NEW MEXICO OIL CONSERVATION DIVISION

STATE LAND OFFICE BUILDING

STATE OF NEW MEXICO

CASE NO. 10617

IN THE MATTER OF:

The Application of C.W. Trainer, for Designation of a Tight Formation, Chaves County, New Mexico.

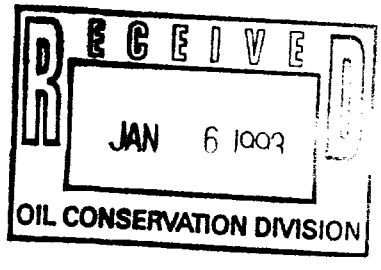
BEFORE:

MICHAEL E. STOGNER

Hearing Examiner

State Land Office Building

December 17, 1992



REPORTED BY:

CARLA DIANE RODRIGUEZ
Certified Court Reporter
for the State of New Mexico

ORIGINAL

A P P E A R A N C E S

FOR THE NEW MEXICO OIL CONSERVATION DIVISION:

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BY: **JOEL M. CARSON, ESQ.**

I N D E X

E X H I B I T S

EXAMINER STOGNER: Call next case, No. 10617.

MR. STOVALL: The application of C. W. Trainer for designation of a tight formation, Chaves County, New Mexico.

EXAMINER STOGNER: Call for appearances.

MR. CARSON: Mr. Examiner, my name is Joel Carson, Losee, Carson, Haas & Carroll, Artesia, New Mexico, appearing for the Applicant. I have two witnesses.

EXAMINER STOGNER: Are there any other appearances?

Will the witnesses please stand to be sworn at this time.

[The witnesses were duly sworn.]

EXAMINER STOGNER: Before we go on the record, Mr. Carson, just for the record I would like to make a little bit of a statement.

MR. STOVALL: Is this on or off the record?

EXAMINER STOGNER: This is on the record. There have been some special administrative procedures passed by the OCD. Such tight formation applications can be filed

administratively; however, that was mostly enacted since we have another jurisdictional agency that handles federal land.

Since this well did not contain any federal lands, I felt it was in the best interest, in dealing with the FERC and getting these on through, that we did make a record by way of testimony. I feel it's beneficial. We also work a little better with it since we are the only jurisdictional agency involved.

That was the reason I requested this application come to hearing at this time, and I appreciate Mr. Trainer and Mr. Joel Carson going this route. With that, Mr. Carson.

MR. CARSON: Mr. Examiner, we understand that. We're happy to do it. It's in everybody's best interest, I think.

JACK AHLEN

Having been first duly sworn upon his cath, was examined and testified as follows:

EXAMINATION

BY MR. CARSON:

Q. Mr. Ahlen, would you state your name for the record?

A. Jack Ahlen.

Q. You're employed for this purpose by C. W. Trainer?

A. That is correct.

Q. I understand you're a geologist by training and by profession?

A. Yes, sir. I received my degree at the University of Wisconsin in geology, B.S., and a master's degree from the same institution in 1952.

Q. You have extensive experience in geology in Southeastern New Mexico?

A. Yes, sir. That has been the primary emphasis of my career.

Q. Besides that experience, you have been the geologist on the Tom Ingram No. 4 and are well-acquainted with this area which is the subject of this hearing?

A. That is correct. I was a well site geologist and initiated that prospect.

Q. Mr. Ahlen, you've also testified before this Commission in other hearings and your qualifications have been accepted, have they not?

A. Yes, sir, they have.

MR. CARSON: We would tender this witness as an expert geologist.

EXAMINER STOGNER: Mr. Ahlen is so qualified.

Q. I'll refer you to Exhibit No. 1 which is a land map, and ask you to explain that map.

A. This is a copy of a portion of Chaves County, Midland Map Company's map that they publish periodically. It contains portions of Township 11 and 12 South, Ranges 28 and 29 East, Chaves County, New Mexico.

I have drawn the proposed outline of the tight formation designation on this land map and it will appear several times in the exhibits as we go through them. The area encompasses a total of 11,040 acres, plus or minus, of which there are 10,400 acres of fee land being 94.2 percent of the area, and 640 acres of State of New Mexico land, being 5.8 percent of the area.

It shows all of the wells that have been drilled in the mapped area, both deep and shallow.

Q. I want to refer you to Applicant's Exhibit 2 and ask if you will identify that and explain that for us.

A. Exhibit No. 2 is a copy of the Tom Ingram White Ranch No. 4 well located in Section

33 of Township 11 South, Range 29 East. It is a copy of the compensated neutron formation density log that was run in April of 1977.

You'll note that my name is on the bottom of that log as a witness demonstrating that I was present as the consultant for that well when it was drilled.

Q. Mr. Ahlen, the purpose of Exhibit No. 2 is to show a typical geological cross-section of that area, is that correct?

A. A typical stratigraphic section, yes, sir, in that it illustrates the formations that are penetrated when you drill a well in this particular area.

The surface is Permian in age, uppermost Permian, Guadalupian, Ochoan. Let me just recite the formation tops as an illustration of the formations expected in this particular area.

Essentially we start out in red beds of the Permian section, go through a little bit of salt, the Salado section. The top of the Yates formation is at a depth of 850 feet and it is marked on the log by a heavy line with the name "Yates" immediately below it and the depth of

850 feet, and that's similar all the way through this particular exhibit.

