent part of the pool. So it's not like Pogo is totally unaffected by the inability to develop acreage.

Furthermore, correlative rights is only the opportunity you have to produce the reserves under your acreage. Kaiser-Francis has not had its correlative rights harmed. They should have gotten out of there a long time ago, drilled the acreage. So I think correlative rights is a red herring before the Division.

A feature of these Delaware pools is that they usually have top-allowable wells with rapidly increasing GORs early in the life of these wells. So if you need GOR relief, you need it early in the life of the pool. Waiting until more data is obtained, like Kaiser wants to do, is unnecessary. There's already been a couple million barrels produced.

And furthermore, who it's really harming is the early investors in the pool, the people who went out there, drilled the initial wells, proved up the prospect, and they're the ones being harmed. They're the ones with the high-GOR wells, they're the ones who need the relief. There's nothing wrong with that. It's benefitting everybody in the pool, to get the high GOR.

The evidence is clear that we have a solution gas drive pool. Ultimate poolwide recovery will not be harmed by increasing the GOR. And as a result, we think the GOR increase should be granted.

We think there's enough data today to make it permanent. We understand that in most cases the Division makes these rules temporary. If you're going to make them temporary, make them temporary for a year; there will be a lot more data. The reservoir is not being harmed, everybody will be taken care of.

We think this Application should be granted.

EXAMINER CATANACH: Thank you, Mr. Bruce.

Would you like to submit a rough draft, as well as --

MR. BRUCE: Oh, I guess if Tom's willing to, I'd better.

EXAMINER CATANACH: Mr. Diem, you didn't have a statement or anything you'd like to contribute?

MR. DIEM: No, I have no statement, Mr. Examiner.

EXAMINER CATANACH: Thank you.

Okay, there being nothing further, this case will be taken under advisement.

And this hearing is adjourned.

(Thereupon, these proceedings were concluded at 3:52 p.m.)

* * *

CERTIFICATE OF REPORTER

STATE OF NEW MEXICO)
) ss.
COUNTY OF SANTA FE)

I, Steven T. Brenner, Certified Court Reporter and Notary Public, HEREBY CERTIFY that the foregoing transcript of proceedings before the Oil Conservation Division was reported by me; that I transcribed my notes; and that the foregoing is a true and accurate record of the proceedings.

I FURTHER CERTIFY that I am not a relative or employee of any of the parties or attorneys involved in this matter and that I have no personal interest in the final disposition of this matter.

WITNESS MY HAND AND SEAL February 10th, 1994.

STEVEN T. BRENNER
CCR No. 7

My commission expires: October 14, 1994

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 10870 heard by me on May 20 1994.

, Examiner
Oil Conservation Division