STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION COMMISSION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION COMMISSION FOR THE PURPOSE OF CONSIDERING:	)	CASE NO. 11,798
APPLICATION OF COLLINS AND WARE, INC., FOR SPECIAL POOL RULES, LEA COUNTY, NEW MEXICO	)	ORIGINAL

REPORTER'S TRANSCRIPT OF PROCEEDINGS

COMMISSION HEARING

BEFORE: WILLIAM J. LEMAY, CHAIRMAN
WILLIAM WEISS, COMMISSIONER
JAMI BAILEY, COMMISSIONER

August 14th, 1997

Santa Fe, New Mexico

This matter came on for hearing before the Oil Conservation Commission, WILLIAM J. LEMAY, Chairman, on Thursday, August 14th, 1997, 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

August 14th, 1997
Commission Hearing
CASE NO. 11,798

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A P P E A R A N C E S

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* * *

WHEREUPON, the following proceedings were had at 9:18 a.m.:

CHAIRMAN LEMAY: Now we will call Case 11,798, the Application of Collins and Ware for special pool rules, Lea County, New Mexico.

Appearances in Case 11,798?

MR. CARR: May it please the Commission, my name is William F. Carr with the Santa Fe law firm Campbell, Carr, Berge and Sheridan. We represent Collins and Ware in this matter, and I have two witnesses.

CHAIRMAN LEMAY: Thank you. Will those witnesses kindly stand and raise your right hand to be sworn in?

(Thereupon, the witnesses were sworn.)

CHAIRMAN LEMAY: Mr. Carr, you may begin.

MR. CARR: Thank you, Mr. Chairman.

MIKE MOYLETT,

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. Mike Moylett.

Q. Where do you reside?

A. In Midland, Texas.

Q. By whom are you employed?

A. Collins and Ware.

Q. What is your current position with Collins and Ware?

A. Petroleum geologist.

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

A. No, I haven't.

Q. Could you briefly summarize for the Commission your educational background?

A. I have a bachelor's degree and a master's degree, in 1985, my master's degree, from Missouri School of Mines in Rolla, Missouri, in geology and geophysics.

Q. Since graduation, for whom have you worked?

A. I've worked with Exxon in Midland, Texas, for six years, with Arco Oil and Gas in Midland for two years, and almost four years now for Collins and Ware.

Q. Does the geographic area of your responsibility include the portion of southeastern New Mexico involved in this case?

A. Yes, it does.

Q. Are you familiar with the Application in this case on behalf of Collins and Ware?

A. Yes, I am.

Q. And are you familiar with the development of the Tubb Formation in the East Warren-Tubb Pool and the

surrounding area?

A. Yes, I am.

Q. Have you made a geological study of the Tubb formation in the area of interest?

A. Yes, I have.

Q. Are you prepared to share the results of that study with the Commission?

A. Yes, I am.

MR. CARR: Mr. Chairman, we tender Mr. Moylett as an expert witness in petroleum geology.

CHAIRMAN LEMAY: His qualifications are acceptable.

Q. (By Mr. Carr) Could you briefly summarize what Collins and Ware seeks with this Application?

A. Collins and Ware seeks the adoption of permanent special pool rules and regulations for the East Warren-Tubb Pool, which would provide for a special limiting gas-oil ratio of 6000 cubic feet of gas for each barrel of oil produced.

Q. When was the East Warren-Tubb Pool created?

A. It was created as the East Warren-Tubb Gas Pool by Order Number R-9467 on March 1st, 1991, and it was subsequently changed to the East Warren-Tubb Pool.

Q. Let's go to what's been marked for identification as Collins and Ware Exhibit Number 1. I'd ask you to

identify this and review it for the Commission.

A. Okay, Exhibit Number 1 shows the -- is a -- shows the boundaries of the East Warren-Tubb Pool in yellow. It's a map at a scale of one inch equal to 3000 feet. North is up towards the top of the page. Each one of those section lines there is a square mile, for scale.

This map shows all Tubb wells within one mile of the East Warren-Tubb Pool. The wells in 26 and 27 are in the Warren-Blinebry-Tubb Oil and Gas Pool.

The map shows the Tubb producers in gray, it shows the oil, gas and water production associated with each one of those wells. Gas is in red, oil is in green, and water is in blue.

It also shows the gas-oil ratios for each well, based on their cumulative production. And I've noticed in the legend the dates up to the cumulative production.

Also on this Exhibit Number 1, it shows a trace of the cross-section. That would be Exhibit Number --

MR. CARR: It would be Exhibit Number 5, and I have misnumbered them. I have reversed Exhibits 2 and 5 to make this more challenging, but I'll try and keep you advised as we go through those.

