BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
July 28, 1965

EXAMINER HEARING

IN THE MATTER OF: Case 3112 being reopened pursuant to the provisions of Order R-2824, which order authorized Gallup-Dakota commingling in the wellbore by means of a dual flow downhole choke assembly in its Jicarilla 28 Well No. 1 located in Unit J of Section 28, Township 25 North, Range 4 West, Rio Arriba County, New Mexico. All interested parties may appear and show cause why the authority granted under this order should not be terminated.

Case No. 3112

BEFORE: Daniel S. Nutter, Examiner

TRANSCRIPT OF HEARING

MR. NUTTER: The next case will be Case 3112.

MR. DURRETT: In the matter of Case Number 3112, being reopened, pursuant to the provisions of Order Number R-2824.

MR. KELLAHIN: Jason Kellahin, Kellahin and Fox, Santa Fe, representing the applicant in association with Mr. Charles Roberts, member of the Colorado Bar who will present the case.

MR. ROBERTS: Charles Roberts. If it please the Commission, I have two witnesses I would like to have sworn at this time.

(Witnesses sworn.)

MR. ROBERTS: At the outset, I would ask the Commission to take notice of the record made in this Case 3112, at an Examiner Hearing held here in part on September 30, 1964, together with all of the exhibits which were, I believe, 1 through 9.

MR. NUTTER: We will take notice of the previous record in this case. This is the same case number, just merely reopened.

GEORGE BROWN, called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. ROBERTS:

Q Would you state your name and address, please?

A George Brown, Durango, Colorado.

Q Are you the same George Brown who testified as an expert witness in Case Number 3112, on September 30th, 1964?

A Yes, sir, I am.

MR. ROBERTS: Will the Commission continue to accept Mr. Brown as an expert witness?

MR. NUTTER: Yes, sir.

Q (By Mr. Roberts) Mr. Brown, are you familiar with the Commission's Order Number R-2824 entered in this case on December 7, 1964?

A Yes, sir, I am.

Q With respect to Order Number R-2824, did you personally supervise and participate in the activity authorized by that order?

A I did.

Q Specifically, did Continental Oil Company conduct packer leakage tests for the dual-flow choke after it was installed in the field, to determine annual packer leakage in the assembly and in direction?

A Yes.

Q Did Continental Oil Company also conduct a packer leakage test prior to the installation of the commingling through the 28-1 Well?

A Yes, we did.

Q And did Continental Oil Company conduct a packer leakage test after drilling that, at the end of six months test period authorized by Order R-2824?

A Yes, sir. At the end of the test period we did run another packer leakage test.

(Whereupon, Exhibits 1, 2 & 3 were marked for identification.)

Q Mr. Brown, I hand you what has been marked as Exhibits 1, 2 and 3, for identification, and ask if these were prepared at your direction and under your supervision?

A Yes.

Q Would you state for the record and the Commission, please, what information is shown on these Exhibits 1, 2 and 3?

A Exhibits 1, 2 and 3 are Northwest New Mexico Packer Leakage test forms. These exhibits are forms completed on the Jicarilla Apache 28 Number 1 well. Exhibit 1 is a packer leakage test taken prior to the installation of the dual-flow choke. This portion of the well was a conventional completion with string and tubing.

On December 17, '64 we shut the well in for the prescribed seven day period, shut-in period, and the well pressure built up on the upper zone to 620 pounds; on the lower zone 1,110 pounds at the end of the seven day period. After the seven day period we produced the upper zone, the Gallup zone flow for period Number 1, and the starting pressure was 310 pounds on the upper

completion; the lower completion was 1,120 pounds at the end of the test. Forty-eight hours later, on the 26th, pressure on the upper zone was 520 pounds; the pressure on the lower zone had increased to 1,130 pounds. Thereby, this indicates that no leakage occurred in through the cross packer at that point, or in the tubing.

We then shut the well in for seven more days, allowing both zones to build up, whereby the pressure on the upper zone was 705 pounds, built up 705 pounds; and pressure on the lower zone was increased 1,170 pounds. We then flowed the lower zone and the started pressure was 305 pounds. The upper completion pressure data 707 at the end of six hours. The producing pressure on the lower completion increased to 350 pounds, and the upper completion pressure increased to 710 pounds, thereby indicating on the second flow period that no leakage existed. This test was submitted to the Commission and approved on January 20, 1965.

Exhibit Number 2 is the packer leakage test taken immediately after the installation of the Dakota dual-flow choke assembly. We installed the dual-flow choke simply with no blank in the tool and with the lower check valve removed from the tool. The purpose of removing the lower Dakota check valve was that pressure build up and drop in the tubing would not be indicated if there was a leak below this or in

the packer. We also removed that, had no blank in the tool, so that we could flow the upper zone completion through the annulus and thereby check and prove that the upper check valve was not leaking.

We shut the well in at the end of that time in accordance with the Commission's regulation. We shut the well in for seven days and the upper zone pressure built up to 615 pounds, lower zone 1,185. We then produced the upper zone. The producing pressure dropped to 225 pounds from 615 in the upper; the lower completion pressure increased from 1,185 to 1,195, and indicated that no leakage existed. The lower zone was flowed up the casing annulus.

This test indicated there was no leakage across the packer and also the upper check valve was holding and no leakage occurred across the check valve.

We then shut the well in for another seven days. Both zones built up, to 663 pounds on the upper zone and 1,220 pounds on the lower zone. We then flowed and produced. The lower Dakota zone dropped the pressure from 1,220 down to 350 pounds, and then down to 254 pounds at the end of forty-eight hours. The upper Gallup pressure stayed. 663. 662, 662. taken with the dead weight of the pressure.

This test was submitted to the Commission and approved on February 24, 1965; and indicated that no leakage occurred

in the packer through the upper check valve assembly of the two.

Exhibit Number 3 is the third packer leakage test taken on 28 Well Number 1, and it was taken at the end of the test period. We again removed the lower check valve for the purpose of the test. On this test we shut in the well for seven days and built up an upper zone pressure of 854 pounds and the lower completion of 855 pounds. We produced the upper Gallup zone up the annulus; again the pressure dropped to 550 pounds. The corresponding lower completion stayed at 806 pounds, continuing to increase five pounds at the end of twenty-four hours. When the pressure on the lower zone dropped -- the upper zone, excuse me, had decreased to 260 pounds and the lower zone pressure continued to increase to 950 pounds, we then shut the well in for another seven days and built up pressure on the upper zone to 774 pounds; the lower zone continued to increase at the end of seven days up to 1,255 pounds. On the lower zone, with the flow period, flow test, we flowed it for a considerable length of time there to allow the Gallup, upper zone to increase, and to obtain working pressure both above and below the corresponding pressure of the upper completion. We note the upper completion started out at 774 pounds, and the lower completion at 1,255 pounds. At the start of the test the first flow pressure on the lower completion was 555;

the upper completion increased to 800 pounds. We took a few more in between there and the last two. At the end of 96 hours we took one at the lower completion which produced 687 pounds, which is below the pressure of 890 pounds, which the upper completion built up to.

We then drew the pressure down on the lower completion to 255 pounds at the same time, within a few minutes there, and the pressure on the upper completion remained at 890 pounds.

This test was submitted to the Commission and approved on 6-25-'65, and the test indicated no leakage through the packer or through the --

Q Based upon the data obtained by the packer leakage tests which are recorded on Exhibits 1, 2 and 3, and with particular reference to the packer leakage test data obtained from the packer leakage test conducted by the Continental Oil Company on its Jicarilla Apache 28 Well Number 1, was there leakage of the packers and communication between the reservoirs at any time?