The Queen is located at a depth of 1530 feet, the San Andres is located at a depth of 2110 feet, the Glorieta formation at a depth of 3455, the Tubb at 4880, the Abo at 5710, the Wolfcamp 6700, Pennsylvanian at 7305, the Mississippian at 8315, and this particular well has a total depth a little bit below 8800 feet. It did not penetrate the Devonian formation which I have estimated at a depth of 8850, and I've estimated the PreCambrian formation to be at a depth of 9560 feet.

Q. Now, let me refer you to Applicant's Exhibit No. 3, and I would ask you to identify that exhibit and explain it.

A. This is a structure map contoured on the top of the Mississippian lime and it covers the area of interest where we seek the designation. It is also located in a portion of Townships 11 and 12 South, Range 28 and 29 East.

It shows the White Ranch field as well as the west White Ranch field. You'll note that the White Ranch field is a structural accumulation. The west White Ranch is also a

structural accumulation.

Both of these fields have produced out of the Devonian formation under structural conditions. The wells at White Ranch have been plugged back and converted, reperforated, and are now Mississippian gas wells.

We propose to reenter the Williamson No. 1 White Ranch in Section 1 of 12 South, 28 East. It's located in the northeast corner of the northeast corner of said Section 1.

We have already plugged back the Devonian well and are attempting to make a completion in the Mississippian well in that particular location. If we are successful, we would like a designation of that whole area that we have outlined for the purpose of possibly reentering the other wells in the immediate vicinity.

You'll note that the west White Ranch is approximately 400 feet structurally high to the White Ranch field. We also have a regional east dip in this particular area of anywhere from 200 to 250 feet of dip to the east/southeast.

The structural accumulations are mapped as closed high in the White Ranch; contour

interval is not sufficient to show the structure other than just a nose at the west White Ranch.

This particular map shows 22 wells, of which 18 are Mississippian penetrations. 11 of those are within the outline of the proposed designated area.

Q. Let's go on to Exhibit No. 4, Mr. Ahlen, and I'll ask you to identify that and explain it to the Examiner?

A. Exhibit No. 4 is an isopach of the Mississippian lime porosity, which is greater than five percent within the mapped area. I have taken all of the old electric logs in this area, whether they were electric logs or radioactivity logs or whatever was available, and I have drawn a line at five percent porosity on those electric logs, and the number you see posted next to the well represents the thickness of the reservoir bed in that particular well.

You will note that I have designated a maximum of 37 feet as the maximum thickness for the porosity in the well in Section 33 of 11-29. That is the Tom Ingram No. 4 White Ranch well, and then the thickness diminishes to zero in the extreme northwestern part of the map.

I have utilized a five-foot contour interval. And the designated area, the suggested designated area, encompasses essentially those lands where the porosity is greater than 15-feet thick in the northern portion of this pod-shaped development.

Q. Are you going to talk about, the Tom Ingram No. 4 well in this area produces no gas, I take it, or oil?

A. Tom Ingram No. 4 is a producer of Mississippian gas.

Q. And you have estimated that all wells higher than the Tom Ingram No. 4 will produce gas?

A. Yes, sir. If you'll refer back to Exhibit No. 3, the structure map, you'll notice that the Tom Ingram No. 4 well is just about the lowest well in the area and it is capable of producing gas. It is my contention that any well structurally high to the Ingram No. 4 should produce gas out of this reservoir so long as it is in this porosity package.

Q. I want to refer you to Exhibit No. 5 and ask you to identify that, Mr. Ahlen, and explain it to the Examiner.

A. Exhibit No. 5 is a structure cross-section of the White Ranch pool. It runs north/sought through the pool. You'll note that I have reproduced the Midland Map Company map on the extreme left of the cross-section, and it shows, with heavy lines, the location of this particular structure cross-section.

You'll note that there are two other lines or sets of lines on that index map, and I will be talking about those on the next two exhibits. One will be a north/south cross-section of the west White Ranch and the other will be an east/west cross-section between the two fields in an attempt to tie this whole thing together.

On this particular illustration, I have shown the lower Pennsylvanian, Mississippian and Devonian part of these wells. The cross-section is hung on the midas 4500 foot datum, that's 4500 feet below sea level, and I have illustrated the top of the Mississippian formation, the top of the Devonian formation, and the pay zone. I have made those notations immediately below the correlation line.

You'll note that the pay zone is

consistently the same distance down from the top of the Mississippian and up from the Devonian formation.

I have some broad black lines within the depth column, and let me explain those. The broad black line on the left side of the depth column represents a drill stem test that was taken during the drilling of that particular well. The broad line on the right side of the depth column is a perforated interval in that particular well.

I have also noted below each of the wells pertinent drill stem tests and perforating information, as well as completion information.

During the drilling of the wildcat discovery well, which was drilled by Republic Natural Gas and Seaboard Oil Company, in the White Ranch No. 1 well, a drill stem test was taken opposite the Mississippian formation. That well is the second well from the left of the cross-section.

That well had gas to the surface in 77 minutes and just a little bit of mud. And they estimated the recovery of that at 35,000 cubic feet of gas per day, essentially a noncommercial

gas well.

That is one of the items mentioned in the regulation, that the natural flow of a well in situ permeability, unstimulated in this instance needs to be less than 336,000 for this particular depth range. That flow rate qualifies it as a tight gas section.

Drill stem tests during the drilling of the Tom Ingram 4 White Ranch tested that same interval. It did not recover or have gas to the surface during that test, and that test was open for two hours. So the gas volume, the in situ gas volume, unstimulated, was less than measurable. It was not measurable.