Q. (By Mr. Carr) Mr. Moylett, what rules govern the development of the Tubb formation in the East Warren-Tubb Pool, the area shaded in yellow on Exhibit Number 1?

A. There are statewide rules, 40-acre spacing, 142 barrels of oil a day with a gas-oil ratio of 2000 to 1, results in an authorized producing rate of 284,000 cubic feet of gas per day.

Q. Now, if we go south and west of the subject pool and we look at the Warren-Blinebry-Tubb Oil and Gas Pool, what rules govern the development of that pool?

A. The rules that govern the development of the Tubb and the Warren-Blinebry-Tubb Oil and Gas Pool is special rules, pool rules, adopted in Case 10,245 on March 15th, 1991, by Order Number R-9497.

Q. Spacing is what? Forty-acre spacing?

A. It's a 40-acre oil spacing. The oil wells are wells producing hydrocarbons possessing a gravity of 45 degrees API or less. Rule 5 is, Oil wells in the Warren-Blinebry-Tubb Oil and Gas Pool shall have the capacity allowables and shall be exempt from the oil and casinghead gas allowables as provided in either Division Rules 701.F.(3) or Rules 503, 505 and 506.

Q. And Rule 505 provides for depth bracket allowables; is that right?

A. Yes, and 506 for GORs.

Q. And so this pool offsets another pool in which there are no gas-oil ratio limitations; is that right?

A. That is correct.

Q. Why is Collins and Ware seeking to increase the gas-oil ratio in the subject pool?

A. Collins and Ware has recently completed two wells that produce in excess of the statewide GOR.

The Payday Number 1, located in Section 24 of 20 South, 38 East, first produced on March 1st of 1997. The GOR of that well was 4655 to 1.

And the second well, also located in Section 24, north of the Payday Number 1, was first produced on March 23rd of 1997. It had a GOR of 12,496 to 1 on a day test conducted on June 5th of 1997.

Q. And that's the M&M Number 1 well?

A. M&M Number 1. And these GORs are consistent with the Tubb producers, you know, on the Central Basin Platform in southeast Lea County, New Mexico. The Tubb in southeast Lea County, New Mexico, averages approximately 16,000 to 1 GOR.

MR. CARR: Mr. Chairman, at this time I would ask the Commission to direct its attention to what has been marked as Exhibit Number 5, I believe, in your packet. That is a cross-section. It is the east-west cross-section, the trace for which exists on Exhibit Number 1.

Q. (By Mr. Carr) Mr. Moylett, if you could review that cross-section for the Commission.

A. This is a -- The datum of this cross-section that

you note on the cross-section here is the top of the Tubb silt marker. You see on the -- Like I said, the datum is the top of the Tubb silt marker here. The vertical scale of this cross-section is one inch is equal to 100 feet. I have not used any horizontal scale. I've spaced each well approximately two inches apart.

The top cross-section is the porosity, neutron-density porosity logs, and the bottom cross-section is the resistivity logs for the same wells.

And basically, the cross-section shows the Drinkard formation on the bottom, and the pick on the Drinkard formation is that resistivity tight -- I mean, that lower resistivity streak. And then you have the Tubb silt marker, and above that is the Tubb marker, and a hundred feet above that is the top of the Tubb formation in the Tubb Oil and Gas Pool, as defined by the New Mexico Oil Conservation Commission.

The cross-section shows basically the continuous -- it shows a non-homogeneous vertically stratified reservoir. It's a continuous reservoir within the East Warren-Tubb Pool. This cross-section goes across the East Warren-Tubb Pool from west to east.

This continuous reservoir within the East Warren-Tubb Pool, you really cannot track the individual porosity stringers. The porosity varies from well to well. But you

can see from the cross-section that the Tubb reservoir continues throughout the pool. If you follow the correlation markers there, I feel you can see the continuity of the overall gross Tubb section in there.

Q. Let's go to what has been marked Collins and Ware Exhibit Number 3, and I would ask you to identify that for the Commission.

A. Exhibit Number 3 shows -- is also at a scale of one inch is equal to 3000 feet. North is up towards the top of the page there. In yellow, highlighted, is the Warren East-Tubb field. In blue I basically show wells which have penetrated the Tubb formation. In gray are also the Tubb producers. I've shown the GORs and the production associated with each one of those Tubb producers. Red I've showed for gas, green for oil, and blue for water again.

Also on there I've showed the trace for the cross-section going from the Warren-Tubb Pool up to the East Warren-Tubb Pool, and it's a northeast to southwest cross-section.

Q. Let's go to Exhibit Number 4, the structure map. Would you review that, please?

A. Exhibit 4 is also at a scale of one inch is equal to 3000 feet, with north to the top of the page. In yellow, again, is the East Warren-Tubb field.

