BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
February 24, 1965

EXAMINER HEARING

IN THE MATTER OF:

APPLICATION OF INTERNATIONAL OIL & GAS CORPORATION FOR A WATERFLOOD PROJECT, EDDY COUNTY, NEW MEXICO

Case No. 3213

BEFORE:

ELVIS A. UTZ

TRANSCRIPT OF HEARING

MR. UTZ: Case Number 3213.

MR. DURRETT: Application of International Oil & Gas Corporation for a waterflood project, Eddy County, New Mexico.

MR. LOSEE: A. J. Losee, Artesia, New Mexico, appearing on behalf of the applicant. I have one witness, Mr. Conrad Appledorn.

* * *

C O N R A D A P P L E D O R N, the witness, having been duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. LOSEE:

Q Will you state your name, residence and occupation.

A Conrad Appledorn, and I am District Superintendent for International Gas & Oil Corporation in Artesia, New Mexico.

Q Have you previously testified before the Oil Conservation Commission and had your qualifications accepted?

A Yes, sir.

MR. LOSEE: Are the witness's qualifications acceptable, Mr. Examiner?

MR. UTZ: Yes, sir.

MR. LOSEE: Mr. Appledorn, will you please describe what has been marked Exhibit 1, which is a map of our proposed Highway waterflood project. This project includes 400 acres,

having ten wells in Sections 26, 25, 35 and 36, Township 17 South, Range 28 East, Eddy County, New Mexico.

Q Will you give us a brief history of the development of this area?

A International Oil & Gas Corporation commenced development of this acreage in November, 1960, and completed the eight wells in Sections 26 and 35 in August, 1961. Wells Number 191 and 194 at the east end of the project area, Sections 25 and 36, were completed in March and June of 1963, respectively. These wells all have 4½-inch OD casing set at total depth and were selectively perforated and fractured with either lease crude oil or water. Most wells flowed on initial completion but pumping units have since been installed. Reported initial potentials range from 45 barrels of oil pumping to 240 barrels of oil in six hours flowing. The offsetting leases to the west and south were developed between 1955 and 1961, and the earliest development was to the south.

Q What is the current production of the wells in this project area?

A During January of this year the ten wells in the project area produced 915 barrels of oil, a very minor volume of water and 6,007 MCF of gas. This is an average of slightly less than three barrels of oil per day per well, and the gas-oil ratio of 6565 cubit feet per barrel. Cumulative production as of January 1, 1965 was 185,777 barrels of oil and 55,258

cubic feet of gas, from the ten wells.

Q Please refer to what has been marked Exhibit 2, and explain what it portrays.

A Exhibit 2 is the production performance--the primary performance in the project area. It shows both oil production in barrels and gas production in cubic feet. If you will note the high rate of decline and our lack of water production, this indicates the area is producing mainly by solution gas drive. The relatively high volume of gas produced indicates the possibility that a secondary gas cap has formed. However, we haven't seen any direct evidence of this, in that we have no single well that has a high gas-oil ratio.

Q What, from your knowledge of these wells, is the highest average production from any well?

A At the present time our highest production will run six to eight barrels of oil per day.

Q Which well is that?

A That is the 191, on the east end--I beg pardon; it was the 194 on the east. And then another high well we have is the 168.

Q What is its average production?

A Four to six barrels of oil per day.

Q What about the remaining wells--what is their average production?

A It will vary from one barrel of oil per day up to, I would say, four barrels of oil.

Q In your opinion have the wells in this project area reached an advanced or stripper state of completion?

A Yes.

MR. UTZ: Did you say 194 for the 628, or 68?

A 168.

Mr. LOSEE: How many barrels?

A 628.

Q What zones are being produced in these wells?

A Mainly from the Upper Premier pay of the Grayburg Formation. If you will refer to Exhibits 3A and B, which are logs of the 191 and 194, the Upper Premier in the location of the 191, Exhibit 3A, is shown between 2315 feet and 2338 feet. The comparable interval in the 194 is 2284 feet to 2266 feet. In addition to the Upper Premier, we also have stray sands higher in the section, opening a couple of the wells. In the 194, referring again to Exhibit 3B, at 1781 to 1788 feet we have a lower Queen Sand that is open, and in the 172 we have a Metex Sand that has been opened. I don't have the exact interval marked on this log; however, it is between the interval comparable to 2050 to 2150 feet. There are two small intervals perforated. These latter two sands, the Queen and the Metex, are tight and limited in areal extent, and haven't produced

too much oil.

Q What are the characteristics of the Upper Premier zone in this area?

A We have had several cores in the general area of this project which indicate that the Upper Premier has a gross thickness of 15 feet to 30 feet. It is a blanket type sand and shale deposit which thickens from north to south. At the north end--northwestern end of the project it will be from 15 to 18 feet thick, and thickens to the southeast. It is mainly red to grayish-red shale, locally anhydritic and dolomitic. It has very widely varied porosity and permeability. Within this Upper Premier gross interval there are one and very occasionally two sands that have sufficient porosity, permeability and oil secretion to be produced.