A No, there was not. If I may state, on this exhibit, the second page of the exhibit is a direct representation of the pressure data obtained on the packer leakage test.

(Whereupon, Exhibit Number 4, marked for identification.)

Q I hand you what has been marked for identification as Exhibit Number 4, and ask you if it was prepared at your

direction and under your supervision?

A Yes, it was.

Q For the record, and for the Commission, would you please relate the activities which Continental Oil Company undertook with respect to, or pursuant to the authority granted by Commission Order R-2824, and in doing so would you explain the contents of Exhibit Number 4?

A Exhibit Number 4 is a chronological completion history obtained on the Jicarilla 28 Number 1 Well, during the test period. On the left side of the sheet is a production history. There is a time curve above the curve, at the upper part of the curve it shows the gas-oil ratio; the lower part of the curve is barrels of oil per day. On the left hand side of the sheet, above and between the two curves there, I have a number, starting with Figure 5, Letter A, and marked off in intervals, 1 through 26. On the right-hand side of the page the meaning and the events that took place during each one of these numbered intervals is briefly stated so you can see what we were doing during that interval of time. I have here a figure, which is the same as Exhibit 4, except it's on an expanded scale so it will be a little easier to read.

The letter "A" and the numbers there, and all the information here is the same as it is on here, and the numbers correspond. I have a little bit of additional data on the end

of this curve, which I had not applied on this curve after June 30th.

Q Basically, what does this show during the interval of the letter "A" here, prior to the installation of the tool?

A It shows the production obtained, tests obtained for about eight days on the well, when it was produced through parallel strings of tubing. The Gallup produced, the Gallup zone here produced approximately 16 barrels per day; the Dakota zone produced approximately 13 barrels per day.

We then started, on January 12th we shut the well in, pulled the tubing , pulled the two strings of tubing from the well, and during the interval shown on Number 1 here, we were releasing one string of tubing in the Model D type Baker permanent packer; and we installed the dual-flow choke to a depth of 660 feet, with the Dakota check valve removed. The check valve was removed for the purpose of taking the first packer leakage test after installation.

We then, during the interval number 2 here, we produced the well, and we haven't shown the production on it. We were recovering load oil used to kill the well; and we finished cleaning up the well and recovered the load oil. At the end of that period we then started on our packer leakage test Number 1, which is actually the second packer leakage test; the second packer leakage test after the installation of the dual

flow choke; and Number 3 is a shut-in period for packer leakage test Number 1. Number 4 was Flow Period Number 1 on the upper Gallup zone, through the check valve, up the annulus. Number 5 was a second shut-in period, packer leakage.

Number 6 was the flow period on the lower zone up the tubing. And during the flow period indicated in Number 4 here, the upper zone through the annulus, we got 180 MCF per day. Flow period on the Dakota produced 21 barrels per day and had a GOR of 9906.

We then started, during interval Number 7, we pulled the complete tool from the hole and installed the lower check valve; and we blanked the Gallup, or the upper zone off in the tool, and we were now going to try to obtain data for a production graphical distribution curve, which we had submitted in the previous testimony of what we are going to try to do to clear and allocate production.

With the Gallup zone blanked off, we continued to produce from the Dakota to try to obtain a steady stabilized rate at three different back pressures; and all this occurred during Number 7 here. And you can notice the production was very erratic, and this covered the period of a week here; and we never did get the production to stabilize on this low permeable reservoir, and we had not obtained steady stabilized flow or even approached it during seven days.

During that time, of course, we had pulled the tool. We installed a bottom hole pressure bomb on a hanger above the tool and below the plunger lift pumper spring; and it was just hanging there on a hanger and would not return for seven days. At the end of the seven days we pulled the pumper spring and removed the bomb, and we came to the conclusion the bomb clock had not operated at all during the period. Apparently going in the hole it had jarred a little bit and the clock mechanism broke and didn't operate. And after seven days here we saw that we weren't going to be able to obtain a stabilized rate in a reasonable period of time. We decided not to go on with that test until we had applied the allocation by the subtraction method, blanking off the other zone.

So, during interval Number 8 shown here, we were -- We put the orifice assembly back in the tool with both zones open and commingled production from both zones. I would like to state right here on, I believe it was February 19th, the production was somewhat below what we would expect from the two zones. From the previous test we had expected about 15 or 16 from the Dakota, and expected about 12 or 13 from the Gallup. This is considerably below; and we bled off the gas to the atmosphere, to take the decreased back pressure on the wells, trying to lower the producing bottom hole pressure of the Dakota zone to the lower pressure of the Gallup zone, with part

entering the tubing, but it apparently was not entering the tubing at this point. After we decreased the back pressure and drew the bottom hole pressure down, I mean, the upper Gallup zone started producing at this point here.

Both of these zones, of course, are low permeability reservoirs, and after they have been shut in, the accumulation of liquids situated around the wellbore allow the production to be considerably higher than what I remember it was stabilized, which is shown here it was approximately 35 barrels per day; and then it decreased and started leveling off during interval Number 10.

Of course, we continued to produce both zones, and we, at this time we started measuring all the gas produced from the commingled zones; and during the entire period from the 10th through the 12th, both zones were open; and during part of the period of Number 11, and all of Number 12, and we have got this note about Number 13, we felt that this was a good stabilized producing rate for the commingling zones at this point. I have it noted here: "Combined zone stabilized rate at 16 plunger trips daily" as Number 13; and, of course, gas-oil ratio measured during the Period 13 was 6599 for the commingled zones. The average GOR over the 21-day period is 6496; but the entire interval Number 13 was the only one for the allocation.

Period Number 14 we pulled the orifice assembly to blank

off the upper Gallup zone and produce the lower zone by itself to obtain a stabilized rate and to use in conjunction with the combined zone sobtraction method allocation. On March 25th -- Well, that was March 25th that we removed the tool and everything and installed the blank in the upper zone on the 28th.

During interval Number 15, we started producing what was supposed to be the Dakota zone by itself here, and when we started producing it, well, we thought it was considerably higher than 12-13 barrels that we had anticipated before for the other zone by itself. Because it is typical of the Dakota reservoir, after a shut-in period of four or five days, that we had thought it would produce a higher rate, which it did; so we continued to produce it, and it never did fall down very much below what we had for a combined for a combined rate.

So, about along in this point, Number 16, we started to suspect that the Gallup zone was not blanking off and both zones were still entering the tubing. The blanking off tool is simply a a little disc that fits over one of the orifice openings, and apparently, we thought, it either jarred loose or did not seat itself properly, and we continued to produce it, and it continued to be greater than that known to be the stabilized rate for the Dakota zone only.

At this point right here, at Number -- starting at Number

18 interval, we drew the well pressure down by bringing the gas to the atmosphere, and when we did this, we noticed that the pressure in the annulus which contained the upper zone, was affected. It did decrease a little bit, and we did this for a couple or three days. We were sure the zone was not blanking off. So, during interval 19 we pulled the upper part of the tool, the orifice assembly, inspected it and found that it had not seated in check assembly. The check assembly had not been removed from the well and was still -- and the check was still holding; so we ordered another orifice assembly and ran it in the hole; and apparently, what we feel had happened, we ran it in vertically and blanked off the lower zone production tube rather than the upper in the previous. We were trying to do this and seat the orifice assembly in the tool, with the other zone blanked off; it was similar to trying to push a piston in a closed cylinder; it just absolutely wouldn't go. For the five inches that has to travel, the fluid wouldn't compress and wouldn't go in. And this has been known, when they tried to do this it would bend the small tube in the orifice head assembly. It was found to be bent, so that is why we ordered another one and replaced it.

