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 BONNEVILLE FUELS CORPORATION FOR POOL CONTRACTION, POOL CREATION, AND SPECIAL POOL RULES, LEA COUNTY, NEW MEXICO

CASE NO. 11,493

ORIGINAL

REPORTER'S TRANSCRIPT OF PROCEEDINGS

EXAMINER HEARING

BEFORE: MICHAEL E. STOGNER, Hearing Examiner

May 2nd, 1996

Santa Fe, New Mexico

This matter came on for hearing before the New Mexico Oil Conservation Division, MICHAEL E. STOGNER, Hearing Examiner, on Thursday, May 2nd, 1996, at the New Mexico Energy, Minerals and Natural Resources Department, Porter Hall, 2040 South Pacheco, Santa Fe, New Mexico, Steven T. Brenner, Certified Court Reporter No. 7 for the State of New Mexico.

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I N D E X

May 2nd, 1996
Examiner Hearing
CASE NO. 11,493

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A P P E A R A N C E S

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By: WILLIAM F. CARR

* * *

WHEREUPON, the following proceedings were had at 2:08 p.m.:

EXAMINER STOGNER: This hearing will come to order.

At this time I'm going to call, on the top of page 2, Case Number 11,493.

MR. CARROLL: Application of Bonneville Fuels Corporation for pool contraction, pool creation, and special pool rules, Lea County, New Mexico.

EXAMINER STOGNER: At this time I'll call for appearances.

MR. CARR: May it please the Examiner, my name is William F. Carr with the Santa Fe law firm Campbell, Carr, Berge and Sheridan.

We represent Bonneville Fuels Corporation, and I have two witnesses.

EXAMINER STOGNER: Are there any other appearances in this matter?

Will both witnesses please stand to be sworn at this time?

(Thereupon, the witnesses were sworn.)

EXAMINER STOGNER: Mr. Carr?

BOB KOZAREK,

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

DIRECT EXAMINATION

BY MR. CARR:

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

A. Bob Kozarek, K-o-z-a-r-e-k.

Q. Mr. Kozarek, where do you reside?

A. Denver, Colorado.

Q. By whom are you employed?

A. Bonneville Fuels, as a senior geologist.

Q. Have you previously testified before the New Mexico Oil Conservation Division?

A. Yes, I have.

Q. And at the time of that testimony, were your credentials as an expert witness in petroleum geology accepted and made a matter of record?

A. Yes, they were.

Q. Are you familiar with the Application filed in this case on behalf of Bonneville Fuels Corporation?

A. Yes, I am.

Q. And have you made a geological study of the area surrounding the South Humble City-Strawn Oil Pool?

A. Yes, I have.

Q. Are you prepared to present the results of that

study to Mr. Stogner today?

A. Yes, I am.

MR. CARR: Are the witness's qualifications acceptable?

EXAMINER STOGNER: They are.

Q. (By Mr. Carr) Mr. Kozarek, could you briefly summarize for Mr. Stogner what Bonneville seeks with this Application?

A. Bonneville requests from the OCD a contraction of the South Humble City-Strawn Oil Pool, creation of a new pool for the production of hydrocarbons from the Strawn formation, and promulgation of special pool rules and regulations for this pool, which provide for 80-acre spacing or proration units, special well-location requirements, special depth bracket allowable provisions, and a special gas-oil ratio for the pool of 8000 cubic feet of gas for each barrel of oil produced.

Q. Mr. Kozarek, could you review for the Examiner the current rules that govern development of the South Humble City-Strawn Oil Pool?

A. There are special pool rules that provide, among other things, an 80-acre spacing which would provide for either laydown or standup 80-acre units, either the north half, the south half, the east half or the west half of the quarter section, and there's a depth-bracket allowable of

445 barrels of oil per day per 80-acre spacing unit.

Q. So basically what we're doing is seeking the contraction of a -- out, of a certain portion of the South Humble City-Strawn Oil Pool?

A. That's correct.

Q. And we're asking that that acreage be established as a new pool for production from the Strawn?

A. Correct.

Q. We're also asking that 80-acre spacing, the well-location requirements and the depth bracket allowable that had been applicable in the South Humble City-Strawn also remain applicable to the development of the new pool; is that right?

A. Yes, that's correct.

Q. In fact, there has been development in this proposed pool under those rules to date; isn't that --

A. Yes, there have been.

Q. All right. Let's go to the exhibits you've prepared for the hearing. But first, could you just explain to the Examiner when the South Humble City Strawn Pool was created?

A. March 1, 1982, and that was Order Number R-6913.

Q. Let's go to Bonneville Exhibit Number 1, the land map. Would you identify and review that for the Examiner?

A. Yes, this Exhibit Number 1 is a land map that

shows all the well spots within the South Humble City Pool area, which is in Township 17 South, Range 37 East, Lea County, New Mexico.

It has the operators of all the currently producing wells within the unit listed, and it shows the -- in the even-dashed outline it shows the existing South Humble City-Strawn Pool, which is the larger unit that's shown on this map, that incorporates the south half of Section 12, the north half of 13, and southwest quarter of 13, and all of Section 14.

And then also with the intermittent dashed pattern it shows the proposed Southwest Humble City-Upper Strawn Oil Pool, which would include the west half of 14, the southeast quarter of 14, and the west half, southwest, of Section 13.

Q. Let's now go to your porosity map, Exhibit Number 2. Would you review this for Mr. Stogner?

A. Yes. This is a summation of the porosity feet of the upper Strawn limestone in the South Humble City Pool, the existing and the proposed Southwest Humble City Pool.

It's kind of easy to tell the difference between that part which was -- 3-D seismic was used on and that part which was just subsurface information, the part with all the squigglies, or the part where we used the 3-D seismic.

And the summation of the porosity feet was used -- we used a 4-percent net porosity cutoff. The porosity was calculated every two feet and then summated, and there's a contour interval of four.

