BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
September 11, 1962

EXAMINER HEARING

IN THE MATTER OF:	
Application of Humble Oil & Refining Company for an order establishing special rules and regulations for the Four Lakes-Pennsylvanian Pool, Lea County, New Mexico. Applicant, in the above-styled cause, seeks an order establishing special rules and regulations for the Four Lakes-Pennsylvanian Pool, Lea County, New Mexico, to include provisions for 80-acre oil proration units therein.	Case 2632

BEFORE: Elvis A. Utz, Examiner.

TRANSCRIPT OF HEARING

MR. UTZ: Case 2632.

MR. DURRETT: Application of Humble Oil & Refining Company for an order establishing special rules and regulations for the Four Lakes-Pennsylvanian Pool, Lea County, New Mexico.

MR. BRATTON: Howard Bratton, appearing on behalf of the applicant. We have one witness, Mr. Sharp.

MR. UTZ: Are there other appearances in this case? You may swear the witness.

(Witness sworn.)

(Whereupon, Applicant's Exhibits 1 through 8 were marked for identification.)

CARL SHARP

called as a witness, having been first duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. BRATTON:

Q Mr. Sharp, have you ever appeared before this Commission?

A No, sir.

Q Will you state your name, occupation and very briefly your professional and educational background?

A Carl Sharp. I received a Bachelor's degree from the University of Texas in petroleum engineering, and since graduation I have been working for the Humble Oil & Refining Company in the capacity of an engineer. About the last eight years I have been specializing in reservoir work. At the present time I'm in the Midland area office as a supervising engineer in charge of the reservoir analysis section.

Q Are you familiar with the Four Lakes-Pennsylvanian Pool?

A Yes, sir.

Q And were the matters contained in the application under consideration?

A Yes, sir.

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

MR. UTZ: Acceptable.

Q (By Mr. Bratton) What is Humble seeking in the application in this case?

A In this case we're asking for pool rules which will provide for 80-acre spacing.

Q That's in the Four Lakes-Pennsylvanian Pool in Lea County, New Mexico?

A That's right.

Q Will you turn to your Exhibit No. 1, Mr. Sharp, and explain what that is?

A Exhibit No. 1 is a structure map on the top of the Cisco in the Four Lakes-Pennsylvanian Field. As you see, it's almost a text book anticlinal structure. We have six wells producing from the Cisco, which is a dolomitic lime, porosity of about 10%, permeability of about 55 millidarcies. The connate water is estimated at 30%.

Q This is a unitized area?

A Yes, sir.

Q The unit outlines are shown on the exhibit?

A Yes, sir.

Q The six wells that are completed in the Pennsylvanian are wells numbers 1, 3, 4, 5, 6 and 7, is that correct?

A Yes, sir.

Q Well, No. 2 is Devonian?

A It's a Devonian well.

Q Is there anything else you care to say with regard to the structure of this?

A No, the map shows all the wells in the field. The two wells down to the southwest, a Triče well and another one on Southern Petroleum Exploration Company lease in Section 3, both shown as dry holes, penetrated the Pennsylvanian or penetrated the producing section, but they were below an oil and water contact and non-productive.

Q Continuing with the geology of the area, with reference to your Exhibits Nos. 2 and 3 which are cross sections through the area, and explain those.

A Well, looking at Exhibit 2 as a north-south cross section, the top line on the top correlation line shows the top of the Pennsylvanian, the second line is the line on top of the Cisco on top of the first porosity. This is the correlation point that the structure map is drawn on, the production to date

has been limited to the Cisco part of the Pennsylvanian, the lower line is a correlation line on top of the Canyon.

On cross section 1 it shows if you look at well No. 1, South Four Lakes field, it was the initial well into Pennsylvanian completed at 10,227 to 57 in the lower part of the Pennsylvanian. This well was completed in May of 1956. I think the second well is well No. 5, it's shown on the next cross section, Exhibit 3.

Q That was the second well completed in the Pennsylvanian?

A In the Pennsylvanian, yes, sir.

Q All right.

A It was also completed in this same porous interval. In this well it was at 10,284 to 10,315. This well was completed in July of 1957. These two completions indicated a relatively small reservoir, the pressure declined in them pretty rapidly. However, in 1959 well No. 6 and well No. 4 were worked over and completed in the upper part of the Cisco and the history on these wells showed a much better performance. They were in a better core sample, on the basis of their performance the other wells were drilled and worked over to the Cisco.