We, at this time here we tried to retrieve the check assembly which had never been pulled from the well yet, and was still in the well. In fishing for it we could not get ahold of it, and

apparently we got it tilted and we were unable to retrieve it after two or three days time fishing, so we had to pull the entire tubing string to get the tool.

At this time we inspected the check assembly real closely and found the check assembly was slightly damaged, not indicating on the tool, and it had just been a matter where we had been unable to seat it properly.

At this time we went back where we were and we installed both the check valve and the orifice head assembly at the surface in the tubing with the Gallup zone blanked off. That was during interval 19. Here we show no production. During interval 20 -- We had to pull the tubing, we had to kill the well, and during the interval 20, as shown by the ledger down here, we produced the load oil during the period, at the end of this period.

Starting period 21, load oil had been recovered and we started other Dakota allocation tests; and as noted here, the production stabilized by ten, three days at ten barrels a day, then dropped to eight for a couple of days and back to ten, down to eight and became stable within a barrel or two. And, of course, we then knew that we had the Gallup zone blanked off, and that this was a representative test to the Dakota zone by itself.

During this period -- Let me go back here for a moment.

On this combined zone allocation test for both zones, the commingling final nine day average on this period from March 15th to the 24th, from the commingled zone was 25 barrels of oil per day, with a GOR of 6599. The average production from the Dakota zone by itself during the eleven day period here in the interval 21, was 9.3 barrels of oil per day. The GOR was 9216. During the time we did keep our gas production data, and the average GOR, you can see it varied very little. It was 9216, which is considerably above the commingling zone, the Dakota being the higher GOR reservoir.

Being satisfied with this, with the representative test for the Dakota allocation of production, we found we can use the combined zone production, and the Dakota production for subtraction method allocation.

During intervals 22, 23, 24 and 25, we performed the final packer leakage test. At the end of the test period, which is Exhibit Number 3, again we show no leakage through the tool or through the packer, or no leakage in the tubing at the end of the period. Interval 25 we continued, like I stated on Exhibit 3, we continued on the last flow period and got considerable production there, to establish there was no leakage through the packer or check assembly at this time.

The hearing was originally set up to be on June 30th. We had a postponement of the hearing and we continued to produce

the well with both zones open, and the bottom plug in check assembly in the well, and produced from the commingling. And, as you note, it leveled off fairly good between 25 and 30 barrels a day, which is just as good, if not a little bit better from the two zones producing separately, through single tubing strings, producing the Gallup by conventional pump, and the Dakota by plunger. And, of course, during the interval on complete tests, we used a plunger lift for producing the well. The last four or five days productions are not noted; I hadn't received the information from the field at the time of the hearing.

MR. NUTTER: Now, I can't read those little numbers there. What is the last point, your last day's production?

A Right here, it is 30, approximately 32 barrels per day. Is that the 30 line?

MR. ROBERTS: This is the 30 line right here, yes, sir.

A Right here, it is a little above that, and for a few days above 30.

MR. NUTTER: And it dipped down there to about the 20 line. That would be the 10 line?

A That's the 25 line, that's the 25 line there. There is very little change of production, within three or four barrels there. I don't know whether I have noted here -- Of course, I did the GOR. During the test it was 9216. The average GOR

during this flow period on the packer leakage test was 8900. See, where the finger is here, the average GOR with the zones commingling over this three week period was 6337, which is very representative according to the combined zone allocation test.

Q So, in summary, during the six-month test period, you conducted three packer leakage tests and found there were no communications, and established, as a matter of fact, there was no communication between the Gallup and the Dakota zones in the 28-1 Well. You undertook production tests at stabilized rates for the purpose of allocating production by the subtraction method. You conducted gas-oil ratio tests and sealed leakage tests, is that correct?

A I would like to go back here on one point; and I didn't stress the point where I did check the seal of the leakage. The seal leakage was obtained during the first shut-in period, or prior to the shut-in period. On the last packer leakage test, what we did there, we loaded the tubing with fluid, both check valves in the assembly, and we had the pressure up to 1500 pounds, and held that pressure for approximately an hour and a half, and at this time there was no indication of any leakage. We recorded the pressure as no indication. The check assembly served as a good seal leakage test.

Q That was by pressure going up the tubing?

A Pressure against the tubing from the surface flow. and

no leakage was indicated through the check valve.

Q That test, in your opinion, established that there was no seam leakage?

A Conclusively established the test; if we had the pressure, it would not have bled off in that period that we had it shut in.

Q During the course of the six month test period, you, of course, had occasion to examine the commingling tools of the dual flow choke. Did you find any evidence of erosion or corrosion?

A No, none whatsoever on either tool. The only thing was when we fit the orifice head assembly, we blanked open the zone is what happened. No erosion or cutting of the tools.

Q In the hearing on this matter on September 30, 1964, you proposed to allocate production to the established producing zone on the basis of the best of the two possible methods, the distribution curve method and the subtraction method; and you have indicated just a moment ago, that you undertook both methods during the test period. Would you please state your conclusion as to the test suitable in this instance, and why it is suitable?

A The production information shown on Exhibit 4 shows that the production allocation by the subtraction method gives a reasonable and accurate method of allocating production

between the two zones. The other method is, the method, the producing method did not prove out to be satisfactory or suitable on this low productivity, or due to the longer period that would be required to stabilize the wells under the distribution.

(Whereupon, Applicant's Exhibit 5 marked for identification.)

Q I hand you what has been marked for identification as Exhibit Number 5, and ask you if it was prepared at your direction and under your supervision?

A Yes, it certainly was.

Q Would you explain to the Commission and for the record the information shown on Exhibit Number 5?

A Exhibit Number 5 is utilizing the data we have, how we would allocate oil and gas production to this Well 28 Number 1, by the data and information obtained during the subtraction allocation method. This is indicated on the sheet, "Based on the subtraction method allocation test". Oil Allocation, the actual figures obtained during the tests, the ratio obtained. The Dakota production would be 9.3 barrels a day, which was the average Dakota production divided by the 25 barrels a day, which is the commingled production. This factor, times your gross commingled production would give you the Dakota production. The Gallup production equals the gross commingled production minus the Dakota allocated production.

Below there I have an example, a theoretical example,

utilizing this factor. If you had 750 barrels a day total commingled production; the Dakota allocation was 9.3 divided by 25, times 750 barrels, which would give us an allocation of 278 barrels for the Dakota zone. Gallup allocation would be 750 barrels minus 278 barrels, which equals 472 barrels.

On gas production, on the GORs obtained during the combined commingled and Dakota allocation tests, the commingled GOR was 6599 cubic feet for one; the Dakota GOR was 9216 cubic feet per barrel. Below there I have a theoretical line, theoretical example of how we will allocate production to the gas production to the two zones. If the theoretical gas production under these conditions were used, the 750 barrels per day, plus the GOR would give us the theoretical total of 4949 MCF of gas to produce during that period with the 750 barrels. The Dakota theoretical gas production would be 9216 GOR times the 278 barrels allocated to the DAkota, which would give us a total of 2562 MCF. The theoretical Gallup production would be the difference between the total gas production and the Dakota, which would be 2387 MCF.