For example, at the Lottie York Number 3 location, we had a value of 20.5. That would be equivalent to 20.5 feet of 100-percent porosity, or 205 feet of average 10-percent porosity.

Q. And that was in the northeast of the southwest of 14; is that correct?

A. Correct. These -- The upper Strawn in this area are foraminiferal algal mounds, and what this shows is that there are a number of discrete -- laterally discrete and separate mounds which each create their own oil pool.

Q. If we look at this exhibit, then, you have been able to map the individual mound that you're proposing to include in the new pool, and that's the mound that extends across the south half?

A. Correct, that would be in the south half of Section 14, and going into the west half, southwest, primarily, of Section 13, and includes, as far as producing wells, it includes the Yates Number 1 Bureaucrat, our Lottie York Number 1, 2 and 3 wells, and the Norris Number 4 well, and then an edge well, the Norris Number 1, which was a -- actually a lower Strawn sand producer.

Q. Mr. Kozarek, let's go to the northwest-southeast cross-section, Exhibit Number 3.

A. Okay.

Q. Would you review that for Mr. Stogner?

A. Yes, this is called a longitudinal cross-section that goes through the proposed Southwest Humble City-Upper Strawn Pool.

As you can see, there's a locator map on the lower left corner, and the cross-section A-A' is basically a west-to-east cross-section and incorporates all the wells that are within the Southwest Humble City-Upper Strawn Pool, and then an edge well and a well which we feel is not part of the same pool.

If we look at the -- start with the dryhole on the -- to the west, the far left, the AnSon Number 1-15 [*sic*] Shipp -- Well, I'd like to also point out that this is a stratigraphic cross-section, and it's hung from the top of the lower Strawn sand, and it was hung in this fashion so that we could see the growth of this mound interval, this upper Strawn mound interval.

And if you were to just kind of trace with your finger the distance, the thickness between the datum, the lower Strawn sand and the top of the Strawn, you'll see that there's considerable thickening and thinning of that interval.

Coincidental with that thickening, when it's thick we also get to be -- that's where the porosity development occurs also.

But if we start at the Anson Number 1 Shipp, we see a relatively thin upper Strawn development, and tight.

We go to the Yates Number 1 Bureaucrat, and we've thickened that interval considerably, and we start to get a certain amount of porosity development in the upper part of the section in that wellbore.

Then from there to the Lottie York Number 3 well, which has -- it's probably as thick of a section of upper Strawn as is present in this area.

And you can see that not only is the overall section thick, but there's a considerable amount of porosity. It would be -- On the right-hand track on the neutron density porosity log, the center line is 10 percent, so you can see that we have a lot of porosity greater than 10 percent.

I'd also like to point out that we paid special attention to the upper part of this section, and if you look at the response of the neutron density curves there, you can see quite a bit of separation between the neutron and the density, the density reading higher than the neutron, which is indicative of gas effect. And we went to pains to stay away from that part to -- part of the

section, in order to keep our gas production down as low as we possibly could.

Q. That's why the perforations on this exhibit are shown as low as they are --

A. Correct.

Q. -- in the interval?

A. Correct.

From that well, we go to a well that's still well within the mound, but not quite as thick, and you can see that it's -- the Strawn has thinned down and the porosity is not quite as great either.

Back up to the discovery well for the field, the Lottie York Number 1 well, and that is a very comparable well to the Lottie York Number 3.

Then to the Norris Number 4 well that we had just recently completed. When this cross-section was done, we didn't have an IP for it, but it was approximately 107 barrels of oil per day and 140 MCF of gas.

Once again, this is a relatively thick well with good porosity section, and also note again that there is a fair amount of spread between the neutron and the density porosity curves, which is indicative of gas -- a factor, gas cap in this area, and that we once again concentrated on getting our perforations as low as we possibly could in the upper Strawn interval, the upper Strawn section.

Then finally to the Norris Number 2 well, which has several lines of evidence that it is not part of the same pool as the Lottie Yorks 1, 2 and 3 and the Norris 4.

One is a core study that was done which indicates that this is part of talus -- distal talus slope deposit, that is, that these mounds were actively growing, and then as they grew, with the wave energy, parts of them would break off and then fall down the slope, and that this was more -- this was a product of this growth that occurred over in this mound. But really it wasn't growth in this area, it was more of a transportation process that was involved. These were all formed more or less in place, and these were transported down the slope somewhat.

Additionally, we have pressure data which indicates that these two are in much different pressure regimes, the Norris 2, from any of the other Lottie York wells or the Norris Number 4 well.

Q. All right, let's go to Exhibit Number 4. This is also a stratigraphic cross-section, is it not?

A. Correct, it's a north-south stratigraphic cross section. Once again the datum is the top of the lower Strawn sand, and this is -- the other was longitudinal; this would be axial, and it goes directly across to upper Strawn algal foraminiferal mounds.

We have a hole in it?

EXAMINER STOGNER: We have a drilling rig --

THE WITNESS: We've got plenty of others.

EXAMINER STOGNER: -- on the Lea Farms Number 2.

THE WITNESS: I don't think we need to worry about extras.

Q. (By Mr. Carr) Please go ahead.

A. Okay. This cross-section, B-B', south to north, shows -- it has the same features as we saw in the other, except it's now cutting perpendicular to the long axis of these mounds, and so we're going up and over them in a short distance, a much shorter distance than we saw in the other direction.

Starting with the Inexco Number 1 Dougherty well, we have a thin, tight upper Strawn section.

Back to the Lottie York Number 1, once again a thick porous mound well.

To a critical well, the Norris Number 1, which is relatively thin but did have a little bit of porosity development in it. It's shown as an abandoned well. This well never was productive or capable of production out of the upper Strawn. It was a lower Strawn sand producer.

And then further to another dryhole, the Inexco Number 1 Lea Farms, relatively thin and tight upper Strawn facies.

And then back up to the Lea Farms Number 2,

thicker, some porosity development within it.