Q Do these two exhibits running north and south and east and west, they actually cover all of the wells in the Pennsylvanian, do they not?

A Yes, sir, all the producing wells.

Q Do they show continuity of the formation throughout the pool?

A Yes, geologically the porous intervals can be traced from well to well. They have good correlation that way.

Q Turning to the engineering aspects of the matter, Mr. Sharp, refer to your Exhibit No. 4, if you would, please. Explain what that is.

A Well, Exhibit 4 was drawn up to show the pressure continuity within the present completion zones in the Pennsylvanian. These are the wells that are in the upper part of it. Those having shown a lot better pressure behavior. Well No. 6 was the initial well being brought in in April of 1959, and as the pressure declined each subsequent well came in at a lower pressure, which is shown on this graph here; the first pressure on each well was fitted in very well with the field average and was lower by an increasing degree with time.

The last pressure point shown over here, cumulative production of about 450,000 barrels was taken in April of 1962. At that time we had a pressure on all six wells, and the maximum variation was only 11 pounds, which I think indicates real good continuity of the pay interval there.

Q That is true, although wells numbers 1 and 3 weren't even completed until there was over 350,000 barrels of cumulative

production from the pool?

A Yes, sir. Well No. 3 was completed in January of '62, and well No. 1 was worked over from the lower part to the upper part in November, 1961.

Q In April of this year you took pressures on all of the wells and there was no more than ten pounds' difference between any of the six wells?

A Eleven pounds' difference between the six wells.

MR. UTZ: When was that pressure taken, again?

A April of '62. That's our latest pressure survey.

Q What were the ranges of those pressures?

A Well, the lowest pressure was 2907, the highest pressure was 2918.

MR. UTZ: Those are bottom holes?

A Those are bottom hole pressures of a subsea datum of 6050 feet.

MR. UTZ: Is that taken with a bomb?

A Yes, sir.

Q (By Mr. Bratton) Now, Mr. Sharp, have you run any interference tests in this pool?

A Yes, sir, the reservoir continuity is also shown on the next exhibit marked as Exhibit No. 5. An interference test was run, all the wells in the field were shut in at the same time.

This one shows the pressure build-up in well No. 4. The flowing pressure was 3205 pounds at the end of about 66 hours, 66 to 70 hours shut in time it had reached its maximum pressure of 3278 pounds. After the shut in pressure had stabilized, wells No. 5 and 7 were put back on production. You'll notice well 5 is southwest and 7 is northeast of No. 4.

Q They're actually on 80-acre pattern, are they not?

A Yes, sir.

Q 4, 5 and 7, with 4 being the middle well in the pattern?

A That's correct.

Q What are the results of the interference tests?

A Well No. 4 remaining shut in, there was a drawdown in pressure of about 30 pounds from 3278 to 3248. With the production of, well, it resulted from the production from 5 and 7.

Q That drawdown occurred in approximately four days, about a hundred ten hours?

A Yes, sir.

Q What is the significance of that test in your opinion, Mr. Sharp?

A I think the interference test and the other pressure we have run in the field definitely show that a well will drain more than 80 acres.

Q And geologically there's continuity throughout, so

there's no reason why a well should not?

A That's right.

Q Turn then to Exhibit No. 6, Mr. Sharp.

A Well, Exhibit No. 6 was drawn up to depict the economics of 80-acre spacing as opposed to 40-acre spacing, and in determining the original oil in place we drew up isopach maps in the conventional manner, and to verify them we also ran some unsteady state volumetric balance calculations to arrive at the original oil in place. In this particular case the unsteady state volumetric balance calculations gave us about 50% more oil in place than we could see volumetrically; in estimating the oil in place we have used it to merely balance the unsteady state because mainly of the difficulties in trying to pick net pay in this type of formation with the contact device we have. So, using the greater amount of oil in place and also this upper zone has evidenced a good water drive, about three-fourths of the withdrawals to date have been replaced by water.

On this basis we estimated a 40% recovery of water drive recovery in the upper zone.

Exhibit No. 5 shows the economics, then, of producing what we would call a typical 80-acre tract. In other words, just an average tract with average oil in place. We've estimated an ultimate recovery from the tract of 199,000 barrels. The

initial investment to drill a well is $172,000; as shown in 40-acre spacing, why two wells on one 80-acre tract would be $344,000.

Q That's drilling and equipping, that is not operation?