Supposedly, say, during the month, one period, you had an actual gas sale of 4635 MCF, and lease use of 450 MCF, you have an actual total gas of 5085 MCF produced during that period. To allocate the Dakota gat to the well, it would take the actual total gas produced times the theoretical factor, GOR

factor, of 2562 divided by 4949, which would equal 2629 MCF. This would be the factor obtained from these. The Gallup allocation purports to be the difference between the actual total gas and that allocated to the Dakota, which would be 2456 MCF. This would give the Dakota GOR for that period of 2629 MCF divided by oil production allocation of 278 and would give you 9457. The Gallup GOR would be obtained the same way, you will have a GOR of 5203, which is this line, obtained during the test period.

Q How can the validity of the subtraction method of production between the Gallup and Dakota zone be assured?

A The assurance of the validity of the allocation tests would be obtained by subsequent and periodic, another periodic test on the combined zones and the Dakota zone.

Q Based upon your experience in this instance, within what period of time should such a subsequent test for the purpose of assuring the validity of the production allocation formula be conducted?

A I feel that an annual test of a combined zone test and a lower Dakota zone test to the allocation production, obtained annually, would be sufficient in this very low declining reservoir; both of them are very low declining rates.

Q Based upon the data obtained during the test period, with respect to the Jicarilla 28 Well Number 1, is it your

opinion, that the subtraction method of production allocation is an accurate and reliable one from an engineering point of view?

A Yes, it is.

Q Are all the wells producing from the Gallup and Dakota reservoirs on Continental Oil Company's acreage, which acreage is shown on Exhibit Number 1 to the September 30, 1964 hearing, marginal wells and physically incapable of producing top unit allowables?

A Yes, they are.

Q Was the Jicarilla 28 Well Number 1 marginal during the test period?

A Decisively so.

(Whereupon, Applicant's Exhibit No. 6 marked for identification.)

Q I hand you what has been marked for identification as Exhibit Number 6, and ask you if it was prepared at your direction and under your supervision?

A Yes, it certainly was.

Q For the record and Commission, please state what is shown by Exhibit Number 6.

A Exhibit 6 is a combined production performance on the Jicarilla 28 Well Number 1, with the Gallup zone pumping and the Dakota zone producing by plunger lift, for a two-year period, 1962 and 1964, prior to the installation of the dualflow

choke.

The purpose of the curve is to show the well was declining at a very low rate, from both zones; and that with the use of the dual flow choke, and producing both zones through commingling, we obtained production as great as, or a little greater than what we were previous to the installation by producing the two zones separately.

Q In your opinion, is the Jicarilla 28 Well Number 1 typical of existing Gallup on Continental Oil Company's acreage in the West Lindrith Field?

A Yes, it is typical.

Q Do you recall Exhibits 7A and 5B, which were introduced in the hearing of September 30, 1964?

A Yes, I do.

Q Would you briefly explain for the record what those ehxibits show?

A 7A and 5B are composites typical of the Gallup well declining curve, based upon actual data, for a period of about three or four years, obtained from five wells on the lease; and, of course, with the extrapolations determined by what the producing life and characteristics of the well would be. This was utilizing four of our wells and one offset well in the area. This is on the Gallup well.

Exhibit 7B is the same type of curve performance obtained

utilizing production data on our Dakota wells on the lease for a period of approximately three years, and extrapolating the trend of the well to determine its productive characteristics in life, These curves were utilized primarily in respect to economy evaluation for past and future development.

Q In your opinion, is the information shown on Exhibit 7A and 5B, and as the record should show, these are original -- are the original hearing exhibits, typical of any Gallup-Dakota wells which might be drilled in the future on Continental Oil Company's acreage in its West Lindrith Field?

A Yes, in my opinion, these represent the typical wells for the area.

Q Based upon your knowledge in this matter, is it your opinion, that any such wells that might be drilled on Continental Oil Company's acreage would be marginal wells?

A Yes.

Q Is it your opinion that the subtraction method of allocation of production would be a suitable and proper method for allocating production for existing and for future Gallup-Dakota wells on Continental's acreage in the West Lindrith Field?

A Yes, it is.

Q This has previously been testified to, but perhaps it would be helpful at this time, are the owners of the royalty

working interest, overriding royalty interest and Continental's acreage common?

A Yes, they are.

Q Do you recall Exhibit 3 which was introduced in the hearing of September 30, 1964?

A Yes, I do.

Q Would you state for the record, very briefly, what is shown by Exhibit Number 3?

A This exhibit was presented in the original hearing as data requirement for surface commingling installation averaged daily, for a period of 90 days prior to that hearing, to show that the Gallup and Dakota zones were both marginal wells, and produced far below top allowable; and the crude purchaser or the royalty owner, on both zones, is the Jicarilla-Apache tribe; what the liquid hydrocarbon from each zone separately was; and the commingled hydrocarbon gravity was; and the value of the gravity crude obtained from each zone separately; and the value of the commingled production in volume calculations; to show that the value of the commingled production would not be less than the sum of the values of the production from each common source of supply. This data is required on all surface commingling installations in the State of New Mexico.

(Whereupon, Applicant's Exhibit 7 marked for identification.)

Q I hand you what has been marked for identification as

Exhibit Number 7, and ask you if it was prepared at your direction and under your supervision?

A Yes, it was.

Q For the record and the Commission, please state what is shown on Exhibit 7.

A Exhibit 7 is an estimated well cost comparison between a conventional dual flow completion, that is one existing string, with parallel strings of tubing, and a commingled dual installation, utilizing the dual flow check assembly.

The conventional dual well cost is estimated to be around $136,000.00, including surface and production equipment; and for the same well on the commingled dual the costs are estimated at $93,100.00. This indicates a difference here of $43,000.00 between drilling the conventional dual and the commingled dual.

These costs and savings are attributable to such things as casing strings. We could utilize four and a half inch casings with a single tubing string in a commingled dual rather than a seven-inch string. We only need 7,000 feet of tubing string in a commingled dual, to 13,500 feet of tubing in the conventional dual. Other cost savings are attributed to the fact we don't have to utilize pumping equipment; we can efficiently and effectively produce both zones with a plunger lift. Such things as rods and surfave equipment are greatly reduced producing through one set of production tools; and

in all the difference and savings with the commingled dual was $43,000.00, approximately.

Q In your opinion, would a conventional dual completion oil well in the Gallup-Dakota zone in the West Lindrith Field be an attractive, economic venture for Continental Oil Company?

A No, it would not, in my opinion.

Q Based upon the use of the dual flow choke installation and the reduction of costs which are shown by Exhibit Number 7, and as a result of its use, will the dual completion of a Gallup-Dakota oil well in the West Lindrith Field by means of using the commingling tool be an attractive and economic venture for Continental Oil Company?

A Yes, sir, I certainly believe it would be. I have worked a great deal on economic analyses on this, the two reservoirs in this area, and the typical declining contour that I have previously discussed, this type of typical well for the area, it would require somewhere in the neighborhood of an investment of $40,000.00 in initial cost to make the venture anywhere near attractive, along with the initial well cost of $43,000.00 reduction of other savings, such as operating costs between a plunger lift operation with one string of tubing, rather than producing two wells with conventional pumping units such as this; and also it would be considerably, as indicated by these tests, considerably less down time, with the plunger

lift and a more efficient operation; and these things all lead me to believe that we could and would be able to drill wells in utilizing the downhole dual flow choke assembly on future wells in the Jicarilla.

Q Does Continental Oil Company have any development plans with respect to the West Lindrith Field which are contingent upon its obtaining approval to use this commingling dual in the future wells?