And it may be interesting to note that if you see the difference between the Lottie York Number 1 where we have porosity development from essentially the top of the lower Strawn throughout that upper -- excuse me, from the top of the upper Strawn section on down, we don't have that same situation in the Lea Farms Number 2. There's a fair amount of tight upper Strawn rock before we get to the porous reservoir rock. That, to me, may indicate that there are two different mound facies that are developed within this area. The one to the south, where the Lottie York Number 1 is, may have been more actively developing.

And then just from that well to another tight well, the Lea Farms Number 3.

But the important thing is, the Norris Number 1 and the Lea Farms Number 2, there's a gap of several thousand feet, with tight upper Strawn -- tight and thin upper Strawn facies. That's not mound; it's an intermound facies there. So it gives credibility on the subsurface to the -- what we're seeing on the 3-D seismic and what Mr. Schwering will later support with engineering evidence that these are indeed two separate mounds.

Q. Mr. Kozarek, what conclusions have you reached from your geological study of this portion of the Strawn formation?

A. That there are several discrete individual mounds, upper Strawn mounds, that are present in this area, and that they would then be separate -- as well as separate mounds, they are also separate sources of supply.

Q. From a geological point of view, is the area that Bonneville is proposing be contracted from one pool and created as another, is that area a separate and distinct reservoir?

A. Yes, it is. The proposed Southwest Humble City Pool has geologic, geophysical and engineering evidence to indicate that it is a separate and distinct pool from the remainder of the South Humble City Strawn Pool.

Q. Is Bonneville Exhibit Number 9 an affidavit confirming that notice of this Application has been provided to all affected interest owners, as required by Oil Conservation Division Rules?

A. Yes, it is.

Q. And to whom was notice provided?

A. To all operators in the pool, to all operators of Strawn wells outside the pool but within a mile thereof, and all unleased mineral owners in the pool.

Q. Will Bonneville Fuels Corporation call an engineering witness to review that portion of the case?

A. Yes, we will.

Q. Were Exhibits 1 through 4 and 9 either prepared

by you or compiled at your direction?

A. Yes, they were.

MR. CARR: At this time, Mr. Stogner, we would move the admission into evidence of Bonneville Exhibits Numbers 1 through 4 and 9.

EXAMINER STOGNER: Exhibits 1 through 4 and -- what did you say about Number 9?

MR. CARR: And 9

EXAMINER STOGNER: -- and 9, will be admitted into evidence at this time.

MR. CARR: That concludes my direct examination of Mr. Kozarek.

EXAMINATION

BY EXAMINER STOGNER:

Q. Let's see, a couple of things. I want to refer to Exhibit Number 1.

A. Okay.

Q. And also your cross-sections. The two main pods, if you will, and I'll call the South Humble City --

A. Would that be Exhibit Number 2, the ϕh map?

Q. Yes, I'm sorry, yes.

A. Okay, that's fine, no problem.

Q. Number 2, I apologize.

You've essentially separated these two pods here. And when I say "pods" the one up to the north, in most of

Section 13 --

A. Correct.

Q. -- where essentially the current South Humble City-Strawn, and then the other pod down toward the south that takes in the south part of 14 and the southwest quarter of 13 -- does that break in between or that space in between or the impermeable area, if you will, between those two, does that show up in your 3-D seismic?

A. There are some -- There's room for latitude on the interpretation of the seismic in that area. Certainly from at least -- from a little bit within the section line, and then west of there, it is.

As we get back to the east, the definition gets a little bit fuzzier. It's what -- It's a result of the fact that the overall Strawn -- the seismic is actually seeing the entire Strawn interval from the top of the Strawn to the top of the Atoka. And as we go to the east, the lower Strawn sand is thickening, and we have not been able to back that response of the lower Strawn thickening out of what we see as -- for the entire isochron, or the entire interval of the Strawn in this area.

So we haven't been able to resolve it, but you can see that we have good evidence for, at the Norris Number 1, and then the Norris Number 3 well, which is the dryhole that's in the southeast -- excuse me, the northwest

of the southeast of Section 13, is also a thin, tight upper Strawn well.

So we do lack a little bit of evidence for that in there, but we feel like it's pretty well borne out by the seismic evidence.

And then we use the core data that we had to separate out the proposed southwest Humble City Pool, that's -- in the Lottie York wells and the Norris Number 4 well, from the Norris Number 2 well.

Q. Okay. Now, the cores were from which wells?

A. We had cores from the -- core data from the Lottie York Number 1, which is the discovery well, and the Number 2, and -- Excuse me, we did not have it from the 1, we had it from the Lottie York Number 2 and the Norris Number 2.

And they showed distinctly different depositional environments, one being part of this mound, which was actively accreting, growing up from the sea floor, and another one, the Norris 2, would show that it was debris that had been broken off this actively accreting mound and then carried downslope and deposited in the location of the Norris Number 2.

Q. Did you have privy to a core in the northern portion or in the South Humble-Strawn Pool?

A. Yes. Now, I can't recall offhand if it's the Lea

Farms or the Ashland Federal, though, but one of those two producing wells that is in the north half of 13 or 14.

Q. And both of those wells were in the Reef?

A. Definitely in the mound facies, right. The Reef or mound facies.

Q. Could you tell by your investigation if the two pods were formed about the same time period? Well, obviously they were, but identical time periods or one a little bit afterwards

A. I think they're pretty much -- You can't exactly tell that from the core, but from the other subsurface studies that I've done, I've zoned out this interval and there are at least three distinct phases of mound development.

But the one that is present in the Lea Farms Number 2 was also active in the -- for instance, the Lottie York Number 1, at more or less the same time.