This map is on the top of the Tubb silt marker,

which was the datum I used in the cross-sections. The contour interval I used here was 50 feet. And the structure out here shows that the M&M and Payday 1 wells are roughly at a subsea depth of minus 3000 feet.

As you proceed from the East Warren-Tubb field to the Warren-Tubb field, you go updip to approximately 200 feet structurally higher than the M&M 1 and Payday 1 wells in the East Warren-Tubb field.

The significance of the structure is that the Warren-Tubb field is at depletion. Most of the wells are plugged back, no longer producing in the Tubb.

However, most of the wells in the East Warren-Tubb field are still producing in the Tubb, and if we -- if the -- That field is 200 feet structurally lower than the Warren-Tubb field and producing, and the Warren-Tubb field is pretty much depleted. It shows that these wells aren't draining, you know, a large area. If that was the case, the Warren-Tubb field would still be producing.

And that's pretty much the significance of the structure. It shows basically that this field, if you looked at a larger scale, it's -- You know, it's on the northeast end of the Central Basin Platform there. It's pretty much defining the limits of the Central Basin Platform, because if you go further to the east there, you get off the Central Basin Platform into depositionally a

deeper -- a water environment.

Q. The first cross-section that you reviewed, marked Exhibit 5, showed reservoir continuity throughout the East Warren-Tubb Pool.

If you'd now go to Exhibit Number 2, your northeast-southwest cross-section, and review the characteristics of the reservoir from the East Warren-Tubb field through the Warren-Tubb field.

A. This cross-section is also a stratigraphic cross-section hung on the Tubb silt marker at a vertical scale of one inch is equal to a hundred feet. There's no horizontal scale of spaces. Once again, each well approximately two inches apart.

It runs from northeast to southwest, from the East Warren-Tubb Pool to the Warren-Tubb Pool there. Once again, I've shown the correlation lines in there, and you can see that this cross-section, compared to the previous cross-section, are identical; they look -- they're very similar.

It shows the continuity of the reservoir from the Warren-Tubb Pool to the East Warren-Tubb Pool. If you look at the logs there, the top cross-section is the porosity log, the bottom cross-section is the resistivity logs. You can follow those markers from both fields there. Those are the gross markers. If you look at the -- You can even

break it down even further, but I basically just went from the top of the Tubb to the base of the Tubb.

Once again, it shows that even though the overall gross Tubb section is similar, there is some variability in the porosities from well to well.

Q. It does show, however, reservoir continuity --

A. Yes.

Q. -- from the East Warren-Tubb field, the subject of this hearing, to the pool immediately offsetting south and west where there is no GOR limit?

A. Yes, the four wells on the left are in the Warren-Tubb Pool, and the three wells on the right are the East Warren-Tubb Pool.

Q. Mr. Moylett, let's now go to Collins and Ware Exhibit Number 6. Could you identify this and review it for the Commission?

A. Exhibit Number 6 is a two-well cross-section. It runs from north to south. It's also a stratigraphic cross-section hung on the top of the Tubb silt. The vertical scale on that is one inch is equal to 40 feet, and those wells are ten miles apart.

The purpose of this cross-section is to show how similar the Tubb formation is throughout the Central Basin Platform in southeast Lea County. Even though these wells are ten miles apart, you can correlate the top of the Tubb

to the base of the Tubb or top of the Drinkard throughout the Central Basin Platform.

The top of the Tubb, the Tubb marker, the Tubb silt, the base of the Tubb silt and the top of that Drinkard -- It just shows the continuity of the Tubb throughout the Central Basin Platform there.

Q. Could you identify and review Exhibit Number 7?

A. Exhibit Number 7 is a type log, what I would call a type log for Collins and Ware wells in the East Warren-Tubb field there. It's a neutron-density porosity log there. What I've colored in is a gamma-ray cutoff on the left and in blue is the 20 API gamma-ray cutoff. And on the right is the neutron-density crossplot porosity cutoff at 4 percent.

This is basically -- It will be some background information for our engineering presentation there.

But what I've shown is, in the blue there, everything greater than 20 API gamma ray is basically the dolomites in the Tubb section there. Anything less than that is the siltstones in the Tubb section there, and those are fairly low permeability siltstones in there, and they're fairly tight and nonproductive.

Most of the production coming from our wells is from that Tubb dolomite. And as you look at what I've highlighted in blue on the left and what I've colored in on

the right is the porosity is greater than 4 percent associated with the dolomites there.