A Yes, we do. We have split our marginal four wells to be drilled during 1965 and produced for 1966; eight additional wells in the sixteen secitons below, for a total of twelve wells. These are, of course, contingent upon approval by the Commission to utilize the dual flow choke assembly, and the economics are based upon well costs utilizing the tool. And, in addition to the twelve wells, we have, the sixteen areas -- the sixteen section leases would just be barely -- just to do development work in future years. There is room for considerable additional development, and additional drilling.

Q You have indicated this already, but perhaps we should ask it directly, does the use of the dual flow choke result in an increase in production rate in respect to the wells?

A Yes, mainly due to their less down-time and average production over any one period, would be considerably more utilizing a plunger lift and dual flow choke assembly.

Q And does use of the dual result in a greater economic life of the well?

A Yes, it allows the well to be produced for a lower economic limit and would certainly add to ultimate recovery from the wells.

Q Just to summarize then, does the dual flow choke used in the Jicarilla 28 Well Number 1, prevent communication between the Gallup and Dakota zones in that well?

A Yes, sir.

Q In your opinion, did the test you conducted fully and completely prove this?

A Yes, sir.

Q In your opinion, based upon your study and knowledge with the dual flow choke, both prior to and during the six-month period, would this tool absolutely prevent communication between the producing Gallup and Dakota zones on existing and future oil wells on Continental's acreage in the West Lindrith Field?

A Yes, it would.

Q In your opinion, was the subtraction method of allocation for production between the Gallup and the Dakota zones accurate and reliable during the six-month test period?

A Yes, it was.

Q In your opinion, would the subtraction method of allocation of production be the proper method of allocating

production between the Gallup and Dakota zones in existing and future oil wells on Continental's acreage in the West Lindrith Field?

A Yes, both suitable and reliable.

Q Have you obtained approval of U. S. G. S. and Shell Oil Company as the crude purchaser, with respect to the installation of the downhole commingling dual?

A Yes, sir.

Q Are those Exhibits 8 and 29 to the September 30, 1964 hearing?

A Yes, I believe so.

Q In your opinion, will approval by the Commission of the use of the dual flow choke, which is also known as a fully completion dual, on a permanent basis in the Jicarilla 28 Well Number 1, and in all other Gallup-Dakota oil wells, whether drilled, or which may be drilled on Continental's acreage in the future, be in the interest of conservation by permitting the recovery of oil that would otherwise not be recovered from the Gallup-Dakota wells of Continental Oil Company's West Lindrith acreage?

A Yes.

Q And will approval otherwise prevent waste and protect correlative rights?

A Yes.

Q Do you have any recommendations for the Commission with regard to this matter?

A Yes, initially, I would like to request and recommend that Continental Oil Company be permitted to continue producing the Jicarilla 28 Well Number 1 with the dual flow choke assembly installed in it until such time as the Commission announces its ruling with respect to the hearing today; and I would also like to request permanent approval of the installation of the dual flow choke assembly in the Jicarillla 28-1 as it has been during the test period.

We would like to recommend that the Commission grant approval to install such a dual flow choke assembly in addition to the commingling oil wells located on its acreage in the West Lindrith Field, and in any Gallup-Dakota oil wells which may be drilled in the future on Continental's acreage in the West Lindrith Field; this acreage being shown on Exhibit 1 of the hearing of September 30, 1964.

And, specifically, that the Commission make provision for administrative approval of future downhole commingling installations by use of the dual flow choke in existing Gallup-Dakota marginal oil wells, and any Gallup-Dakota marginal oil wells which may be drilled within the Continental Oil Company's West Lindrith acreage, which consists of four Jicarilla Apache leases covering Sections 15 through 22 and

27 through 34, in Township 25 North, Range 4 West, Rio Arriba County, New Mexico.

And, two, that the application for such administrative approval be filed in triplicate with the Commission and such applications contain detailed date as to gravity, value and volume of the liquid-hydrocarbons from each pool, as well as the expected gravity and value of the commingling liquid-hydrocarbon production, a schematic diagram of the proposed installation, a plat showing the location of all wells on applicant's lease, and the pool from which each well is producing; and whether the actual commercial value of the commingled production will be less than the sum of the values of the production from each common source of supply, and if so, how much less.

And, three, that allocation of production to the Gallup and Dakota zones be by the previously discussed subtraction method based on annual production tests of the commingled Gallup-Dakota and the Dakota at stabilized production rates.

And, four, Continental conduct a packer leakage test and seal leakage test upon installation of a dual flow choke in future wells.

Five, that Continental conduct a production test of the commingled Gallup-Dakota and of the Dakota upon installation of the dual flow choke, and annually thereafter.

Number 6, for Continental to conduct an annual packer leakage test with respect to each well so equipped, in accordance with the New Mexico Oil Conservation Rules and Regulations.

Seven, Continental be granted an exception to Rule 303A and any other applicable rules for the permanent installation of the dual flow choke in Jicarilla Well Number 1, and in any existing Gallup-Dakota marginal oil wells or Gallup-Dakota marginal oil wells which may be drilled on Continental Oil Company's West Lindrith acreage, the location of which I have already described.

Q Do you have any additional comments that you would like to make to the Commission at this time?

A Only that it is my opinion the data presented today in regard to the dual flow choke assembly installation of the Jicarilla 28 Well Number 1 conclusively shows that the dual flow downhole choke assembly can be effectively used to produce commingled hydrocarbons from two separate reservoirs simultaneously through a single tubing string, without communicating between the two zones. The tests show that a leakage does not occur through the check assembly and that annual production allocation tests and packer leakage tests can be satisfactorily performed in accordance with New Mexico Oil Conservation Commission requirements for commingling of marginal zone wells.

I believe that future tests will show that excess energy from the lower Dakota zone can be effectively utilized to produce the entire weaker Gallup zone which previously required artificial lift by pumping, and by minimizing test requirements, operating costs over conventional dual completion method can be greatly reduced, and the current income from a marginal well such as 28 Well Number 1 can be greatly increased.

By use of the dual flow choke future well costs as previously discussed, can be greatly reduced, and further development of the Dakota reservoir and the Gallup reservoir in the West Lindrith Field would be economically feasible. Use of the tool in this area would also prolong the economic limit of both zones and result in an increase and ultimate recovery from both the reservoirs, thus preventing unnecessary waste and allow recovery of a great deal of oil which would otherwise be left in the ground.

MR. ROBERTS: I have no further questions of this witness.

MR. NUTTER: Are there any questions of the witness?

CROSS EXAMINATION

BY MR. NUTTER:

Q First of all, Mr. Brown, that is your name, isn't it, sir?

A Yes.

Q First of all, I would like to ask you if you would submit your recommendations in writing to us when you get home?

A Yes, sir.

Q We will probably want to study them before we get the transcript back, you see.

A In this respect, I would, at this time, like to request that we be allowed to continue the use of this dual flow choke on Well 28 Number 1 until you reach some decision.

MR. NUTTER: This will be permitted. Secondly, I would like to make the observation, Mr. Brown, among your recommendations there was more or less a blanket authority to permit the use of this, in this same field, on its other locations on these leases, as shown on the original call of hearing. And I was just checking, the original application which is dated August 11, 1964, requests for the purpose of installing the tools in a test well, being the Jicarilla 28 Number 1, and the call of hearing, as you will notice there on your sheet, Mr. Roberts, is for this one well. And the call of this hearing is just to appear and show cause why the authority granted under this order, which was for one well, should not be terminated. And I am not sure that the Commission would have jurisdiction under the call of this hearing, either the original call or the present call, to expand this into more than one well.