Q. Now, I notice on a couple of instances in the cross-section -- I'm looking at B-B', over toward the left-hand side, and the second well, that's that Bonneville Fuels Corporation Lottie York Number 1 --

A. Got it.

Q. -- you have the main body, and then underneath it there's a smaller --

A. There is a small porosity development there, and

we've speculated on that, and we kept thinking we'd probably see it, and -- where we had a really hot seismic response, like on the Lottie York Number 3, and we have not seen it in any other wellbore or really for -- to my knowledge, any wellbore within this township. And there's some production to the north up in the Shipp field. I haven't seen it up there either.

So it's kind of enigmatic. It might just be a little local -- or real local. It does not map outside the immediate vicinity of the Lottie York Number 1, and we don't think it is necessarily part of the oil column that's present in the Lottie York Number 1 either.

EXAMINER STOGNER: Okay. I have no other questions of this witness.

MR. CARR: That concludes our presentation with this witness.

At this time we call Mr. Bob Schwering

(Off the record)

MR. CARR: Mr. Stogner, as we go through the engineering presentation, you might want to keep that porosity map out because we're going to be relating back to that.

EXAMINER STOGNER: Exhibit Number 2 is what you're referring to?

MR. CARR: Yes, sir. Yes, sir.

ROBERT A. SCHWERING,

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

DIRECT EXAMINATION

BY MR. CARR:

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

A. My name is Robert A. Schwering.

Q. Where do you reside?

A. I live in Golden, Colorado.

Q. By whom are you employed?

A. I'm employed by the Bonneville Fuels Corporation.

Q. And what is your current position with Bonneville Fuels Corporation?

A. I am operations manager for the south area.

Q. Are you a geologist?

A. No, sir.

Q. You're a petroleum engineer?

A. I am a petroleum engineer.

Q. Have you previously testified before the New Mexico Oil Conservation Division?

A. No, sir, I have not.

Q. Could you summarize briefly your educational background?

A. I graduated from the New Mexico School of Mines, Institute of Mining and Technology in 1980 -- 1981. I was

a *cum laude* graduate that year.

Q. While with the School of Mines, did you also teach certain classes?

A. Yes, sir, I taught mud lab.

Q. Would you review your work experience for Mr. Stogner, please?

A. Yes, sir, from June of 1981 until the end of 1991, I worked 11 years for the Arco -- 10 1/2 years for the Arco Oil and Gas Company in a position as either a drilling engineer or a drilling foreman, field supervisor.

Subsequent to that, for 3 1/2 years, I was a consultant in Colorado.

Subsequent to that, I have worked for the Bonneville Fuels Corporation for a period of about a year and three quarters.

Q. Are you a registered petroleum engineer?

A. Yes, sir, I received my license in 1992 in the State of Colorado and my number is 23108.

Q. Are you familiar with the Application filed in this case on behalf of Bonneville Fuels Corporation?

A. Yes, sir, I am.

Q. Have you made an engineering study of the area surrounding the South Humble City-Strawn Oil Pool?

A. Yes, sir, the engineering study I have performed has been focused primarily on what we are calling the

Southwest Humble City-Upper Strawn Formation Pool.

Q. And are you prepared to present the results of that study to Mr. Stogner?

A. Yes, sir, I am.

MR. CARR: Mr. Stogner, we tender Mr. Schwering as an expert in petroleum engineering.

EXAMINER STOGNER: You graduated what, *cum laude*?

THE WITNESS: (Nods)

EXAMINER STOGNER: Well, I don't remember much of that now, Mr. Schwering. I guess I just graduated that same time.

THE WITNESS: Well, I wasn't there, in fact. I was in an interview.

EXAMINER STOGNER: Well, that's probably why I didn't remember it.

So qualified.

MR. CARR: We would note that Mr. Schwering also in his career as an instructor, instructed Mr. Catanach, and we're not --

EXAMINER STOGNER: We won't hold that against him. He's still an expert witness, Mr. Carr.

Q. (By Mr. Carr) Mr. Schwering, have you prepared exhibits for presentation in this hearing?

A. I think I have.

Q. Could you refer to what's been marked as

Bonneville Exhibit Number 5, identify that and review it for the Examiner?

A. Yes, sir, I prepared Exhibit Number 5, which is a current reservoir survey, reservoir pressure survey, in the vicinity of the proposed Southwest Humble City Pool. The reservoir survey was conducted on wells that are operated by the Bonneville Fuels Corporation.

The Lea Farms Number 2 well was shut in from 3-4-96 to 3-11-96, and it had a P*, or pseudo-ultimate reservoir pressure, of approximately 391 p.s.i.a.

The Norris Number 2 was the next well we tested. It had a pseudo-ultimate reservoir pressure of 192 p.s.i.a. on a seven-day test conducted between March the 4th and March the 11th of this year.

Subsequent to that, and as soon as we had finished completion operations on the new Norris Number 4 well, we shut in the proposed Southwest Humble City field, the part that we control and produce, and obtained some pressure data in that field.

The buildup on the Norris Number 4, a brand-new well at the east end of our reservoir, or our easternmost well in that reservoir, built up to a P* of 1160 p.s.i.a. and actually broke over in late time, which indicates that this may in fact be a real good estimate of the reservoir pressure. The other P*'s are probably high estimates of

reservoir pressures, because they had not built up to the point where they broke over.

The Lottie York Number 3 indicated a P* of approximately 1240 p.s.i.a. on a 7-day buildup. On the Lottie York Number 1 -- and that well, by the way, the Lottie York Number 3, is at the west end of the reservoir, and those two wells, the maximum pressures they achieved during buildup and the P*'s they achieved are both within 10 percent of each other, and they're at the east and west end of the reservoir.

The Lottie York Number 1 Lottie York Number 2, I shot fluid levels on those wells on the 25th of March, 1996, and calculated the maximum pressure in those wells. The Lottie York Number 1 had built up to 1178 p.s.i.a., as near as I could calculate, off the fluid level. And the Lottie York Number 2 had built up to 1027 p.s.i.a.

I'd like to note that the Lottie York Number 2 is still building at about 30 p.s.i. per day, and that that well has the least permeability of any of the wells we have in the reservoir, and consequently, you would expect it to build up slower than the other wells.