Q. Mr. Moylett, would you now identify Collins and Ware Exhibit Number 8 and review this exhibit for the Commission?

A. I've been talking a lot with Paul Kautz, who is the District Geologist with the New Mexico Oil Conservation Commission in the Hobbs Office there. I've talked to Mr. Kautz concerning the development of the acreage matters -- concerning the development of the acreage in the East Warren-Tubb field there, and Mr. Kautz prepared this letter for presentation here today.

In Mr. Kautz's letter, which is Exhibit Number 8, he supports the higher GOR limit of 6000 to 1 for the East Warren-Tubb Pool.

The maps provided by Mr. Kautz note that the Tubb and Blinebry Pools have merged together. He concluded that the Blinebry is one continuous reservoir across this area. Mr. Kautz also concluded that the Tubb formation, and specifically the Warren-Tubb Pool and East Warren-Tubb Pool are one continuous reservoir.

Mr. Kautz also summarizes the GOR limits in the Tubb reservoirs in the area, and he notes that the Warren-Tubb-Blinebry Pool has no GOR and concludes that 2000-to-1 GOR in the East Warren-Tubb Pool does not protect

correlative rights.

Q. Now, Mr. Moylett, the Division order which denied the Application of Collins and Ware for a 6000-to-1 GOR for the East Warren-Tubb Pool found, in Finding 10, and I quote, that the Applicant presented no geologic data to establish that the East Warren-Tubb Pool and the Warren-Blinebry-Tubb Oil and Gas Pool represent a single common source of supply in the Tubb formation.

Has that data now been presented?

A. Yes, it has.

Q. The Division order which denied the Application of Collins and Ware also found that the Applicant presented no geologic data, i.e., structure maps, isopachs, et cetera, to characterize the Tubb reservoir in Sections 23, 24 and 25. Has that data now been presented?

A. Yes, I've reviewed the matter with the Division's geologist in Hobbs who concurs that these pools are one common source of supply. Additional data, including a structural map, several cross-sections and a type log have also been presented to characterize the Tubb reservoir in this area.

Q. Will Collins and Ware also call an engineering witness?

A. Yes, they will.

Q. Were Exhibits 1 through 8 either prepared by you

or compiled under your direction and supervision?

A. Yes, they have.

MR. CARR: At this time, Mr. Chairman, we would move the admission into evidence of Collins and Ware Exhibits 1 through 8.

CHAIRMAN LEMAY: Without objection, Exhibits 1 through 8 will be admitted into the record.

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

CHAIRMAN LEMAY: Thank you, Mr. Carr.

Commissioner Bailey, do you have any questions?

COMMISSIONER BAILEY: I don't have any questions.

CHAIRMAN LEMAY: Commissioner Weiss?

COMMISSIONER WEISS: No questions.

EXAMINATION

BY CHAIRMAN LEMAY:

Q. Just some background, Mr. Moylett. There's no Blinebry production in here at all, it's just Tubb, as far as the East Tubb field? Because I know this other field has got Blinebry production too.

A. If you go back to Exhibit 3, which shows -- It's the map showing the producers in the area with the cross-section line on it.

Q. Uh-huh.

A. Okay, if you look at it, the wells in Section 24,

the M&M 2, 3 and Payday 2 are Collins and Ware wells, and they were unsuccessful attempts in the Tubb, and they were plugged back and are now Blinebry completions. And I've noted that "BLBR" underneath those wells there, that there are Blinebry completions. I didn't put a Blinebry production map here, because I was addressing mainly the Tubb.

Q. Well, then, would those wells be incorporated because of the mile limit into the Warren-Tubb-Blinebry Pool and not the East Warren-Tubb field?

My confusion is, it should be one field, I guess, because it was developed later, but it was established separately.

A. Right.

Q. Is that right?

A. Right.

Q. And the Warren-Tubb-Blinebry Pool has Blinebry production in it?

A. Yes, it does.

Q. Your pool evidently will have Blinebry production, or it looks like it is starting to get some Blinebry production on the plugback?

A. Yes, sir.

Q. But currently the pool rules only apply to the Tubb and not the Blinebry?

A. Right, the statewide Blinebry rules that I was aware of is a 6000-to-1 GOR already.

Q. Statewide? I don't think we have a statewide --

A. Well, actually the Blinebry Oil and Gas Pool is 6000 to 1.

Q. Yeah.

A. I don't think there was -- I'm aware of the GOR for the Blinebry in the -- I don't think there is an East Warren-Blinebry Pool.