A That's correct, that's just the drilling of the well and laying of the line to the tank battery. It doesn't include a pumping unit initially as all the wells are flowing. Based on an average oil price of 301 per barrel, taking into account the value of the gas and the liquids being extracted from the gas, deducting the initial investment, we have estimated an ultimate profit of $328,546 for an 80-acre well, or $136,421 for two wells on one 80-acre tract or 40-acre spacing.

If we look further down here, the profit to investment ratio on the 40-acre spacing gets down to 0.4. If we had used the volumetric calculations based on the isopach map, 40-acre spacing would have shown a loss under these conditions. With the data we have and with the risk involved that possibly the volumetrics could still be right, it appears that from a business standpoint there's too great a risk involved to drill a well here on 40-acre spacing. By going to 80-acre spacing over the total field approximately a million and a half dollars will be saved which can be spent in exploratory drilling or other searches for oil.

Q On your volumetric calculation, Mr. Sharp, you came up with approximately 120,000 barrels under an 80-acre tract?

A Yes, sir.

Q You went to your material balance study and that showed approximately 60% higher than your volumetric study did?

A Yes.

Q And it is the material balance that is reflected on the economics here?

A Yes, sir.

Q So this is the most optimistic you could possibly be as to the recovery in the field?

A Yes, sir, I think this is an optimistic look at it.

Q You have used a recovery factor of 40%, is that correct?

A 40%.

Q Because this is a water drive?

A It's water drive.

Q So what is reflected in the economics here is the most optimistic as to recoverable oil there as to the oil in place and as to the recovery factor, is that correct?

A Yes. The original oil in place, we're taking the most optimistic look at it, under the recovery factor it's definitely more optimistic than a solution drive and 40% is normal for a water drive.

Q If you had used the results of your volumetric study you would actually lose money on 40 acres, is that correct?

A Yes, sir.

Q And, of course, your, instead of a two to one ratio on 80-acres it would be considerably less than that?

A Yes, sir. It would be less than one to one on 80 acres.

Q In your judgment, Mr. Sharp, would economic waste result from the drilling of 40-acre wells on this unit?

A Yes, sir, it would.

Q Could you economically justify the drilling of 40-acre wells on the unit?

A No, I couldn't recommend it.

Q Turn to your next Exhibit No. 7, Mr. Sharp. Explain what that is and the purpose of it.

A Well, Exhibit 7 shows the location of the South Four Lakes Pool. It's a map showing the northern part of Lea County with just a little bit of the surrounding counties on it. The Four Lakes-Pennsylvanian field is circled in red. Circled in green are six fields which are also Pennsylvanian, well, with the exception of those in the very south which are Wolfcamp, but they're of kin to Pennsylvanian, being dolomitic limestones of slightly newer age, but these show the other fields in the area which are on 40-acre spacing.

Q You mean on 80-acre spacing?

A On 80-acre spacing, excuse me.

Q Your Ranger Lake is immediately south of this pool, is that correct?

A Yes, sir.

Q And your Lane and South Lane lie to the north, Allison, South Gladiola to the east?

A Yes, sir.

Q Have you briefly compared these pools this morning from the case records of the hearings on those pools?

A Yes, sir. I reviewed the case records of these fields and picked up what data I could find on them. As might be expected, they did vary considerably, it appears that possibly Ranger Lake, which geographically is the closest well to Four Lakes, also almost most nearly represents it, whereas we are estimating a porosity of 10%, Ranger Lake has about 7%. Estimated permeability was 28 millidarcies at Ranger Lake as compared to 55.

At Four Lakes we used a 30% connate water as compared to 25% at Ranger Lake. On the basis of net pay the Ranger Lake estimated a considerably greater amount of oil in place, but because it is a dissolved drive the recovery factor was lower. The estimate there was about 175,000 barrels recovery from an 80-acre tract.

As you will note it on our economics, on 40-acre spacing we would recover about 100,000 barrels of oil and make a small profit.

At Ranger Lake they estimated they had to recover at least 108,000 barrels of oil to break even. So I think these are probably fairly comparable.

Q Your basic difference, they had considerably greater oil in place but a considerably reduced recovery factor?

A Yes, sir.

Q Actually, did they not estimate originally some 210,000 barrels recovery under an 80-acre tract?

A That's true, on the initial hearing they estimated 210,000.

Q And experience proved disappointing and they had to reduce that?

A That's correct.

Q And your figures might be somewhat reduced if experience is not too happy?

A It could possibly be.

Q Is there anything further you care to say with regard to this map or comparisons with the other Pennsylvanian Pools in North Lea County?

A No, sir.