That concluded the seven-day shut-in that we run in the field to determine what the reservoir pressure might be.

At this time, I'd like to detail the significant

engineering conclusions I can draw from the data.

The first conclusion, and the most significant, is that the proposed Southwest Humble City-Upper Strawn Formation Pool is a hydraulically distinct reservoir with an average reservoir pressure of approximately 1160 to 1250 p.s.i.

The four wells in this pool that are operated by BFC are well connected hydraulically. The maximum buildup pressure at the Lottie York Number 3 is within 10 percent of the buildup pressure in the Norris 4, even though these wells are at opposite ends of the reservoir.

The two wells evaluated outside the pool are in structurally distinct reservoirs which are hydraulically disconnected from this pool. The Norris Number 2 reservoir pod has a P* of approximately 185 p.s.i., and the Lea Farms has a P* of approximately 385 p.s.i. And Mr. Stogner, I believe I got my a's and g's crossed up with the word processor there.

Item number 4, the closer proximity -- Or conclusion number 4 is, the closer proximity of the Norris Number 2 well to the proposed Southwest Humble City-Strawn Pool, along with the lower pressure of that reservoir pod, supports the assumption that these reservoirs, being the reservoir pods in the South Humble City, are hydraulically distinct from the reservoir pod which we characterize as

the Southwest Humble City Pool.

Q. And in reaching those conclusions, you've used standard and accepted engineering calculations, have you not?

A. Yes, sir, I used the semi-log analysis techniques out of Robert C. Earlougher's book, *Advances in Well Test Analysis*, which is the industry standard.

I would like at this time to comment that if it's so desired by the NMOCD and they need to look at the buildup analyses, that I will make copies of that available as soon as this hearing is ended, if that's your direction.

EXAMINER STOGNER: So noted, but at this time I don't believe so.

THE WITNESS: All right.

Q. (By Mr. Carr) Mr. Schwering, let's take a look at the boundary calculations now, and I would ask you to review your Exhibit Number 6 for the Examiner.

A. Yes, sir. Exhibit Number 6 is the reservoir boundary confirmation that we got out of certain well tests which I did analysis on.

These well tests -- What you're looking for there, Mr. Examiner, is, in the late time in the buildup, on a semi-log plot, you'll get a slope doubling. From more or less a linear slope with so many p.s.i. per cycle, you will get about a doubling in the slope, and that will

provide you a way to calculate a distance to that boundary, based on what you understand about other reservoir parameters.

Well, in the history of this reservoir, there have been three well tests that I'm aware of that have allowed the calculation of boundaries, and those three well tests are as follows.

The first well test indicating boundaries was the second well test run on the Lottie York Number 1, between December 12, 1982, and December 15, 1982. The P* that was achieved at that time was 3092 p.s.i.a.

The nearest measured boundary that could be scaled off of Exhibit Number 2 there was 507 feet. The nearest well-test calculated boundary was 468 feet, that being the boundary to the north of the Lottie York Number 1 well. And in fact, that's a real close correspondence between where that boundary shows up by Mr. Kozarek's interpretation of the seismic of the well log data, and where that boundary calculates to be.

The Lottie York Number 2, during its initial shut in, gave evidence of two boundaries. The nearest measured boundary on the interpretation map you have is 275 feet to the north of the Lottie York Number 2. The nearest well-test calculated boundary is 90 feet. There is a second well-test calculated boundary which shows up, which is some

456 feet from the well. I cannot very well explain that boundary, but I'll go into that in just a few minutes.

The third test which showed a distinct boundary was the pressure buildup test for the Lottie York Number 3, which was just concluded between March 18th and 25th of 1996. I've already discussed the P*. The nearest measured boundary to that well is some 482 feet to the north, and the nearest well-test calculated boundary is some 151 feet.

I'd like at this time to address some conclusions that I think I can usefully draw from that.

First, the most significant engineering conclusion in evaluating the previously submitted data is that the northern boundary is more or less repeatedly confirmed by the well-test data, and while we don't see any of the other boundaries in these calculations -- the buildups were not long enough and the wells are not located close enough to the other boundaries in the reservoir to see those boundary effects.

The well-test -- The real significant conclusion here is that the well-test calculated boundaries are all closer to the subject wells, with one exception, than the zero porosity thickness contours, which we present in Exhibit Number 2, which would mean that those contours may in fact extend out further than permeability in the reservoir does. And this also lends credence to our

believing that these wells are in fact -- that the reservoir pods are in fact separate and distinct and that the Southwest Humble City reservoir pod we're addressing in this action is distinct from the other reservoir pods.

At this time, I would like the -- Mr. Examiner to cross out conclusion number 3, because I don't think I can safely say very much at all about the two boundaries that I see in the Lottie York Number 2 well test, other than to state that one of those is closer than the northern boundary, and I do not know what causes the second boundary effect that I see there.

So if you would, sir, please remove that --

EXAMINER STOGNER: So noted.

THE WITNESS: -- because I think that conclusion was inappropriate and hardly worth following.

Once again, I relied on standard well test analysis technique used by Earlougher and detailed in *Advances in Well Test Analysis*, and I am more than happy to make copies of the boundary calculations and those well tests to the Commission if they would be desirous of having those.

EXAMINER STOGNER: There again, Mr. Carr, I don't think so.

Q. (By Mr. Carr) Mr. Schwering, let's take a look now at the gas-oil ratio data, and I'd ask you to refer to

Bonneville Exhibit Number 7, identify that and review it for Mr. Stogner.

A. Yes, sir. We're getting -- I lack one exhibit, Bill.

Q. Do you need Exhibit Number 7?

A. No, Number 8. No, I've got it. There, forget it.

Exhibit Number 7 is basic GOR data, which we have acquired from the proposed Southwest Humble City Formation-Upper Strawn Pool.