Q. Doesn't look like it to me. My concern --

A. There isn't --

Q. My concern was whether --

A. Right.

Q. -- you would be protected in your Application by addressing only the Tubb --

A. Right.

Q. -- and Blinebry completion would fall under a different pool, but you would also have the higher -- the needed GOR relief if you needed it? Because Paul seemed to address --

A. Right.

Q. -- the Blinebry also in his letter.

A. I was under the impression that the Blinebry wells that we're completing will be in the Warren-Blinebry Pool.

Q. Yeah, that was my question.

A. Right.

MR. CARR: And our engineering witness can provide some background on this, because apparently one of the pools was originally formed as a waterflood unit, and the boundaries were frozen back at that time, but we can address that with the engineering witness.

CHAIRMAN LEMAY: Okay, thank you. Any other questions? That's all I have.

Thank you.

THE WITNESS: You're welcome.

CHAIRMAN LEMAY: You may be excused.

MR. CARR: At this time we would call Brent Lowery.

BRENT LOWERY,

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 Brent Lowery.

Q. Where do you reside?

A. I reside in Midland, Texas.

Q. By whom are you employed.

A. Collins and Ware.

Q. What is your current position with Collins and Ware?

A. I'm an operations engineer for Collins and Ware.

Q. Mr. Lowery, have you previously testified before the Oil Conservation Commission?

A. No, sir, I haven't.

Q. Could you summarize your educational background?

A. I have a BS in petroleum engineering from Texas Tech University.

Q. And when did you receive your degree?

A. I graduated in 1984.

Q. Following graduation, for whom have you worked?

A. I spent four years working for Damson Oil Corporation, a small independent in Midland. The next three years after that, I was a reservoir engineer for Marathon Oil Company, again in Midland, Texas.

The six years following that, I was an area engineer for Fina Oil and Chemical that -- including all the reservoir, drilling and operations engineering duties for the geographical area in west Texas. And came to work for Collins and Ware in February of 1997.

Q. Does the geographic area of your responsibility for Collins and Ware include the portion of southeastern New Mexico involved in this case?

A. Yes, sir, it does.

Q. Are you familiar with the Application filed in this case on behalf of Collins and Ware?

A. Yes, sir.

Q. Have you made an engineering study of the area?

A. Yes, sir, I have.

Q. Are you prepared to share the results of that study with the Commission?

A. I am.

MR. CARR: We tender Mr. Lowery as an expert witness in petroleum engineering.

CHAIRMAN LEMAY: His qualifications are acceptable.

Q. (By Mr. Carr) Let's go initially, Mr. Lowery, to what has been marked Collins and Ware Exhibit Number 9. I'd ask you to identify this exhibit and review it for the Commission.

A. Exhibit Number 9 is a tabulation of production information from PI that tabulates all the Tubb completions in the Warren-Tubb field, or -- It's actually the Warren-Tubb-Blinebry Oil and Gas field.

This production information includes only what was reported as Tubb production. In some wells I deleted the production information because the perforated interval is also listed, and I went through that and took out anything above approximately 6400 feet in the -- according

to our cross-sections and markers and things, that that would be actually considered Blinebry production for our discussion here.

So this reflects only what was produced out of the Tubb. It also indicates that there are no Tubb producers, or at least no production being reported in the Tubb in that field at this time.

It also indicates that the cumulative recovery from the field is over 2 million barrels and 33 million cubic feet of gas, and the cumulative GOR for the Tubb producers in the Warren-Tubb unit is 16,365 cubic feet per barrel.

Q. All right. Now that we've looked at the Warren-Blinebry-Tubb Oil and Gas Pool, let's move to the East Warren-Tubb Pool, Exhibit Number 10. Would you review the data shown on that exhibit?

A. Exhibit Number 10 is a tabulation of all the production data available in the Warren-Tubb East field producers. Some of the data is -- Well, let's see. It's all as of March, 1997, with the exception of the two Collins and Ware wells, which is through April.

And it indicates, especially in some of the better wells, we have in excess -- or a GOR in excess of 2000 to 1, almost fieldwide. There are a few exceptions to that in some of the poorer producers to the south and a

little bit east of the -- what we consider the main area of the field.

Q. Let's move now to Exhibit Number 11. Will you identify and review that?

A. Exhibit Number 11 is a tabulation of production for the Collins and Ware M&M Number 1 well since it started producing. Included for most of the time period is the oil, gas and water rate, along with flowing tubing pressure. Starting in early June we didn't report flowing tubing pressure or water production.

And this indicates, in general, a fairly low GOR relative to what it's making now. In the next exhibit we'll see that represented graphically.

The other thing that this shows too is, you know, indicated in the periods when the well was shut in, we had a shut-in tubing pressure of roughly 1700 pounds. And as we were producing it on a fairly small choke size, anywhere from 10/64 to 14/64, our flowing tubing pressure exhibited very little drawdown over the shut-in tubing pressure, yet we still have a GOR significantly in excess of 2000 to 1.