These wells were later stimulated. The No. 1 White Ranch by Mobil, and then some 15 years later, Tom Ingram. Tom Ingram recompleted the No. 1 and the No. 2 well, and then Wainoco recompleted the No. 3 well. Actually, Wainoco was the proponent for the No. 4 White Ranch well as well.

All of these wells have been completed and have been producing Mississippian gas. All of them had to be stimulated in order to become commercial wells.

Q. Mr. Ahlen, to sum up, in reviewing the data you have on Exhibit No. 5, that data suggests that this is a tight formation within the meaning of the regulation?

A. Yes, sir, it is.

Q. I want to refer you to Exhibit No. 6.

A. Rather than be redundant, let me just say this is a structure cross-section of the west White Ranch field. The datum has been changed to minus 4000 feet for convenience.

It shows the same top of the Mississippian formation and the top of the Devonian formation. The pay zone is located in almost exactly the same places within the Mississippian section here as it is in the White Ranch field itself.

It's slightly closer to the top of the formation because regional truncation is causing the Mississippian to be thinner and thinner in a westward direction. The porosity thickness is approximately the same. The well that we are reentering again is the second well from the left on this cross-section, the J. C. Williamson White Ranch No. 1.

I have noted the pay zone there and I

have written the number 75, and that weird symbol in there means ohms in the log column, and that refers to the resistivity of that particular formation, suggesting that it is somewhat porous. The 75 ohms means that it's unusually high resistivity for the type of porosity I expect in that reservoir, suggesting a low water saturation.

You'll note that there was another drill stem test taken on this cross-section, and that was in the Ohio Oil Company No. 1 State WR well. It was a drill stem test across the Mississippian pay zone. That particular test had a 1000-foot water blanket, it was open for two hours, and recovered that water blanket plus 120 feet of slightly gas cut mud.

You'll note by the flow pressures there and the 30-minute build-up pressure, that it was very low. 860 pounds for a 30 minute build-up pressure is extremely low. There was no measurable reservoir fluid to the surface, so it again qualifies as a tight formation designation.

Q. Let's look at Exhibit No. 7. I'll ask you to identify Exhibit No. 7 and explain it for the record.

A. Exhibit No. 7 is an east/west cross-section between the White Ranch field and the west White Ranch field, showing the relationship again of the pay zone to the top and the bottom of the Mississippian formation and the top of the Devonian formation, as well as the pay zone. It illustrates two of the same wells that we saw on the previous two cross-sections, but it relates the fields to each other. It's also datumized on the minus 4000 foot datum and shows that the Williamson well is significantly higher structurally than the Republic Seaboard White Ranch Well No. 1.

Q. Mr. Ahlen, while we're looking at this particular exhibit, would you take this opportunity to explain the geology of the Mississippian formation in this area?

A. Yes, sir. The Mississippian formation is primarily a limestone formation. In the upper portion of it, it has minor amounts of chert included in the Mississippian, and the chert occurs primarily as nodules of chert within the limestone.

The lower one-third of the Mississippian formation is somewhat clastic in

that it has shale and sometimes siltstone included within the formation. The formation varies in thickness from 600 to 800 feet thick, depending upon where you are within this immediate area.

The pay zone is almost always in the upper one-third of the formation. There are other porosity zones within the Mississippian, but the one that has been developed so far is this one approximately 150 to 200 feet down from the top of the Mississippian formation.

The pay zone itself is a rather unique lithology within the Mississippian formation. It is a limestone, pellet, clastic type of material, and you might think of it as a limestone sand within an otherwise--primarily a mudstone matrix, but it appears to be continuous throughout the area as I've contoured it with the isopach map.

Q. One more thing, Mr. Ahlen. Would you compare the pay zones in the Williamson to the Ingram, as it applies to this exhibit?

A. Well, the pay zone here in the Williamson well is significantly higher structurally. It consists of the same kinds of rocks. It's primarily a limestone bullet, but it

is called a pellet packstone. In other words, a sandstone made out of limestone pellets.

Q. Let's look at Exhibit No. 8?

A. Exhibit 8 is a hole core analysis of the pay zone in the Tom Ingram White Ranch well No. 4. This is the core analysis of the core that was taken in the Mississippian at a depth of 8494 to 8573, actually.

We took two cores. The first core penetrated the pay zone, the second core was taken immediately below the pay zone. We were not sure how thick the pay zone would be, so when Mr. Ingram said he wanted to make sure he had all of it, I put the core barrel in the second time and we cored the rest of it and it was very tight. It had no porosity, no permeability or saturation at all.

The portion we see analyzed right here is that portion of the core which I judge to be porous and permeable and oil saturated. You'll note that in the depth column it is not broken up into even feet. As it came out of the core barrel, we just broke it at convenient spots and there might be 1 foot analyzed, 1.2 feet analyzed or 1.8 feet analyzed in each one of these

segments.

You'll notice that the permeability is extremely low throughout this zone. There are several places where the horizontal permeability is less than 1 millidarcy, and generally speaking the permeability 90 degrees is less than the horizontal permeability, which is normal in sedimentary rocks.

Porosity is tabulated next in the fourth column. The next two columns show fluid saturations, one for oil and one for water. And then there is a lithologic description in the far right-hand corner.

Q. Now, if I'm correct, this Exhibit 8 basically furnishes the raw data for Mr. Stubbs' later interpretation of what this means in terms of porosity?

A. Yes, sir. This is just the data as received from the core laboratory, as they analyze the core and it's essentially the hole core analysis which leads to later conclusions, and petroleum engineers are qualified to make an interpretation of this data and determine certain conclusions.