Q Please refer to what has been marked Exhibit 4, and explain its meaning.

A This is a map of the structure--geological structure in the area. We have contoured the map on top of the San Andres which immediately underlies the Premire Sand, and it reflects the structure of the Premier Sands in this area. You will note the dip is southeast at about 400 feet per mile. We are right in what is called the hinge zone of the northwest shelf area.

Q Please refer to what has been marked Exhibit 5,

and explain its meaning.

A Exhibit 5 is an isopach map of the net pay in the Upper Premier Sands. If you will note, this sand development --one and occasionally two sands I spoke of, which are produceable, the development is quite lenticular in an east-west development. The pay is sharply marked to the north and feathers out to the south from this trend of maximum development. Much of the pay to the south from, I should say from the two-foot interval line and the three-foot interval line southward, is not economically produceable and in many wells it is not opened. To prepare this map we used much information from the Obo wells. Each proration unit in this area has an Obo, and these wells here were drilled and logged through the Premier, and they give us quite a bit of pay information which is not shown on the map.

Q What are the reservoir characteristics of the Upper Premier?

A The Upper Premier net pay ranges from two to seven feet in pay thickness. It increases in thickness to the west. Our core analysis indicates that the sand has an average porosity of 16.2, an average permeability of 9.6 millidarcies and a water saturation of 28.4. Average permeability and average porosity are taken from sands that have a cut-off of more than 1/10 of 1% millidarcies permeability. We find that

the thin sands, less than two inches in thickness, generally have no permeability or very little.

Q What is the volume of oil-in-place, in your opinion, and what percent of this has been produced?

A We have used this isopach map; we have calculated that this reservoir within this project area has a volume of 1558 acre-feet; it has 1,219,000 barrels of stock tank oil-in-place. Of this we have produced 185,777 barrels or 15.2% of the oil-in-place. From analysis of the production performance, Exhibit 2, we estimate that ultimate primary recovery will be 200,500 barrels of oil, or 16.4% of the oil-in-place.

Q In your opinion, is waterflooding feasible in this reservoir?

A Yes, in my opinion it is. The remaining oil saturation, permeability, porosity, and water saturation, primary performance and depth of the reservoir are all generally quite favorable for substantial secondary recovery by waterflooding. Also, similar Premier Sands are being successfully waterflooded in the Artesia Pool and in nearby pools.

Q Will waterflooding of this project prevent waste and conserve natural resources?

A Yes. We think significant quantities of oil will be recovered that we couldn't get otherwise, by primary means, economically.

Q How much oil will be produced, if you have made a calculation, in this project area?

A We estimate that we can recover about 228,000 barrels of oil during the life of this flood, which is slightly more than we anticipate from primary production, and this is 18.7% of the oil-in-place. Total primary and secondary recovery is estimated to be 428,600 barrels or 35.2% of the oil-in-place, and these figures are within the range of average recoveries for sand of this type.

Q What do you predict will be the life of this flood?

A We anticipate a flood life of from five to five and a half years.

Q What type of injection pattern do you propose to use?

A If you will refer to Exhibit 5 again, the linearity of that pay field and the close spacing of the wells east of that line of wells, they are only 660 feet apart north and south--limits us in any usual five-spot pattern. Because of the difficulties posed by this type of development, we would propose to use what I can best call an end drive--actually it's injection into both wells at the eastern end of the pay, and after fill-up is achieved we expect that the flood front can be moved westward along the maximum line of pay development, and encroachment out of the project area will be limited

by lack of permeability. As wells are watered out westward we will request the Commission's approval to convert additional wells to injection.

Q What water injection rate and pressure do you expect to use?

A We expect, from similar experience with the Premier in other areas, that we can inject 400 barrels of water per day at less than 1500 pounds per square inch. After fill-up is achieved we expect to inject about 300 barrels per day at similar pressure.

Q What water sources do you have plans to use?

A We intend to buy water from commercial water plants.

Q Will you used produced water to supplement the purchased water?

A Yes.

Q Are there any water zones in the area?

A Yes, fresh water was encountered in this project area between the depths of 260 and 300 feet. Three of these wells were drilled with cable tools, and the other seven were drilled with rotary; and all found fresh water in substantial amounts in this general interval.

Q How do you propose to protect this fresh water?

A Surface casing is set and cemented in all wells in the area. We have prepared Exhibits 6A and B showing the

casing programs in the two proposed injection wells.

Q Referring specifically to these two proposed injection wells, 191 and 194, when were they drilled?

A Wells 191 and 194 were drilled in March and June of 1963, respectively--191 in March and 194 in June.

Q What grade of casing was run in these wells?