Let's go on now to Exhibit Number 12, the graphic presentation of the production information on the M&M Number 1, and I'd ask you to review that for the Commission.

A. Exhibit Number 12 is a graph of Exhibit Number

11, showing the oil, gas and water rates as a function of time. It's listed by day. And the gaps of the data, if you look at the bottom of the scale on the X axis, indicate when the well was shut in.

This exhibits fairly normal or typical solution gas drive depletion behavior, and it also indicates some rate sensitivity to lower rates. As the well produces, you can see a gradual increase in GOR, you know, up until June when we shut it in or pinched it back to produce within the statewide 2000-to-1 GOR allowable. You can also see, as we produced it, a gradual decrease in oil production and increase in gas production, which would cause the fairly low but steady increase in gas-oil ratio.

In June, when we started pinching it back, you know, to be within our allowables, you can see the top line in blue, which is the representation of GOR, the GOR increased dramatically as we pinched the rate back. And if you refer to Exhibit 11, the rates between June 29th and July 3rd still represent gas production that's a little in excess of the 284-MCF-a-day statewide depth bracket allowable, and the GORs are in excess of 50,000 to 1.

As we continued to produce, we opened the choke up a little bit for the next week or so, starting July the 4th, which represents a rate that's approximately double the 2000-to-1 GOR limit allowable, and our GORs come back

down, not quite to where they were before, but to a more reasonable number, consistent with what the well is making whenever it's producing at a significantly higher rate.

Again, we pinched the well back, this time somewhat below what the allowable was, 2000-to-1 depth bracket allowable is, and the GOR again increased. And again we opened it back up some, and the GOR came back down in line with what the well was producing before we pinched it back. And this could be an indication of waste of reservoir energy by not efficiently moving the liquid hydrocarbons and to the surface for sale.

Q. When you cut the well back, in fact, the oil production drops dramatically, does it not?

A. Yes, it does.

Q. Once this happens, in your opinion, can you economically go back and produce this at a later time?

A. If it continues for a long period of time at the higher GOR, we're dissipating reservoir energy faster than the liquid is being removed and possibly could result in permanent loss of economic reserves, anyway.

Q. Now, you've indicated that the reservoir drive mechanism is a solution gas drive?

A. Yes, sir, we have.

Q. Does this reservoir perform in a fashion which is consistent with other solution gas drive reservoirs?

A. Yes, it does. The typical behavior of a solution gas drive reservoir is a steady -- the gradual increase in GOR until you reach a mobile gas saturation, at which time the GOR increases rapidly.

The gentle decline in oil production and the slight incline in gas production, again, are typical of a solution gas drive reservoir.

Q. What is Exhibit 13?

A. Exhibit 13 is an excerpt from the *Applied Petroleum Engineering* book by Craft and Hawkins, which has been the reservoir-engineering textbook for a number of years in the petroleum engineering curriculum.

Q. Basically, what does this exhibit show?

A. This exhibit describes in detail the producing characteristics of a solution gas drive reservoir. It includes real life examples.

The main points that it makes are on pages 117 and 118 and again on 391 and 392. It describes what we refer to now as differential depletion, which results in increases in producing GOR early in the depletion history of solution gas drive reservoirs, you know, because of relative permeability changes and differences in the state of depletion at points away from the wellbore.

On page 119 it also describes in detail the depletion characteristics of an actual solution gas drive

reservoir.

On page 120, it also shows that -- in this same example -- that attempts to control GOR were unsuccessful. And it also goes on to state that it's typical for one not being able to control the GOR in solution gas drive reservoirs.

And on page 123 it also states that the producing rate does not have a material effect on theoretical ultimate recovery but has a very definite effect on economic recovery.

Q. Could you identify Collins and Ware Exhibit 14?

A. Exhibit 14 is Society of Petroleum Engineering Paper Number 1887.

Q. What does this show?

A. In the abstract and in the conclusions here is an extensive study on solution gas drive reservoir and ultimate recovery. It indicates that the solution gas drive reservoirs are insensitive to initial production rate.

Q. It talks about the reservoir and it says many are horizontal, homogeneous zones. After these thin zones are depleted, are they predominantly gas-producing, if they become substantially depleted?

A. If we refer back to Exhibit Number 7, you'll see that the producing interval -- we see that the producing

interval in the M&M Number 1 well, which is the real well in issue here, consists of 15 individual porosity stringers, which in effect could be considered 15 separate reservoirs, and each one of those can be at various stages of depletion.

And because of relative permeability, the effects created during drawdown -- you know, as gas saturation increases and you reach the critical gas saturation where gas is mobile, relative permeability to gas increases and the relative permeability to oil decreases, which results in a higher producing GOR.