Q. Now, does this core data include

information about both sides of the reservoir, above the top and below the bottom of what you determine to be the quote "pay zone"?

A. Actually, the top of this core is into the reservoir a short distance. Rather than blindly core head and predetermine a depth to place the core barrel, when we were drilling this well I was looking for a drilling rig so that we could put the core barrel in the hole at the appropriate point because it costs quite a bit more to core than it does to just regularly drill. So there's approximately two to four feet of the pay zone missing at the top of this core analysis. We have adequately covered the base of the pay zone, though.

Q. The point to make is that this does not include just plain rock outside the pay zone?

A. Well, no, sir. It costs extra money to run a core analysis on core that doesn't have any pay. So, in my estimation, at the time that we took this core, I only had analyzed that part of the reservoir that I thought might be pay.

Q. Let's look at Exhibit No. 9. I would ask you to identify that and explain it.

A. Exhibit 9 actually consists of two

parts. There's a second page behind. The first page is a core graph, or a picture of the information that we just talked about on Exhibit 8, with the addition of a gamma ray log, which was run on the core after it was reassembled at the laboratory.

The gamma ray is utilized to help you identify the exact location in the well that the core was taken after you have run a natural radioactivity log in the well, and it helps you correlate the porosity deflections in the core with those on the electric logs.

It again illustrates the permeability--well, the far left is the gamma ray, the next is the permeability column, then there's the porosity column, and then also illustrated are the fluid saturations, being oil on the left and water on the right.

Q. Am I correct in understanding that Exhibit 9 is a pictorial view, essentially, of Exhibit A? Is that the way that works?

A. Of Exhibit 8.

Q. I'm sorry.

A. Yes, sir. The second part of that exhibit which is stapled to it is the five-inch

log, the compensated neutron formation density of that well. I have xeroxed the heading for identification with a xeroxed copy of the pay zone.

Immediately to its right it shows the top of the pay zone at 8502 and the bottom of the pay zone at 8545 or 46. It shows the configure of the borehole as well as the natural radioactivity of the formation on left, and also an indication of the porosity on the right in the limestone.

The porosity is exaggerated in those parts of the hole that are washed out, which you can see on the caliper log over there, so there's not an exact correlation of porosity with a core porosity or where we have a wash out on the log.

Q. I'll refer you to Exhibit No. 10, ask you to identify that and explain the exhibit, and also explain how to read it, I guess.

A. Okay. Exhibit No. 10 is a copy of the pressure chart that was in the pressure recorder during the drill stem test Tom Ingram took on the No. 4 White Ranch well.

The data is labeled with circles and little stems hanging out of it. Time, on this

particular graph, runs from right to left, and one can note on the right side of this the slanting line that is jagged, going up to the left, and then the label "No. 1." That is a picture that the pressure chart sees as it's being lowered into the well.

Where the line stabilizes and becomes horizontal, that's where the tools are at rest in the bottom of the hole and they're getting ready to do the test. One is known as the initial hydrostatic pressure. That's actually the pressure of the drilling fluid in the annulus before the drill stem test takes place.

At the setting of the packer, the pressure drops--let me state that pressure increases up on the page here and there's low pressure on the bottom of the chart and high pressure on the top of the chart. When the tool opens, the pressure drops precipitously almost to nothing, where label point "No. 2" is. The area between 2 and 3 is the initial flow pressure. Between 3 and 4 is the initial shut-in pressure portion. Between 4 and 5 is the opening of the tool a second time, and 5 is the beginning of the final flow period.

Now the pressure recorder is within a cylindrical tube and time is continuous within the cylindrical tube, so the time initiates on the right side of the chart again as we come into data point No. 6. The final shut-in pressure is from 6 to 7, and it goes across completely through the cylinder again to point No. 7.

That's the final shut-in pressure of the final shut-in period. The test is over and the packer is pulled. And the point No. 8 is the final hydrostatic pressure, and then the sloping line to the lower left is the tool coming out of the hole again.

You will note that between points 2 and 3 and between points 5 and 6, those are very low pressures and there's hardly any slope to those lines. This illustrates the relative tightness of the formation.

Then also, between reference points 3 and 4 and reference points 6 and 7, the relatively slow increase in pressure of the build-up curves, also suggest a rather tight formation.

The second page of that illustration are the laboratory derived initial hydrostatic

pressure, initial flow pressure. Both of them, the initial and final of that, the initial shut-in pressure and then the second flow period, the initial and final pressures of that, the final shut-in pressure and the final hydrostatic pressure, are all tabulated there in the upper third of the page.

The lower part of that page is the digitized results of reading the various pressures and time through the rest of that test. The next page and the next page and the next page are all incremental pressures of time and pressure, the logarithm of some of those values. Those numbers are helpful to the petroleum engineer to compute permeability and other relationships within the borehole.

Q. Well, Mr. Ahlen, as you analyze this exhibit, which is pretty mystifying to a layman, do you reach some sort of conclusion as to what it shows you?

A. This is a classic chart of a tight formation.

Q. I want to refer you now to Exhibit No. 11 and ask you just to identify that and briefly tell the Examiner what that is?

A. Exhibit 11, stapled together, is the scout tickets on all of the wells drilled within the outlined designated area. It is classic information that is available publicly on all wells, historical information for the drilling of individual wells.

It gives the well names, their locations, when they were drilled, what was encountered during the drilling process, if any tests were taken, and anything else that might have been of interest or unusual during the drilling of any of the wells.