A This is 4½-inch 11.6-pound J-55.

Q Was this new or used casing?

A New.

Q In both wells?

A In both wells.

Q I note from these two wells that the top of the cement surrounding the 8-5/8 inch casing is calculated in both wells to be 150 feet, and the amount of cement used is actually different. Is there some reason that--I'm sorry; strike that. Why don't you just delete that question.

MR. UTZ: The cement is the same but the top is different.

WITNESS: That one figure was a typographical error which I corrected in the new exhibit.

MR. LOSEE: Do you propose to operate your waterflood under Rule 701?

A Yes, sir.

Q With the allowables provided by that rule?

A Yes.

Q Have you calculated what will be the maximum daily allowable?

A Because of the way we intend to prosecute this waterflood, we have a little problem there. Our initial allowable will be four wells or 168 barrels per day, plus the usual allowables for the other wells. If expansion of the flood is followed such that all ten wells become subject to Rule 701, the maximum allowable will be 420 barrels per day. There is some question whether we would reach that maximum allowable, depending on how the injection program is followed.

Q Did you prepare these Exhibits 1 through 6, or were they prepared under your direction?

A I prepared some; others were prepared under my supervision.

MR. LOSEE: I move the introduction of Exhibits 1 through 6.

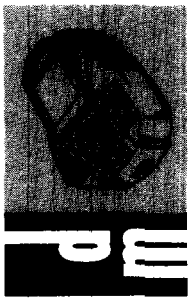
MR. UTZ: Without objection, Exhibits 1 through 6B will be entered into the record.

MR. LOSEE: I have no further questions.

CROSS-EXAMINATION

BY MR. UTZ:

Q Mr. Appledorn, is the top of the cement on the



8-5/8 inch high enough to shut off all fresh water zones in the area?

A Yes, sir. The fresh water we encountered was 260 feet in this area. Actually it was quite dry down to below 200 feet. The one well in the lowest circulation zone of about 100 feet was where they couldn't keep anything in the hole.

Q That's why the top is different. And what was there between the top of the cement on the 4½-inch and the casing shoe on your 8-5/8? Any oil or gas or fresh water?

A We found some oil stain in the Yates Sand at about 750 to 800 feet, but neither in the cable tool holes nor in the air drill rotaries were they able to get any type of flood show at all. The sand showed some stain. The "A" Field, which is the Seven Rivers and Yates Field, occurs about a mile away.

Q Was the casing new when you put it in these wells?

A Yes.

Q What weight casing did you use?

A 11.6 pound, 4½-inch.

Q Do you propose to test the casing before injection?

A Yes, we intend to set a packer on two-inch tubing above the highest perforation, and then we will test at 2000 pounds.

MR. UTZ: Are there any other questions of this witness?

MR. IRBY: Yes, sir. Mr. Appledorn, I think you and I have a secret about this cement on this surface string casing. In your original exhibits on Well Number 194 you had the top of your cement at 150, the same as the other well, and you had the same amount of cement in each well, but your casing was set at a different depth. Now, as I understand what you told me during the lunch hour, you have computed this 75 sacks of cement in each well to rise to the point indicated after allowing 25% loss in each case?

A Yes. On Well Number 194 there is somewhat greater than a 25% loss, that 100-foot top. Actually the way the cement is calculated, I take the volume of cement under the normal cementing operations--regular cement with the normal water content will have 1.18 cubic feet per sack. We also run eight pounds of salt per sack to help us seal, which gives us 1.21 cubic feet per sack. I throw in 25% to allow for irregularities, and then using normal pipe and hole volume tabs I calculate the height to which this will go. In the case of the 191, the actual calculated top is 142 feet, and I evened that out at 150. In the 194 I had a typographical error there in the first submittal. This one I made 100 feet; actual calculated top is 26 feet. However, we found a fair

amount of lost circulation in these dry surface gravels, so I reduced it to 100 feet because of that.

Q Do you intend to inject down casing, as I understand it?

A Yes, if the casing will stand the pressure test and more than that.

Q And if it doesn't?

A We will run tubing with the packer.

MR. IRBY: That's all I have.

MR. UTZ: Are there any other questions? ... On this Number 168 well, is your statement as to oil production four to six barrels?

A Four to six barrels, yes, sir.

MR. UTZ: The witness may be excused. Are there other statements in this case? The case will be taken under advisement. The hearing is adjourned.

* * *

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, ELIZABETH K. HALE, Notary Public and Court Reporter, do hereby certify that the proceedings in Case Number 3213 were taken by me in shorthand; and that the foregoing is a true and accurate transcript of such proceedings to the best of my knowledge, skill and ability.

IN WITNESS WHEREOF, my hand and seal of office this 17th day of March, 1965.

Elizabeth K. Hale
Notary Public

My commission expires

May 23, 1968.

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 3213, heard by me on Dec. 29, 1965.

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