And as this mechanism goes on, each one of these individual stringers, or one where the relative permeability to gas has increased significantly, it's going to be -- although it's oil-bearing, it's going to be predominantly gas-producing because of these relative permeability effects.

And you have -- Again in the *Craft and Hawkins* example, it talks about thinner zones, higher permeability zones, depleting faster than thinner -- or thicker, lower-permeability zones.

In effect here, we have 15 separate reservoirs that some stringers can be producing predominantly oil, some can already be producing at a high GOR, that would explain some of the high-GOR behavior we see in this well

relative to some of the others in the reservoir.

Q. Mr. Lowery, would you identify Collins and Ware Exhibit 15 and explain why it is included in the exhibit package?

A. Exhibit Number 15 is an older -- it's a forerunner of the Society of Petroleum Engineers -- and this paper was an investigation into high-rate production in limestone reservoirs and its effect on recovery, and this is predominantly a laboratory paper.

But their conclusions are that the faster you draw down a solution gas drive reservoir, the higher the recovery is. But they also put a caveat in there that at real life producing rates can't come close to being the size -- what they measured in the laboratory.

Q. Now, is this reservoir rate-sensitive?

A. It doesn't appear to be rate-sensitive to higher rates. But it appears that when you pinch it back at lower rates, the GOR increases, which could be an indication of rate sensitivity on the low end. But it doesn't appear that it's rate-sensitive to high rates.

Q. Will approval of the requested increase in GOR cause the waste of reservoir energy?

A. I don't believe it will.

Q. How are you currently producing your wells in this pool?

A. The two wells that we have completed in the Tubb are both flowing. The Payday Number 1 is on a 14/64 choke, and the M&M currently is on a 10/64.

Q. Does Collins and Ware have plans for additional development in the pool?

A. We're continuing to drill out there, although, as our geologic testimony indicated, we seem to have defined the limits of the Tubb formation out here, although -- as we continue to drill these wells through the Tubb and evaluate and test the Tubb in offset wells. But we're continuing that with the Blinebry development as a backup.

Q. Will the requested increase in gas-oil ratios solve the problem Collins and Ware is facing with GORs in the East Warren-Tubb Pool?

A. Yes, it will. It will give us enough gas rate to more efficiently produce our M&M Number well [*sic*] for sure.

Q. Now, the Division order which denied the Application of Collins and Ware following the Examiner Hearing found that the Applicant presented no reservoir engineering data to characterize the nature of the Tubb reservoir. Has that data now been presented?

A. I believe it has.

Q. Will approval of this Application, in your opinion, be in the best interest of conservation, the

prevention of waste, and the protection of correlative rights?

A. I do.

Q. Were Collins and Ware Exhibits 9 through 15 prepared by you or compiled under your direction and supervision?

A. Yes, they were.

MR. CARR: At this time, Mr. Chairman, I'd move the admission as evidence of Collins and Ware Exhibits 9 through 15.

CHAIRMAN LEMAY: Without objection, Exhibits 9 through 15 will be admitted into the record.

MR. CARR: One last thing.

Q. (By Mr. Carr) Mr. Lowery, you were present when Chairman LeMay asked Mr. Moylett some questions concerning the pool rules and the limits of the existing pools in the area. Could you respond to that question?

A. I understood the question to be, Was Blinebry production included in the maps that were presented, and why our field wasn't included in the Warren-Tubb-Blinebry Oil and Gas Pool?

And according to Paul Kautz again, the Division Geologist in Hobbs, indicated that the Warren-Tubb-Blinebry Oil and Gas Pool was formed as a secondary or a waterflood unit, and the limits of the field at that time were frozen

because of it being a waterflood, and we couldn't be included in that field.

Q. So that's why we have two pools and one reservoir; is that right?

A. That's right.

MR. CARR: Mr. Chairman, that concludes my direct examination of Mr. Lowery.

CHAIRMAN LEMAY: Thank you, Mr. Carr.

Questions from fellow Commissioners?

Commissioner Bailey?

COMMISSIONER BAILEY: I have no questions.

CHAIRMAN LEMAY: Commissioner Weiss?

EXAMINATION

BY COMMISSIONER WEISS:

Q. Yeah, this differential-flow business, if you look at your Exhibit 7 --

A. Yes, sir.

Q. -- did you do any selective testing throughout this zone? In other words, is the gas coming out of the top perforation, or as far that --

A. The way we completed this -- the perforations are marked on the exhibit -- we put blocks of perforations opposite the highest porosity. But then to get it to produce we had to frac the whole thing.