Q. Now let me refer you to Applicant's Exhibit No. 12. I would ask you to identify that and explain it.

A. Exhibit No. 12 is a copy of the topographic map of the Malstrom Ranch and the Cult ranch, topographic quadrangles in the immediate vicinity of the requested area. It is here for the purpose of identifying the location of fresh water wells that are producing in the area, as well as any other fresh water resources in the area.

There are two wells in the area that have produced fresh water, although in extremely

limited quantities. There is what is called "Loco Well" located in Section 30 of Township 11 South, 29 East, along the east line of that section. A second well is located at the Malstrom Ranch headquarters in Section 3 of 12-29.

Both of those are very poor-quality wells. They're not very deep. They produce water out of thin, Permian sands, and there have been several attempts--well, all of the outlined area is on the L. E. Ranch, and there have been many attempts to drill water wells in the area but most of them have been failures. There are very few good fresh water wells in the area. That water is used for stock on the ranch.

Q. And, Mr. Ahlen, I take it that it's your opinion that the granting of this petition will not in any way affect any fresh water source?

A. We will probably fracture the Mississippian formation at a depth of anywhere from 7500 feet to 8500 feet. And on Exhibit 2 I named the many formations that intervened between the zone that we're going to fracture and the area where these water wells produce their

water. There are many plastic, essentially plastic formation that will absorb most of the forces of that, and it's very unlikely that the pressure that we use at such a great depth will influence any of the shallow water producers.

Our disposal systems will be such that we do not contaminate the surface as well, as federal and state regulations are already sufficient to cover that.

MR. CARSON: Mr. Examiner, I would like to move the introduction of Applicant's Exhibit Nos. 1 through 12.

EXAMINER STOGNER: Exhibits 1 through 12 will be admitted into evidence at this time.

MR. CARSON: I didn't have any more questions of Mr. Ahlen, at the present time anyway.

EXAMINER STOGNER: I don't have any at the present time. I want to go ahead and hear the next witness, and then come back in and cross-examine on both.

BRUCE A. STUBBS

Having been first duly sworn upon his oath, was examined and testified as follows:

EXAMINATION

BY MR. CARSON:

Q. Mr. Stubbs, will you state your full name for the record?

A. Bruce A. Stubbs.

Q. You're an independent petroleum engineer located in Roswell, is that correct?

A. That's correct.

Q. You're employed by C. W. Trainer in support of his application today, is that correct?

A. That's correct.

Q. Mr. Stubbs, for the purpose of the record, would you state a little bit of your educational experience and background?

A. I'm a graduate of New Mexico State University with a degree in mechanical engineering in 1972. I have spent over 20 years in the oil and gas industry in the Permian Basin. I'm a registered professional engineer in New Mexico and Texas.

Q. Mr. Stubbs, you have previously testified before the New Mexico Oil Commission and your qualifications have been accepted, is that correct?

A. That's correct.

MR. CARSON: I would tender Mr. Stubbs as an expert witness.

EXAMINER CATANACH: Mr. Stubbs is so qualified.

Q. Mr. Stubbs, I am going to refer you to Applicant's Exhibit No. 13 and ask you to identify that exhibit.

A. Exhibit 13 is a tabulation of the laboratory core data that we used to make some calculations to determine the average in situ permeability in the productive interval. We also need to look at Exhibits 14 and 15.

Q. Okay. Would you just discuss them all at once and analyze them for the Examiner.

A. Okay. To the right, at an average permeability over the productive interval, we had to make a chart of porosity versus permeability, to assign a permeability value to the intervals that have less than .1 millidarcy in laboratory data. That's Exhibit 15.

If you'll notice, there's a set of dashed lines at the bottom. Just for an example, if the particular core interval had a porosity of five percent, reading vertically up to the

porosity permeability line, and then to the left would indicate a permeability of .015 millidarcies.

We use that porosity permeability distribution to estimate the permeabilities of the core that was reported less than .1 millidarcy.

After a permeability value is given to each core interval, we calculate a flow capacity for that interval which is the sixth column in the middle of the page and arrive at a value of millidarcy feet for that core interval.

Because this is a laboratory analysis and it's a single-phase flow, you're using air to determine the permeability of the core. To arrive at an in situ permeability, we have to introduce the water saturation which reduces the permeability.

Exhibit 14 is a typical permeability curve of a wetting fluid. Using that curve, you can determine or read the percent saturation at the bottom, go up again vertically to the theoretical curve and then over to the left to determine the percent relative permeability.

Using the relative permeability times

the millidarcy feet, we calculate a relative flow capacity in the last column on the right. So the total flow capacity for the cored interval that we consider productive is 3.02 millidarcy feet. The core interval is 40 feet, so by dividing that 3.02 by 40, we have a relative permeability of .0755 millidarcies for that interval.

Q. Which is less than the .1 established by the Rule?

A. That is correct.

Q. Am I correct, Mr. Stubbs, that in preparing your Exhibit Nos. 13, 14 and 15, you examined the exhibits which were previously referred to by Mr. Ahlen, being Exhibits 1 through 12, and they form the basis for part of your analysis, is that correct?

A. That's correct. There's a couple other considerations in the flow capacity of the core. If you'll notice on the original laboratory data, Exhibit 8, the permeabilities that are high, in this case .3 millidarcies and .4 millidarcies, correspond to intervals that they describe as having fractures.

Based on the productivity and the drill stem test, it's my belief that these

microfractures or small fractures will probably heal once the overburden pressure is put on that particular core. So the permeability may even be lower than this .07 in the actual reservoir condition.