MR. ROBERTS: I think your point is well taken, Mr. Nutter. Now, what we had in mind by this was to approach this matter along the lines that Rule 303A permits, namely, that once you demonstrates it, the workability of and the reliability of such a tool as this, that further use of the tool in the same pool, with respect to the same zones, be approved administratively.

MR. NUTTER: You recommend approving this administratively, and using this means to determine how much was being taken from each pool?

A Yes, sir.

MR. ROBERTS: Yes, sir, that's what we have in mind.

A Along this line, the original hearing, of course, was to install an inter-test well. The express purpose of this being not only to decrease operating costs on this well, the well that has already got seven-inch casing in it and tubing was in the well, but was to test this dual to determine if it would perform to the satisfaction of the Commission and Continental Oil Company; and we felt that these tests could show us whether we could complete other wells in the area, utilizing this tool, and do it economically.

We have undertaken many studies, economical and reservoir devices, to determine if we could do additional development in this area, and all the evaluations showed it couldn't be done

efficiently if you had a well cost of $136,000.00; and with the high operating cost encountered in pumping high GOR oil wells of 7,000 feet. So, the original hearing, although it was for a test well, the express purpose of it was to determine if the tool could be used to further develop this lease; and to prevent waste by recovering some of these vast reserves that lunderlies the sixteen section block. And we have production all around the area which consistently shows that we are not going to get anymore production from these two than we are getting right here. Most of them on our lease are a little worse than, or some of them considerably worse.

I think for the purpose of our application here today on the show cause order, what we desire immediately, of course, is to continue the use of the steel on a permanent basis in Jicarilla 28 Well Number 1; and as a matter of looking to the future we would seek to handle such matters as this, namely, the utilization of this tool with respect to Continental Oil Company's acreage in the West Lindrith Field, specifically the Gallup-Dakota reservoir, we would seek to handle matters such as this on an administrative basis.

Now, may I repeat this one recommendation which I state as being specific as Number 1: "The Commission make provision for administrative approval of future downhole commingling installations by the use of the dual flow in the existing, and

future marginal Gallup-Dakota oil wells". We would like to get provisions where we can do it administratively, still giving the Commission the authority to approve or disapprove.

MR. NUTTER: I see.

MR. DURRETT: Let me say at this point, Mr. Examiner, we are up against a legal technicality, as far as the Jicarilla well is concerned. Mr. Roberts agrees, from what he has stated here today, the issue concerns the Jicarilla 28 Well Number 1. There are other legal technicalities present. Let's get together after the hearing and work that out to Continental's satisfaction.

Q (By Mr. Nutter) Now, Mr. Brown, I noticed on your packer leakage test, that in each instance here it's after the Dakota is opened that each one of these Gallup zones has been increasing, it was still building up?

A Yes, sir.

Q And the build up in pressure on the Gallup either discontinued immediately, or was around, on the one test taken, at the end of the test period it continued to build up from approximately 800, well, about 800 pounds, it built up to almost 900 pounds; but prior to the time the Dakota was opened it has been built up at a faster rate; on the other two tests the pressure build-up on the Gallup just discontinued completely?

A Yes, it sure did.

Q And I wonder if you would attribute this to the exclusive fact of opening up the Dakota, or just what?

A The Dakota is high in gas-oil ratio and, of course, after being shut in there is quick expansion and cooling in the tubing, which I am sure accounts for some of the reduction in pressure build-up; and although if this well typically builds up very fast, because it is a fractured reservoir, during the start of the shut-in period and very quickly levels off, and takes days, months, I don't know how long it would take to completely stabilize this --

Q In the Gallup?

A In the Gallup, because the production fills the fractures immediately, and, of course, pressure builds up. It's -- I forgot to mention the first of the tests, in the first of the statement here, that during the packer leakage test Number 1, we took a bottom hole pressure on the Gallup by fluid level survey in the annulus, and 96 hour shut-in. Of course, we took some periodic tests prior to the 96 hours, it was building up very slowly, only up to 721 pounds; and then, of course, on the Dakota zone, we had the tubing off, we had a pressure bomb in the well, and the bottom hole pressure after 320 hours, built up to 1525 pounds, but the Gallup is typical; in all our present history out there, builds up very quickly during the first, I would say, 24 hours, and very little

increase in pressure from there on, after the fractures are filled. And, again, the Dakota does give a considerable cooling effect to the pressure during the flow period, and doesn't allow it to build up as much as it probably would in one-fold.

Q Now, though, to what do you attribute the fact, on this most recent test, which was at the end of the test period, that your Gallup had built up to 854 pounds? The pressure on any of these other tests never even came close to that 854 pounds on the Gallup.

A I believe if you will notice there, there is a considerable time difference in the Gallup on shut-in.

Q You indicate it was 33 days. I look at the chart; it shows it was eight hundred and something pounds, and 40 hours back here. I don't know just when this thing built up to 854 pounds. It's not on the chart?

A No, it's not. Of course, this well has been shut in, the Gallup zone was shut in during the complete period of the Dakota allocation test, and we do have a pressure recording on that, continuous for those 33 days, if you would like to see that. During the complete test, both during the production and shut-in periods, pressures were kept on the wells on both zones tubing and annulus during the entire six-month period.

Q Normally, you had been able to get that well up to about 600 pounds, or slightly over?

A On 168 hours.

Q On 168 hours, 164 hours, you got 620 and 615 pounds, respectively. Do you have the chart there for that 33-day test for shut-in?

A No, I sure don't; just for the seven shut-in period. Of course, I do have them available. I don't have them with me at this time; I could make those available for the Commission on the entire 33 shut-in period.

Q I would like to see those charts, if you have them.

A Yes, I would be glad to submit them. Any pressure information on the tubing, or casing, on either shall be for the entire six-month period and is available. We have every chart on that.

Q Now, after the two zones are commingled in this dual, these two zones flow up through the tubing, is this correct?

A Yes, sir.

Q But normally you would have to pump the Gallup and the Dakota would flow?

A The Dakota would produce by a plunger.

Q By a plunger. Are you using a plunger lift in here now?

A Yes, sir, we are. This is the reason, on the initial test we had to put a bomb on the hanger below the plunger lift and above the tool, the bomb would then be between the tool and

the plunger spring, which is on a collar, and the plunger would flow freely but would not flow effectively and efficiently without use of the lift.

Q I also notice on your GOR test taken after the tool was installed, after you produced the Gallup you had to produce it up the annulus?

A Yes, sir.

Q And you didn't produce any oil?

A That's true, we had a seven-inch casing and two-inch tubing, and 700 pounds of pressure. It was not enough.

Q Your oil just slipped back?

A Just hasn't got enough reflex there and volume to carry the liquid to the surface, although the pressure can be adequately decreased for the purpose of packer leakage tests.

Q Now, Mr. Brown, do you think that a well which has declined from 13 barrels a day to 9 barrels a day from January to May is a well which is stabilized enough so that you can allocate production on tests taken only once a year? Percentagewise that's quite a large change in the productivity.

A Yes, the test obtained on the Dakota during that first period shown as Number A there, the 13 barrels a day; the Dakota had been shut in previous to that, and has shown on the other test, after the shut-in period, it produced quite high; so we do have a few days highs in there.

This was not a stabilized rate at 13 barrels, this was just an average for those seven days. We had some 15 barrel days, and some 8 or 9 barrel days, but as you will notice, I don't have it here, production from the Dakota zone over the past two years are approximately 10 barrels per day, 10 or 11.

Q Now, your original Exhibit 3 has some figures. Were these the figures on this particular well, or were they average figures for the Dakota wells?