The Bonneville Fuels Corporation, as a part of this action, has also requested a special limiting GOR of 8000 standard cubic feet per barrel for the newly designated pool if the New Mexico OCD honors our request to establish a new and separate pool.

A lot of the petrophysical data upon which a lot of the well test calculations and in fact all the calculations I've done in my reservoir study are based on, come from a Core Lab differential analysis, numerical simulation, undertaken in 1995, which was based on computer simulation of the results of a 1982 flash liberation analysis on a separator sample obtained from the Lottie York Number 1.

The proposed pool was discovered by the Lottie York Number 1 in 1982, and the following reservoir fluid

and pressure parameters have been determined.

The reservoir at discovery was an undersaturated oil reservoir. Initially reservoir pressure was 3715 p.s.i. Bubble-point pressure was 2987 p.s.i. And the dissolved gas in the oil was about 1190 standard cubic feet per stock tank barrel of oil originally in place.

The average reservoir pressure is estimated to have declined below the bubble point pressure in approximately June of 1983. Since that time, as pressure has dropped in the reservoir, gas has been evolving in the reservoir as a separate phase. Prior to that time, there was single-phase flow in the reservoir; only oil was mobile.

Two volumetric calculations of original oil in place, based approximately on an unrefined version of Exhibit Number 2, bracketed the oil in place at between 9.08 and 10.57 million stock tank barrels of oil originally.

My material balance calculation, prior to the bubble-point pressure, seems to indicate an initial reservoir volume of some 9.6 million stock tank barrels of oil, with a corresponding complement of 11.42 billion cubic feet of natural gas.

Production and well test data available to the Bonneville Fuels Corporation indicated that as of March

18th, 1996, approximately 1.58 million stock tank barrels of oil had been produced out of the reservoir.

Approximately 2.76 BCF of gas had been produced, including estimated wastage at the tanks.

Approximately 115,000 stock tank barrels of water had been produced, indicating very little evidence of a water drive. And the average water pressure since 1-1-82 has declined to approximately 1200 p.s.i.

The dissolved gas complement at 1200 p.s.i., based on the fluid analysis work, is approximately 626 standard cubic feet per stock tank barrel of oil remaining.

Simple computations indicate that the following data are true as of March 18, 1986

Produced gas originally dissolved in the oil which has been produced, approximately 1.88 BCF.

Remaining oil in place, approximately 8.02 million stock tank barrels of oil.

Dissolved gas remaining in that oil at 1200 p.s.i., 5.02 BCF.

Gas liberated from oil remaining in the reservoir, 4.53 BCF.

Free gas produced to date, .88 BCF. Free gas remaining in the reservoir as a unique or gas phase, 3.65 BCF.

Clearly until this time, the location of wells

has allowed free gas to accumulate in the reservoir, and this gas expansion has acted to improve the recovery of oil.

With the implementation of a 3-D seismic survey and the accurate definition of the areal extent of the reservoir, Bonneville Fuels has recently drilled two new wells in the reservoir, the Lottie York Number 3 and the Norris 4, in order to protect correlative rights and properly develop the reservoir for optimum drainage under depletion drive pressure decline, the primary production mechanism.

In the drilling of the Lottie York Number 3, an induced gas cap was discovered in a DST in the top section of the upper Strawn. Effort was expended to understand the log character of the gas-cap reservoir segments, which involved interpretation of both the neutron density curve separation, as well as a micro- -- an MSFL and deep induction curve separation that we saw on the induction suite.

This allowed us to avoid perforating the existing gas cap when those two wells were completed, and we did in fact perforate low in the section, and to the best of our ability, given the mechanical limitations of the well, have avoided excess gas production.

Attached to this exhibit are a spreadsheet and

three graphs. The spreadsheet computes the GOR between January 1, 1995, and March 18, 1996, of the three wells BFC had in the Southwest Humble City Pool prior to 3-15-96.

Graph I presents the GOR behavior of the Lottie York Number 1, Number 2 and Number 3 wells, since January 1 of 1995.

Graph II presents the instantaneous producing GOR of the reservoir since the field was completed in 1-15 of 1982, along with the cumulative producing GOR and an estimated decline of reservoir pressure across that time.

Graph III presents the GOR behavior of the Norris Number 4 well since its recent completion.

Inspection of Graph I indicates that the Lottie York Number 1 well has an average GOR of approximately 4200 standard cubic feet per stock tank barrel of oil, across the last 12 months, or eight months during which it produced -- that's -- no, across the last 12 months, pardon me.

In the last 12 months, this has been significantly exceeded as the well's bottomhole pressure became too low to lift oil effectively with a plunger lift installation. We undertook significant fishing operations and finally cleaned up the wellbore and installed a beam pump, at which time the well returned to a GOR of approximately 3500 standard cubic feet per stock tank

barrel of oil.

The Lottie York Number 2 GOR is steadily increasing due to effects of increased drawdown caused by improvement of the Lottie York Number 1 well and completion of the new Lottie York Number 3 well. When the Lottie York Number 1 well was crippled, the Lottie York Number 2 well GOR decreased.

The Lottie York Number 2 well has an average GOR at this time of approximately 3000 standard cubic feet per stock tank barrel of oil.

The Lottie York Number 3 GOR has steadily increased through its nine-month life to approximately 4200 standard cubic feet per stock tank barrel of oil.

The high GOR prior to the shut-in test on 3-18-95, during the last two months prior to that test, was due to downhole pump failure, which we discovered when we pulled the well for the pressure buildup.

Inspection of Graph II indicates that field instantaneous producing GOR has steadily increased through the life of the field. The GOR originally, or listed as RSI, was about 1200 standard cubic feet per stock tank barrel, which confirms the fluid analysis data that we got from Core Lab. And the period of time in which the GOR stayed around 1200 standard cubic feet per barrel was essentially from January, 1982, to late 1987.