Q. Now, I want to refer briefly to Applicant's Exhibit No. 14 which is simply taken from reference material, is that correct?

A. That's correct. It's from the Petroleum Engineer's Handbook put out by the Society of Petroleum Engineers.

Q. The type data, called "core analysis methodology" that goes with it, is simply a statement in writing of how you applied the data, is that right?

A. That's correct.

Q. You've already explained Applicant's Exhibit No. 15. Now explain Applicant's Exhibit No. 16 and tell us what that shows.

A. Okay. 16 is a qualitative analysis of the drill stem test. Because no real reservoir fluids were measured, calculations are somewhat questionable.

By doing a Horner analysis, you can determine the bottom hole pressure approximately

3720 pounds. You can look at the slope of the curve, which is very steep in this case, 4,700 psi per cycle, indicating a very tight formation.

The test was a mechanically good test, and the test tools functioned properly as they should. The recovery was approximately 500 feet of slightly gas cut mud, which is about 2.45 barrels. The total flow time was 136 minutes.

When they returned the sampler to surface, it had 250 psi and inside was 2240 cc's of slightly gas cut mud. Again, no measurable quantities of reservoir fluid. The shut-in curves because of the slow build-ups indicate again a low permeability formation without damage.

The first shut-in time was a total of 90 minutes. It was not adequate to reach a straight line portion of the curve, so it was not used for analysis in this case. The second shut-in time was total 240 minutes and it reached a straight line portion of approximately 160 minutes. At that point it was still building a rate of almost 6 psi per minute, again yielding a very steep slope.

I did a sample calculation just to kind of get a range of permeability values; assumed a rate of about 30 Mcf a day. It's the third page which is just an example of a gas calculation. This is a standard Horner analysis to arrive at a permeability number.

The permeability number in this example is .001 millidarcies, which is very, very low, but it does correlate to the amount of recovery in the test as being an extremely tight formation.

Q. Did you arrive at some opinion as to whether this resevoir is capable of commercial production in its natural state?

A. From all the information I've seen, it is not commercial without stimulation.

Q. Let's go on to No. 17, and ask if you would explain that exhibit to the--

A. I did a production study in all of Chaves County and found that there are 12 wells that have been completed in the Mississippian formation and have production. All but one of those wells required stimulation just to even be close to being a commercial well.

The only well that did not require

stimulation, and it is the best well in Chaves County, is the Hudson Federal No. 1 well. It was completed naturally, and its maximum production rate was 1.8 million a day. The rest of the wells, you'll notice, are 300 Mcf a day or less. That's after stimulation. And that's even below the maximum unstimulated production rates required for in the regulations.

Q. How far away from our area is this Hudson Federal No. 1?

A. That well is about seven miles to the southeast.

Q. Let's go on to Exhibit No. 18. I would ask you to explain that.

A. This is part of the table of maximum unstimulated production rates out of the regulations. The depth range that we're working in is the 7500- to 8500-foot range which allows a maximum allowable production rate not to exceed 336 Mcf a day to 388 Mcf a day, and that's unstimulated.

Q. Now, when you take that chart that comes out of the OCD regulations, this is, by that calculation, a tight reservoir, is that correct?

A. That's correct.

Q. Let's go on to Exhibit No. 19, and I would ask you to explain that.

A. Mr. Trainer is presently testing a White Ranch No. 1 well, which is in Section 1. It's the old Williamson well. It's been perforated and had a slight show of gas, no measurable quantities of gas. We ran a fluid gradiant and pressure tests on it the other day, over last weekend, and it showed 205 pounds bottom hole pressure with about 500 feet of condensate in the hole. There's still no measurable gas rates.

Q. The purpose of Exhibit 19 is just that that is the most recent data that we have in the area of interest?

A. This is the most recent data, and it shows that the unstimulated rate is well below 336 Mcf a day.

Q. Let's go on to Exhibit No. 20 and have you explain that.

A. Exhibit 20 is an economic analysis of a typical well in this area, and I primarily used the White Ranch No. 4 as my model.

I did a volumetric analysis on the

White Ranch No. 4 and it indicates that in a 40-acre drainage area there's about 779 million cubic feet of gas in place. That well appears that it's only going to recover 10 percent of that gas.

The average recovery for the four wells in the White Ranch field is only slightly less than 200 million cubic feet of gas, or approximately 25 percent of the original gas in place. It's going to take some kind of stimulation technique to increase these ultimate recoveries, probably larger acid treatments or jelled acid or something to give a larger drainage radius. Using some of those techniques, you would hope to see a 50 percent or better increase in ultimate recoveries to somewhere over 300 million cubic feet of gas per average well.

We estimate the cost to reenter, stimulate, and equip the Mississippian well at approximately $187,000. Presently the average gas price in that area is about $1.50, and the gas is about 1132 BTU gas, so it would sell for around $1.70.

Running economics at $1.70 per Mcf and operating costs at $2,000 per month, in an

ultimate recovery of 322 million cubic feet, yields an 18.99 percent return on a $187,000 investment, with a payout in 2.81 years. These are pretty marginal economics and really don't support the risk involved in trying to complete one of these wells.

With the tax credit, which adds approximately 50 cents tax credit per Mcf, using the same scenario of a $187,000 investment, yields a 58.28 percent return on investment and 1.66 year payout. This now is a much more palatable set of economics and would support some risk involved in developing this resource.