So, you know, if you can imagine a big wedge out

here, all these reservoirs are in communication with one another, and it's -- you know, after we frac it, it's not possible to get vertical segregation, you know, by isolating perfs.

Q. I understand that. But before you did that, did you do any DST or anything to tell you whether the gas is on the top, on the bottom or --

A. No, we didn't.

And I might add, too, that just from the size of the stringers here, that, you know, a significant secondary gas cap, you know, in my opinion wouldn't be formed, just from the lack of the thickness in individual stringers.

You know, you think of the secondary gas cap being formed in a 50-foot-thick or 100-foot-thick homogeneous reservoir.

COMMISSIONER WEISS: That was my only question. Thank you.

EXAMINATION

BY CHAIRMAN LEMAY:

Q. Just a couple quick ones here. What you were responding to Commissioner Weiss, you were saying these stringers, little compartments that, in essence, you don't have very good vertical permeability? Is that why you wouldn't get any secondary gas cap or any particular segregation of the flows?

A. There's some natural vertical permeability barriers here, just from changes in lithology, you know, in between and before we, you know, drilled the well through it and did our completion.

But because of the fracture stimulation that we put on it, you know, the theory is, we put a nice, big penny-shaped frac behind there as vertical plane, you know, penetrating several hundred feet into the formation.

The best example of this graphically is this being the wellbore here, and this being the plane of our fracture and the table being the actual reservoir, if you stack, you know, layers on the table and you put this wedge through them, back here behind pipe you have a vertical conduit that has all these interconnected.

And because of that, you know, our isolation techniques are only good at the wellbore. If you've done something outside the pipe such as a frac job, there's no way to vertically segregate, to test for, you know, changes in gas production or whatever. I mean, it's vertically communicated in the back.

But also, reservoir pressure itself prevents crossflow because you're producing this well through this fracture. You know, you draw down a significant -- You know, the producing pressure in the wellbore is much less than what it is in the reservoir. So all your flows are

going to be coming through these stringers to this vertical fracture that we have here that's much lower pressure than back behind -- you know, in the formation adjacent to that. So you shouldn't have crossflow.

I mean, it's possible, you know, if you have a higher pressure zone. I'm assuming that because these stringers were deposited geologically at essentially the same time, that their fluid characteristics and pressure characteristics should be identical. If not identical, they're very similar.

And, you know, in that case you're not going to have a higher-pressure zone feeding into a lower-pressure zone because we don't have the well shut in, and anything that flows into our vertical fracture that we've placed and into the wellbore itself is going to the surface and down the sales line, as opposed to crossflowing into another formation. And in that sense --

Q. Have you seen any effect of the flood that was instituted down there, in terms of --

A. We don't see --

Q. -- the pressure of water? You don't see the effect of the flood at all?

A. No. In my investigation of what actually went on in the waterflood -- and I'm doing this by memory; my numbers might be slightly off. But I think there were six

injectors in those two sections to the south and east of us, or south and west of us, in the Warren-Tubb-Blinebry Pool.

And you know, my estimation, having dealt with waterfloods quite a bit, that's loosely considered a waterflood. I would expect it is more along the lines of a disposal project to handle produced water.

But as far as being an effective waterflood and that waterflood affecting what we're doing up here, I see absolutely no effect at all, and minimal effect in the Warren-Tubb Unit.

Q. One final question. Your maps -- the maps presented -- your partner does show yellows. Is that yellow the -- Is that acreage ownership, or is that just the extent of the --

A. That's the extent of the Warren-Tubb East Pool.

Q. Is there any other operator besides Collins and Ware in that development, East Warren-Tubb Pool?

A. Yes, there are. There are several others.

Q. Do you know if they support your Application?

A. We haven't --

MR. MOYLETT: Stevens and Tull is. They're in a well --

THE WITNESS: Yeah, Stevens and Tull operates offset wells, and they're also in ours. And we have -- I

personally haven't; Mike has talked with them, and they support that.

CHAIRMAN LEMAY: That's all I have. Thank you very much. You may be excused.

MR. CARR: Mr. Chairman, that concludes our presentation in this case.

CHAIRMAN LEMAY: Thank you, Mr. Carr. Will you prepare a proposed order?

MR. CARR: Yes, sir, I will.

CHAIRMAN LEMAY: Couple weeks, maybe --

MR. CARR: Yes.

CHAIRMAN LEMAY: -- submit it within two weeks?

If there's nothing else, we shall take the case under advisement, and you may be excused. Thank you very much.

(Thereupon, these proceedings were concluded at 10:00 a.m.)

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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 Commission 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 August 16th, 1997.

STEVEN T. BRENNER
CCR No. 7

My commission expires: October 14, 1998