The GOR for the last year, for the entire field, has averaged about 4000 standard cubic feet per stock tank barrel of oil. It has been higher significantly, going almost to 5000 standard cubic feet per barrel in two short periods in which the Lottie York Number 1 was crippled and the Lottie York Number 3 had a downhole pump problem, which we've since cured.

The shape of the cumulative producing GOR curve indicates that free gas in the wellbore vicinities became mobile in November, 1984, and that free gas in the reservoir generally became mobile in August of 1988. And you see that in the change in slope of that R_p curve and its steady increase as reservoir life has progressed.

Inspection of Graph Number III indicates that the GOR at the Norris Number 4 well, the new producer, is steadily increasing and is currently at approximately 2000 to 2200 standard cubic feet per stock tank barrel of oil. Some months must pass before the true characteristic GOR of this well is evident.

The initial well test indicates this well principally produces from fracture porosity, and its behavior may be at substantial variance from other wells in this reservoir, all of which produce primarily from vugular-type porosity.

The engineering conclusions I can draw from this

are that an induced gas cap was discovered during the drilling of the Lottie York Number 3, the log character of principally gas-saturated zones has been recognized, perforating those zones has been avoided in our production practice, completion practice.

Number two, the original GOR of the reservoir in the undersaturated state was 1190 standard cubic feet per stock bank barrel of oil. This is confirmed by the cumulative producing GOR curve.

The instantaneous producing GOR of the reservoir has steadily risen through its life to its current value of approximately 4000 standard cubic feet per stock tank barrel.

Approximately 3.65 BCF of gas exists as an independent phase in the reservoir. Gas cap expansion, free gas expansion and gravitational segregation energy has been used by BFC to optimize oil recovery from this reservoir under the primary production mechanism.

Number three, optimum recovery from this reservoir by the depletion drive mechanism will be approximately 25 percent of the original oil in place if we are real effective from here on out in preserving our gas energy to the best of our ability.

Under this mechanism, the remaining primary oil to recover is .82 million stock tank barrels of oil.

At the same time that we produce approximately all of the remaining gas in place, or 8.66 BCF of gas, the GOR inherent in the expected remaining producible reserves makes the requested GOR of 8000 appropriate. That is, if you take the 8.66 BCF and divide it by .82 million stock tank barrels of oil, if we are able to optimize production, we will achieve a GOR across the remaining life of the well under primary mechanism of about 10,560 standard cubic feet per stock tank barrel.

Number 4, additional wells were drilled to optimize recovery and protect correlative rights in this reservoir as soon as Bonneville Fuels Corporation confirmed the validity of its seismic interpretation. Both new wells have been selectively perforated to optimize oil recovery at the base of the upper Strawn section.

While the additional drawdown of the reservoir due to the new wells may accelerate GOR increase versus time, the selective perforation of the wells and the prospective abandonment of perforations when they gas out should allow Bonneville Fuels to optimize oil recovery in this reservoir by the depletion drive mechanism.

In proposing the special GOR of 8000 standard cubic feet per stock tank barrel, Bonneville Fuels Corporation is seeking a GOR that will allow optimum reservoir recovery if the reservoir is produced to

depletion by the depletion drive mechanism.

Setting the special GOR at a realistic value, below the remaining estimated recovery GOR of 10,560 standard cubic feet per stock tank barrel, will give the Bonneville Fuels Corporation an incentive to take further steps to optimize recovery from this reservoir as reservoir performance and economics dictate recovery technique.

The standard state rule of 2000 standard cubic feet for this depth of well per stock tank barrel of oil is just too low for this reservoir at its current condition. Only the new Norris Number 4 well is producing near the limiting GOR of 2000 standard cubic feet per stock barrel of oil.

The use of the 2000 standard cubic feet per stock tank barrel of oil limiting GOR will only cause premature abandonment of oil reserves and waste if it is not raised. This will be further demonstrated in Exhibit Number 8.

A copy of the flash liberation analysis, the Core Lab differential liberation analysis, the volumetric reservoir estimates, the material balance estimate and an individual well test will be made available to the Commission if they feel they need them.

EXAMINER STOGNER: No, thank you.

THE WITNESS: It's pretty wordy.

Q. (By Mr. Carr) All right, Mr. Schwering, let's go

now to the GOR performance test on the Lottie York Number 3, and I'd ask you to refer to your Exhibit Number 8 and review the results of that test for Mr. Stogner.

A. Yes, sir. Exhibit Number 8 is a GOR and production performance test which Bonneville Fuels undertook to run at the Lottie York Number 3 between April 1 and April 29, 1996, as soon as the well's pump problems had been cleaned up and had been returned to production.

On 2-2-96 an allowable of 230 barrels of oil per day was assigned to production at the Lottie York Number 3. This allowable was based on the limiting GOR allowable of 2000 standard cubic feet per stock tank barrel of oil for casinghead gas, and at this depth bracket that meant that we had to keep our casinghead gas at 890 MCF per day or less.

Mr. Sexton, the Hobbs District Supervisor, has kindly permitted the Bonneville Fuels Corporation to conduct appropriate production and production testing at rates above this limiting GOR, in order to have all these limiting-GOR issues addressed at this time.

The procedure was to produce casinghead gas up the well annulus using various choke settings while oil was beam-pumped up the tubing, until relatively stabilized oil production and gas rates could be achieved, and then four- to five-day intervals were averaged.

The purpose of this performance testing was to determine the choke setting and really the back pressure held against the well at which oil production was optimized relative to gas production -- that is to say, at the choke setting at which the GOR was minimized.

The production data in Table 1, I'd like to draw your attention to the fact that there were two tests run with 27/64-inch choke, because in the first pass that proved to be the minimum GOR setting. At that choke setting, the well averaged about 290 barrels of oil per day, producing about 1275 MCF of gas per day, and the GOR for the well was around 4200 standard cubic feet per stock tank barrel of oil.