Q Did you give, Mr. Sharp, all of your well data here? I believe you did give your porosity, permeability, connate water, was there anything else as to your reservoir data that you cared

to introduce?

A Oh, I think that fairly well covers the pertinent points on this.

Q In your opinion, Mr. Sharp, will one well in the Four Lakes-Pennsylvanian Pool efficiently and economically produce the recoverable oil in place under that 80-acre tract?

A Yes, sir.

Q In your opinion would the drilling of wells on 40-acre tracts result in economic waste?

A It would.

Q Turn to your Exhibit No. 8 and explain what it is.

A Well, Exhibit 8 is a proposed set of field rules providing for 80-acre spacing. Rule No. 1 sets out the 80-acre spacing and allows some flexibility in that a well may be located in either end of an 80-acre proration unit. It may be located on either quarter quarter section. This flexibility appears desirable since the field is essentially developed now. Well, Rules 2 and 3, I believe, are routine. No. 3 sets out the 80-acre proportional factor for the present depth range, that's the same as it is now except on 40's. And Rule 4 makes provisions for tracts that may have more or less than 40 acres in a quarter quarter section.

Q Actually, this is a unit operation and all of the lands

are unitized, is that correct?

A Yes, as shown on the map, I think the entire productive limits will be on the unit.

Q Is there anything further you care to state with regard to any of your exhibits, Mr. Sharp?

A No, sir.

Q Were Exhibits 1 through 8 prepared by you or under your supervision?

A Yes, sir.

MR. BRATTON: We would offer in evidence applicant's Exhibits 1 through 8. We have no further questions at this time.

MR. UTZ: Without objections, Exhibits 1 through 8 will be admitted into the record in this case.

(Whereupon, Applicant's Exhibits 1 through 8 were admitted into the record.)

CROSS EXAMINATION

BY MR. UTZ:

Q Your discovery well was completed below the 10,000 feet?

A Yes, ten two something.

Q Since you considered the upper perforations to be in the same zone and apparently the Commission considers it to be so?

A Yes. The entire Cisco has been prorated as the Four Lakes-Pennsylvanian so far. We have no desire to split them apart.

Q I wonder if you would repeat your core data, I have the connate water?

A Let's see, the porosity is 10%. I can say the core data is fairly limited. We had some cores in two wells. We didn't get complete coverage. The permeability on 55 darcies is based on buildup.

MR. BRATTON: It's 55 millidarcies.

A Excuse me, 55 millidarcies. The connate water was 30%.

Q I believe you stated in your opinion it's a water drive pool?

A Yes, sir. Volumetric or material balance work shows a water drive.

Q Actually 55 millidarcies is not a tremendous amount of permeability for an oil pool?

A In West Texas it is. In other parts it's not really.

Q Referring to your Exhibit No. 5, did you have a tabulation that would show the exact number of hours that the No. 4 well had been shut in before you opened to 5 and 7?

A Well, you can read it on that plot. It's about 95 or 96 hours. I don't have the exact tabulation with me.

Q Then the next pressure you took on that well, was it slightly over a hundred hours?

A Yes, sir.

Q And which would be, oh, seven or eight hours after you started producing 5 and 7?

A Yes, sir.

Q You actually experienced that amount of decline on your shut in well?

A Yes, sir. Well, it's an unsaturated crude, the pressure is still above the saturation point, so there's no gas in solution we believe now in the reservoir, so with solid fluid in there you would expect to notice a pressure change much more rapidly than you would if you did have a gas saturation, make it more compressible.

Q Do you intend to go ahead and fully develop this well on an 80-acre pattern?

A We have approval to drill another well now. Some of the edge locations I don't think we can say we are going to develop because with the water drive and the water moving in I don't believe it will be possible to get right out on the edges.

Q What is the location of your other well?

A I can tell you approximately. It would be in the quarter quarter section immediately to the south of well No. 2.

MR. UTZ: Are there other questions of the witness?

MR. BRATTON: I believe not.

MR. UTZ: The witness may be excused.

(Witness excused.)

MR. UTZ: Are there any statements in this case? The case will be taken under advisement.

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, ADA DEARNLEY, Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission at Santa Fe, New Mexico, is a true and correct record to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF I have affixed my hand and notarial seal this 1st day of October, 1962.

Ada Dearnley
Notary Public-Court Reporter

My commission expires:

June 19, 1963.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 2632, heard by me on Sept. 19, 1962.

....., Examiner
New Mexico Oil Conservation Commission