Q. Mr. Stubbs, to kind of recapitulate a little bit of what you're saying as far as the reason why this credit is necessary, if I was looking back at I believe we had 22 wells in the general area, 18 of which Mr. Ahlen said penetrated the Mississippian, would it be fair to say that you had about $10 million worth of wells which produced less than $2 million worth of gas?

A. That's correct. Like I said, there's 12 wells that have produced out of the Mississippian and we're recovered a little over 2 Bcf of gas. At $1.00 or $1.50 an Mcf, that's

less than $3 million.

Q. So, under normal circumstances, these are not commercial wells?

A. No.

Q. Mr. Stubbs, you've now had occasion to review Exhibit Nos. 1 through 20. In your professional opinion, after having examined those exhibits and the Rules, does it appear to you that this is a tight formation which would qualify for the credit?

A. Yes. The area outlined by Mr. Ahlen is a tight formation, and it's not productive unless it's stimulated.

MR. CARSON: I would like to move the introduction of the rest of the Exhibits, which I believe are Nos. 13 through 20.

EXAMINER STOGNER: Exhibits 13 through 20 will be admitted into evidence at this time.

MR. CARSON: I have no further questions of Mr. Stubbs.

EXAMINATION

BY EXAMINER STOGNER:

Q. Mr. Stubbs, in looking at Exhibit No. 17 showing the maximum production--

A. Yes, sir.

Q. --again, is this stimulated or unstimulated?

A. The only well on there that is not stimulated that I could find is the Hudson Federal well. That was completed naturally. The rest of them had acid jobs or frac jobs. And that maximum rate is the first month's production divided by the days of the month.

Q. How many wells am I looking at here in the area which you're proposing today?

A. Well, the White Ranch wells, the first four are the first four are in the area we're talking about. The others are scattered out over Chaves County.

Q. Now, you just kept your review into Chaves County and not over into Lea County, is that correct?

A. That's correct. This particular area is located almost centrally in the eastern part of Chaves County, so it's probably, what, Jack, 10, 12, 15 miles to the Lea County line, something like that?

MR. AHLEN: Yes.

EXAMINER STOGNER: Mr. Carson, help me with my memory. If I remember right, all of the

Mississippian formation in Lea County is already covered with a tight formation designation, is that correct?

MR. CARSON: I think that's right.

EXAMINER STOGNER: Okay.

Q. One of the stipulations, Mr. Stubbs, is that no well is expected to produce over five barrels of oil or condensate, and I don't remember any testimony to that effect; however, I believe some of your exhibits did show some liquid production. Do you want to elaborate a little bit more on that?

A. Yes. I believe the Rule reads that it will not produce over five barrels of crude oil per day without stimulation, and most of the wells, all except for the Hudson Federal well which is seven miles away, basically didn't produce until they were stimulated.

The White Ranch wells, even after stimulation, for example the White Ranch No. 1, produced--and this is after stimulation--306 Mcf a day, 8.7 barrels of oil a day, just for a very short time. And that oil production, which is probably condensate, dropped off within just a matter of months.

The other two wells, the 2 and the 3, produced less than five barrels a day and then No. 4 had a short period of time that it produced about 10 barrels of condensate per day after stimulation.

Q. Your west White Ranch No. 1 well, it's not on any of the cumulative data because that's now being completed at this time. What kind of fluids have you seen on the test on this particular well?

A. They have recovered a slight show of gas, and based on the pressure gradiant we ran last weekend, there appears to be about 500 feet of condensate in the hole based on the pressure gradiants.

Q. There again, unstimulated, production does not come close to the five barrels, is that correct?

A. That's correct.

Q. Now, when I look at Exhibit No. 13, this is the core data information, as you mentioned, there are quite a few instances where the permeability did go above .1. This is just the permeability from the core data, not taking into effect the wetting of the liquids. It was

due to fracturing? Was that your conclusion, whenever I look at Exhibit No. 8 and Exhibit No. 13?

A. That's correct. I believe the Rule reads that it's the average permeability over the pay zone. That's what I did, is calculate an average relative permeability of about .07 millidarcies. It's also my belief, based on the drill stem test data, the test after perforating, that the wells just don't have any permeability until they're stimulated.

And the cores that show relatively high permeability in this case, have small fractures because it is a hole core analysis so they measured the permeability in those fractures. Those fractures were probably healed due to the overburden pressure in a reservoir condition.

Q. Are you concluding that this is your production interval, what I show here, from 8491 to 8534?

A. That's correct.

Q. And that is perforated?

A. There's an 11-foot correction between the core data. The core data is 11-feet high to the log data. The perforated interval on the

logs is 8502 to 8535, 33 feet. The porosity interval on the log is about 43 to 44 feet thick.

EXAMINER STOGNER: Mr. Stubbs, I don't have any other questions of you.

Mr. Ahlen, why don't you come up to that seat there.

JACK AHLEN

Having been recalled to the stand, was examined and testified further as follows:

EXAMINATION

BY EXAMINER STOGNER:

Q. Going back to the basic geology of the Mississippian formation and how it's deposited, could you elaborate a little bit more on those particular aspects, and also why you have alluded several times and Mr. Stubbs has alluded several times to the Hudson Federal No. 1 well, which is seven miles away, and how the deposit changes from here and why, perhaps, is there some sort of a boundary or a barrier between that seven-mile interval where the Hudson Federal is in this particular area?

A. The producing zone in the Hudson Federal is stratigraphically higher than this

particular zone. As a matter of fact, that stratigraphic interval is not even present in the White Ranch area because the basal Pennsylvanian unconformity has truncated and removed that part of the section.