A Probably taken from our composite curve there at the end of the area, just a ratio, which I believe the ratio is probably close to what we came up with there. I don't remember what figures they were, but they were not actual figures from this specific well.

Q Now, if these figures are correct, using the 9.3 for the average daily Dakota production and taking the production on this new data that you have here, which isn't on Exhibit 4, but taking it from the 1st day of July on to the end, that would be an average combined production of 29.5 barrels per day?

A Yes.

Q So your Gallup is actually producing in excess of 20 barrels per day at this time then?

A No, sir. Your ratio would be the same, I believe.

Q Your Dakota is producing a little more than your

Gallup is producing?

A A little more, I don't know how much with the plunger operating, but it's operating at optimum cycles on this specific well; and the adjustment in time may be an hour to the surface flowing with the plunger coming up, or an hour and ten minutes maybe. We might decrease it to an hour, I mean to forty minutes and it's sort of an art to get a plunger lift operating efficiently.

Well, the pumper out here is trying to get it producing efficiently, and has been taking real close care of it to show us during the last two or three weeks that we can produce it effectively, and should market around, we can get at least 25 or 30 barrels a day. We are paying pretty close attention to it, and it is, like I say, sort of an art to get that thing working, and it takes a lot of practice to get it operating efficiently, and it does take some playing with.

Q Now, if the well is producing in excess of 9.3 barrels why would you use 9.3 for your allocation and subtraction?

A Well, these two test the allocation for the combined and the Dakota test, we tried to keep the producing characteristics and operating characteristics of the plunger lift and everything pretty much the same here. We needed to know more than we did to try to get the well stabilized, if it was going there along there open, and with the pump operating,

you might get up to 27 or 28, so we kept it there at that point, and the same point characteristics as on the Dakota test, so we ended up with a ratio rather than a figure for the two zones.

In other words, if we produce during the month, 3 or 4 barrels of oil per day, the same ratio would apply, and I believe would be correct, if the well was producing a little more efficiently, and level off at a good efficient rate, and we would get more production than the 9.3 for the Dakota, and a little more for the Gallup, which we would come out a little over 16 barrels per day on the per well, day per day basis according to the facts that we had obtained during the allocation. And I believe this factor would hold true and would be reasonably reliable as far as allocation of a marginal zone for a period of a year.

We have discussed this period, we have requested this period of one year because we strictly believe if we have a plunger lift in the well we have to run any kind of a well in an attempt to blank off the zone and if we are required to get a wire line service company out there to pull out the plunger lift we have in the well --

Q And maybe end up pulling the tubing like you did the last time?

A Yes, possibly, but we have to put it back in there

to produce it, and unblank it; if you have to pull everything out of there again, this cost runs two or three hundred dollars every time you even try to pull a well -- pull the equipment one time.

Q This is just for the equipment stops to pull the blank and put them back?

A Right, you are hooked for $200.00, in that neighborhood, any time you run that kind of a test, and cost-wise, economically, you can't run too many tests of this type on it.

Q Now, Mr. Brown, you have requested this because these are low marginal wells, and your Commission dictated that you have to keep your operating and your completion costs down. What would happen in the event -- Now, I notice that you are using four and a half inch casing, what would happen in the event that you drilled a well and completed it with four and a half inch casing and it turned out that it wasn't a low marginal? You wouldn't propose to use this type of system to allocate among good wells, would you?

A Top allowable you mean?

Q Yes, sir.

A On our recommendation here, we have specifically asked on future marginal oil dual Gallup to include completion. We wouldn't expect the Commission to use the same reasoning or

same policies to govern a top allowable well, although if it were a flowing well and approved, in other situations, that allocation can be done through the distribution basis, and on a reliable basis; but as far as our requests are that the best marginal oil Gallup dual completion be used.

Q Have you made any dual completions yet with four and a half inch casing?

A No, we haven't, just single completion. We have two wells out there which are equipped with, comprised of two strings of four and a half and one string of two and seven-eighths casinghead in a common wellbore; that is why we have requested the authority on future and existing wells to reduce operating costs. You might want to take one of those four and a half inch casings and produce the well as one single.

Q In other words, produce the four and a half in one zone and abandon the other?

A Abandon the other.

Q This would give you the ease of artificial lift?

A Some of those that are Gallup wells, of course all of them are marginal, six or eight barrels a day. They have to pumped, and of course, at or very near their economic limit at the high operating cost.

Q Do you have anything else?

A No.

MR. NUTTER: Any questions of this witness? If there are no further questions the witness may be excused.

(Witness excused.)

* * * * * * * *

CARL TUNSTAHL, called as a witness, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. ROBERTS:

Q State your name and address and by whom employed and what position, please?

A Carl Tunstahl, New Iberia, Louisiana, employed by Otis Engineering Corporation as Gas Tool Salesman, and have since the first been working on a dual flow check for Continental Oil Company.

Q Mr. Tunstahl, what is your educational background?

A I have a Bachelor of Science Degree in Petroleum Engineering from the University of Southwest Louisiana, Lafayette, Indiana.

Q Are you the same Carl Tunstahl that testified as an expert witness in this Case Number 3112 on September 30, 1964?

A Yes, I am.

MR. ROBERTS: Will the Commission continue to accept Mr. Tunstahl as an expert witness?

MR. NUTTER: Yes, sir.

Q (By Mr. Roberts) Mr. Tunstahl, are you familiar with the Commission's Order R2824 entered in this case on December 7, 1964?

A Yes, I am.

Q With respect to Order R-2824, did you personally participate in your professional capacity, in the matters authorized by Order R-2824?

A I did, and on two occasions I did visit the location of the Jicarilla 28 Number 1 and did consult with our agent in Farmington and went over the application for the use of the dual flow check, the wire line operations connected therewith. I did not visually and personally witness it, but since that time, have been further ihformed by Continental Oil Company and have reviewed the information that was contained in this application.

Q Based upon all the information you have in regard to the installation of the dual flow choke on the Jicarilla 28 Well Number 1, did the tool prevent communication between the Gallup and Dakota zones at all times?

A Yes, sir, it did.

Q Will the tools so perform with any other Gallup-Dakota oil wells on Continental Oil acreage in the West Lindrith Field?

A It should perform very beautifully.

Q And the reason for your conclusion in this regard is?

A From all the indications, from information from Continental Oil Company, the Jicarilla 28 Number 1 is a typical marginal operation in that field and should be a representative well of future development wells that might be drilled in connection with dual flow choke.

Q Based upon your experience with the tools in laboratory tests and actual field use, can you testify as to the reliability of the dual flow shoke in performing its intended function?

A It has performed its intended function here very nicely, and I might state that we have more performance data since we last appeared here at the last hearing, and all the applications that we have had have been successful.

Q The tool is used rather extensively in other areas of the country and overseas?

A Right, we have, or had at the time of the last hearing, essentially seventy-five in operating condition with the dual flow choke and one hundred total. By the end of this year we should have over one hundred fifty, or well over the hundred mark, at the time, actually operating.

Q Do you recall testifying on September 30, 1964, with regard to the distribution curve and the subtraction method of allocating production?

A Yes, sir, I do.

Q Which is the suitable method to use in the case of the Jicarilla 28 Well Number 1?

A The suitable method here would be the straight subtraction method, based upon the caomparative operating conditions between single zone and combined zone production. In other applications with the Commission that we fall back into that same method, the distribution curves possibly indicate, but the original data which we tried to obtain for the long stabilization period on this low permeability reservoir were highly indicative that it would be necessary to conduct well tests in excess of those anticipated.