At lower choke settings, being -- and here I'd like to reference you to Curve I -- at lower choke settings, which on only two of the days got us below the 890-MCF-per-day requirement -- which, by the way, corresponded with only 139 barrels of oil production -- At lower choke settings, you can see that by holding significantly larger amounts of back pressure against the formation, the permeability to gas against that back pressure is much higher than the permeability to oil, and what you see is that the GOR is very high.

At a 20/64 setting, which gave us the only two days when we met the state standard, we were up around 6000

standard cubic feet per stock tank barrel.

If we were to produce the well at any length of time at that choke setting, with that back pressure, the result would be that we would excessively deplete gas, while inefficiently recovering oil, and thereby wasting resource.

The engineering conclusions that I can draw are -- some from previous testimony, which is that there's an induced gas cap and 3.65 billion cubic feet of gas out there. We need to utilize the energy from that gas to the best of our ability to optimize the oil recovery.

That in fact, this well produces, with the lowest GOR, at 27/64 inches. At a higher choke setting, which is more unrestricted flow to the atmosphere, the gas tends to outcompete the oil in getting into the wellbore, at 30/64 inches, and we see the bullet-shaped nature of Curve I. And what that indicates to me is that if we were to open the well to the atmosphere on the back side, we'd turn it into a gas well in short order.

Neither can we choke it back too much. What we have to do is from time to time conduct these little production-optimization tests at the well and determine what the optimum choke setting is in order to produce the well at the lowest possible GOR.

The production tests for the GOR determination

was conducted in accordance with standard field practice, and to the best of my knowledge, with due diligence. I took the morning reports, but I was not out there adjusting the choke.

Q. Mr. Schwering, Bonneville is asking this Division to separate the South Humble City-Strawn Oil Pool into two new ones; is that correct?

A. Yes, sir.

Q. You're asking that the new pool to be created have a special gas-oil ratio set for that pool of 8000 to 1?

A. That is correct.

Q. And along with that, you're asking that the rules that have been applicable to the South Humble City-Strawn Pool -- that is, 80-acre spacing, defined spacing units, and depth bracket allowable -- that those same rules remain in effect for the new pool; is that correct?

A. That is correct.

Q. In your opinion, will the granting of this request be in the best interests of conservation, the prevention of waste and the protection of correlative rights?

A. Yes, sir, I do strongly believe that to be the case.

Q. Were Exhibits 5 through 8 prepared by you?

A. Yes, sir, they were.

MR. CARR: At this time, Mr. Stogner, we would move the admission into evidence of Bonneville Exhibits 5 through 8.

EXAMINER STOGNER: Exhibits 5 through 8 will be admitted into evidence.

MR. CARR: And that concludes my direct examination of Mr. Schwering.

EXAMINATION

BY EXAMINER STOGNER:

Q. Mr. Schwering, does Bonneville Fuels operate any wells in the -- what you're proposing, the existing South Humble City-Strawn Pool, is located? The pod to the north, the other reservoir?

A. We operate the Lea Farms Number 2. And in fact, I obtained pressure data from that well, indicating that it was separate and distinct from this reservoir.

Q. Now, which one is the Lea Farms Number 2?

A. To the immediate north on that ϕh map of what we're proposing as the Southwest Humble City Pool, Mr. Stogner. It would be this well, sir.

Q. I show that to be the Lea Farms Number 3 on your Exhibit Number 1.

A. No, the Lea Farms Number 3 is this dryhole down to the side of it here --

Q. Is the dryhole, okay.

A. -- Mr. Stogner.

Q. All right. So the Number 2 is the one that has "4.75" number written beside it in Exhibit Number 2?

A. That is correct, sir.

Q. Okay.

A. I'm sorry these were not labeled. That's oversight on my part. I should have provided a map.

Q. Did you also run similar tests -- and show the reservoir pressure data, but did you run similar tests, like the information on your Exhibits Number 6, 7 and 8, on that Number 2 well, Lea Farms --

A. Yes, that built up to 395 p.s.i.

Q. Okay.

A. And the Norris Number 2, which is the 2.98 out to the right-hand side --

Q. Yes.

A. -- that built up to almost 200 p.s.i.

And all of the wells that we tested, that are currently produced by Bonneville Fuels within the proposed Southwest Humble City Pool, they built up to approximately 1200 p.s.i., within 10 percent of each other.

Q. Is the 8000 to 1 going to be sufficient later on, as the pool depletes -- the proposed new pool depletes down to very little oil, where we have 100-percent gas expansion

in the pool, and you're producing mostly gas? Is that going to be sufficient enough casinghead gas allowable to deplete that out to zero, or as near as economically possible?

A. Probably will not. But I believe that that -- the designation of 8000 standard cubic feet per barrel will cause Bonneville Fuels to incur some minimal cost to try and optimize the use of that natural gas energy in the reservoir to produce all the oil we can.

Sometime -- If the pool were depleted by the primary mechanism to atmospheric pressure, at some point the oil would become relatively immobile and at that time we might -- the State might cause us to come in and redesignate this thing as a gas pool. But we'll have to cross that bridge when we get there.

Q. Well, actually that wouldn't happen; it would just still be an oil pool but you'd be subject to the casinghead gas allowable, and at that time you can increase the casinghead gas allowable to the -- sufficient to bring it down.

A. Okay. I know in Texas they -- in several cases I was involved in, the state did cause casinghead gas to become gas.

EXAMINER STOGNER: Any other questions of this witness?

MR. CARR: No further questions.

EXAMINER STOGNER: You may be excused.

Mr. Carr, do you have anything further in this case?

MR. CARR: No, Mr. Stogner, that concludes our presentation in this matter.

EXAMINER STOGNER: In that case, Number 11,493 will be taken under advisement.

(Thereupon, these proceedings were concluded at 3:15 p.m.)

* * *

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 11493, heard by me on 2 May 1996.

, Examiner
Oil Conservation Division

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 May 8th, 1996.

STEVEN T. BRENNER
CCR No. 7

My commission expires: October 14, 1998