The Hudson well itself probably is producing from a small biothermal reef out of the Mississippian formation, as exemplified by the outcrop near Alamogordo. There are small biothermal reefs present on the outcrop there, and I feel as though there is a biothermal accumulation in the Hudson Federal well that is the present production.

That is further exemplified by the fact that two wells were drilled directly offsetting that well, one to the south, the next location south, and it's not shown on these maps, but there was a second offset drilled to the west of the Hudson Federal, and neither of those wells hit the reef. As a matter of fact, those were dry holes.

Q. And you have no indication that there is such a reef in this particular area?

A. None whatsoever.

Q. What kind of deposit are we looking at,

going back to the basic geology?

A. The Mississippian is essentially limestone in this vicinity. All over Chaves County as well as Lea County it's essentially a limestone.

This is a unique zone within that limestone section. The Mississippian normally is a very tight, hard, silicious limestone with no porosity whatsoever. No measurable porosity. I'm sure there's some there, but certainly you can't measure it in the laboratory.

This particular zone is unique in that it stretches over a relatively broad area and it is significantly different from the normal lithology in the Mississippian. The rock in the pay zone consists of small limestone pellets that are packed together. It's more like a sandstone made up of lime pellets and then they are packed together and it's called a packstone.

Q. What kind of environment, marine environment, are we looking at that causes this?

A. I visualize a relatively shallow shoal in which there's some wave activity impinging on the bottom sediments and sorting them and accumulating them in sort of a small bank.

Q. And this small bank that you allude to can be shown in Exhibit No. 4, which is concentrated in this area?

A. Yes, the isopach map of the Mississippian.

Q. This is by no means a reef in which you're alluding with the Hudson well?

A. Absolutely.

Q. At the beginning of your testimony, you gave me some numbers, 22 wells total in the area?

A. On the mapped area, yes.

Q. 18 had penetrated the Mississippian?

A. Yes, sir.

Q. 11 of which are in the subject area?

A. Yes, sir.

Q. And, from Mr. Stubbs' testimony, only four of these wells are completed in the Mississippian, is that correct?

A. Yes, sir.

Q. Now, do either one of you know if there was any test of the Mississippian in any of the other seven wells?

A. Yes. To the south, the other seven-- Outside the area, you mean?

Q. Inside the area. You said there were

11?

A. There's one drill stem test inside the area in the Ohio "WR" No. 1, which is in Section 36 of 11-28. That was drill-stem tested in the pay zone and it recovered very little fluid and had 860 pounds shut-in bottom hole pressure after 30 minutes. It is the direct north offset to the well that we are reentering.

Q. What's the name of that well again? The Ohio--

A. The Ohio "WR" State No. 1. It's in the southeast of the southeast of Section 36, 11-28.

Q. But it never produced from the Mississippian?

A. That is correct. Also the Republic Natural Gas and Seaboard No. 1 White Ranch well drill-stem tested the Mississippian when that was originally drilled as the discovery well for the White Ranch pool, and that's located in Section 34 of 11-29. It's the one that had gas to the surface in 77 minutes, estimated at 35,000 cubic feet per day.

Q. And that is covered in one of your cross-sections?

A. My previous testimony, and it's also

tabulated on the bottom of that north/south cross-section that is Exhibit No. 3.

Q. You know of no other information, such as core--

A. No other wells were cored in this area.

Q. You did an extensive review of that--

A. Yes, sir.

Q. --trying to find them?

A. Yes, sir.

Q. The stimulation out here in the Mississippian, in this particular area, what is the normal procedure? What kind of fracture or stimulation procedure do we see out here?

A. I would have to read that off the--

MR. STUBBS: The data is in the scout tickets. Most of them had what I would term relatively small acid jobs in the range of 6,000 gallons. One of them, the White Ranch No. 4, I believe, was frac stimulated with 27,000 gallons and 7,500 pounds of sand, so relatively small treatments.

EXAMINER STOGNER: Mr. Carson, I don't have any other questions of Mr. Ahlen or Mr. Stubbs.

Do you have anything further?

MR. CARSON: No, nothing further.

EXAMINER STOGNER: What I need from you, Mr. Carson, is three additional copies of the exhibits.

MR. CARSON: Okay. We can handle that.

EXAMINER STOGNER: You can either get them to me today or subsequent to today's hearing.

Also, Mr. Carson, between now and the time I submit this to the FERC, if you can get with Mr. Stubbs and Mr. Ahlen and keep me posted on any data on that west White Ranch No. 1 that might be of any benefit, or any information for that matter, if you could keep that ongoing until the time this is submitted to the FERC, in which you will also get a copy of any letter to that aspect.

I understand the urgency and the desire of Mr. C. W. Trainer to get this thing in, since it is a December 31st deadline in getting wells either drilled or any applications for NGPA 107 tight formation wellhead determinations in by that date. I will try to expedite it as my workload allows.

With that, if there's nothing further

in Case No. 10617, I'll take it under advisement.

Let's take a short, 10-minute recess at this time.

(And the proceedings concluded.)

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 10617, heard by me on December 10, 1992.

Examiner
Oil Conservation Division

CERTIFICATE OF REPORTER

STATE OF NEW MEXICO)
) ss.
COUNTY OF SANTA FE)

I, Carla Diane Rodriguez, 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 caused my notes to be transcribed under my personal supervision; 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 December 23, 1992.

Carla Diane Rodriguez

CARLA DIANE RODRIGUEZ, RPR
CCR No. 4