We had previously anticipated tests on the order of twenty-four to forty-eight hours in order to get stabilized rates, and there again, we ran into a limitation on the actual equipment because seven days is as long as you would be able to test anywhere; and subsequently the well, we might, if we are real lucky, get a stabilized rate in this period, but we would have no indication whatsoever that this data was true and correct, if we pulled the bomb, naturally we would have to back up and start over and any production which is missed in this particular application can be tacked on at the end. But then you have got to determine if the payment is there, and economics just don't justify continual exhaustive testing and we must fall back

to subtraction methods in these marginal wells; where top string allowable wells will be encountered, at this time, if such is present, other distribution curve methods can be presented and closer check points made, and annual testing.

Q In your opinion, would the subtraction method of allocation of production be the suitable method with respect to any Gallup-Dakota marginal oil wells on the acreage in the West Lindrith Field?

A Yes, it would.

Q And I suppose the reason for this conclusion is the same as you have related with respect to to 28 Number 1?

A Yes, if it is typical, yes.

Q In your opinion, based upon actual experience with the tool, will the tool extend the economic life of any well in which it is used?

A So far we have extended the economic life of wells in which this tool has been used and have been able to recover, as we would in this case, hydrocarbon that would be left untouched and revenue for the producing company's wells and the state are concerned, if this tool were not applied.

Q In your opinion, would the approval by the Commission of the use of the dual flow choke on a permanent basis in the Jicarilla 28 Number 1 be in the interest of conservation, and permit the recovery of oil that would otherwise not be recovered

from the Dakota well on the West Lindrith acreage?

A Yes, it would.

Q And will approval of this tool on a permanent basis otherwise prevent waste and protect correlative rights?

A Yes.

Q And can the same be said with respect to its use in any additional well on Continental Oil Company's West Lindrith acreage?

A Yes, sir, it can.

MR. ROBERTS: I have no further questions of this witness.

MR. NUTTER: I missed your name, sir.

THE WITNESS: Tunstahl.

CROSS EXAMINATION

BY MR. NUTTER:

Q Mr. Tunstahl, I noticed during Mr. Brown's testimony, he was going through these chronological events that occurred across the test period and there were two or three occasions where both zones were being commingled, and the Gallup was not entered. Now, what is the cause of this, is it misjudgment as far as the size of the orifice is concerned, or just what is it?

A In the application of all cases here, we have observed the same thing. We have a tubing pressure which is that

pressure immediately above the dual flow choke and until this pressure is sufficiently reduced, or what it amounts to, until it reaches the static bottom pressure of the weaker zone, the check valve in the tool remains on seat and the pressure in the tubing at all times is higher than the pressure, static bottom hole pressure of the weaker zone, so consequently the weaker zone has no means to flow because it cannot flow uphill against the high pressure, and when the tubing pressure is sufficiently reduced, at that time we commence to get production from the weaker zone and continue to get additional production from the tubing which is lower down to its desired point of maximum production.

Then using a plunger lift like you have got here just means that your plunger has to work more quickly or more efficiently, you have to unload the well to a lower bottom hole pressure to get the weaker zone to come on.

Q What about this other problem that was encountered, where the Gallup was theoretically blanked off with the blanking plug, but there was indication of leakage, and they had to pull the tool to get the orifice and found the orifice was damaged? Is that a common occurrence?

A No, sir, it is not. I feel that is partially my responsibility, but it reverts back to a human error. We were instructing our agent on the use of a new tool and in the

instruction of its use, whether I missed it and didn't tell him that it was necessary to knock out the plug, or whether he forgot to knock out the plug, in order to get the plunger --

Q Now, that would be the fishing tool, wouldn't it?

A No. You don't get it in the orifice head assembly. If we refer to this one, it will be easier to see. Here we have the orifice assembly, the prong, its supporting part in green. Now, when we blank the lower zone, we put the blanking device over on the left here, which is a ruptured disc, and here is a punch to rupture the disc, and for equalization this forms a piston down into here and the surface for this double "O" ring is the upper check valve assembly. When the upper check valve assembly starts into the tool, it must travel here. We have the orifice head assembly and this time, it's shown in green, the prong assembly, it must travel from this point down to here, all this down in here is a closed chamber and just like trying to put a packer into the tubing with a plug in the tubing string, there is no way to compress the fluid, and consequently you end up leaving the orifice head without having actually blanked it.

Q I see.

A It's necessary in the two-inch model to knock out a plug or rupture the disc in the assembly to allow the tremendous volume involved for this liquid. In other words, if we put it

over the tremendous volumes, then we can put the orifice head in; if we are trying to put it in a two-inch area, there is just no way to compress that.

Q What was the problem with the fishing equipment?

A With the fishing of it, when we got ready to fish the check assembly out, to check it, at that time it had sand around it which was evidently left over from this operation of trying the orifice head in.

Q So the fishing problem was also a result of this original error?

A I would say it all stemmed from one error, the horseshoe nail.

Q And you think this is not a defect in the tool itself, but this was something that was a human error and can be corrected?

A Yes, sir, it is a human error and can be corrected. It won't happen again.

MR. BROWN: I would like to add here the error was human with the blank. We believe this is what happened. We blanked off the other zone. We were trying to blank off the upper zone, which you can blank off with the check valve assembly in there, you have a very short distance to move to seat on the upper assembly, and therefore, you can blank it off. We inadvertently, I believe what happened, put the blank

in the wrong opening and therefore, it was trying to seat in that closed cylinder and would not do it. The point was we were not trying to seat to blank off the other, but just got it in the wrong zone.

MR. NUTTER: I see. Are there any other questions of Mr. Tunstahl at this time? Mr. Tunstahl, did you get the tool?

A I got the tool back but our clerk is still screaming about the little orifice insert, but we won't bother about that.

MR. DURRETT: I think I have been told this before, but what does the tool cost?

A The dual flow choke sells for $1,200.00 for the two-inch, the landing device to seat it sells for about $150.00. It can be dressed up and modified and go on into just how elaborate you want from the simplest completion to the most elaborate, depending upon the niceties and extra niceties that might go along with it.

MR. NUTTER: If there are no further questions of Mr. Turnstahl, he may be excused.

(Witness excused.)

MR. ROBERTS: I offer Exhibits 1 through 7 into evidence.

MR. NUTTER: Continental's Exhibits 1 through 7 will be admitted in evidence.

(Whereupon, Exhibits 1 through 7 admitted in evidence.)

MR. NUTTER: Do you have anything further, Mr. Roberts?

MR. ROBERTS: Only to say, Mr. Nutter, that we believe we demonstrated that the commingling tool is completely workable and reliable and we submit that in the interest of conservation, and Continental Oil Company ought to be permitted to use the tool on a permanent basis in the Jicarilla 28 Well Number 1, and use of this tool in the initial well on Continental Oil Company's sixteen section block in the West Lindrith Field as to the Gallup and Dakota zones as to marginal oil wells, that should be handled by application for administrative approval in accordance with the requirement of Rule 303B.

MR. NUTTER: Does anyone have anything they wish to offer in Case 3112? We will take the case under advisement and the hearing is adjourned.

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

I, Irene Watts Court Reporter, do hereby certify that the foregoing and attached transcript of proceedings before the New Mexico Oil Conservation Commission Examiner 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 26th day of Oct., 1965.

Irene Watts
Notary Public - Court Reporter

My Commission Expires:

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ILLEGIBLE

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 3112 (re-opd) heard by me on 7/28, 1965.

_____, Examiner
New Mexico Oil Conservation Commission