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**THE OIL AND GAS CONSERVATION COMMISSION OF
THE STATE OF COLORADO**

CAUSE NO. 54

DUNE RIDGE FIELD

**DONALD E. WEIMER
CERTIFIED SHORTHAND REPORTER
2027, NEWPORT
DENVER 7, COLORADO
TELEPHONE FR. 7-0358**



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BEFORE THE OIL AND GAS CONSERVATION COMMISSION
OF THE STATE OF COLORADO

IN THE MATTER OF THE INVESTIGATION TO }
TAKE MEASURES TO PREVENT THE WASTE OF }
OIL AND GAS IN THE DUNE RIDGE FIELD, }
LOGAN COUNTY, COLORADO. }

CAUSE NO. 54

PURSUANT TO NOTICE to all parties in interest, the
above-entitled matter came duly on for hearing at the State
Capitol Annex Building, Denver, Colorado, at the hour of 10:45
o'clock a.m., March 18, 1955.

BEFORE:

Mr. Warwick Downing, Chairman
Mr. H. C. Bretschneider, Commissioner
Mr. Russell H. Volk, Commissioner
Mr. F. M. Van Tuyl, Commissioner
Mr. Harvey Houston, State Oil Inspector

APPEARANCES:

R. T. Robberson, Esq., Denver, Colorado, for the
Shell Oil Company;
A. M. Ramsey, Denver, Colorado, for the
State Land Board;

A. J. Jersin, Denver, Colorado, Deputy Director,
William R. Smith, Denver, Colorado, Petroleum Engineer,
Wilbur Rocchio, Esq., Assistant Attorney General,
for the Oil and Gas Conservation Commission.

CHAIRMAN DOWNING: The next case is Cause No. 54, Dune Ridge Field. Who appears in this matter?

MR. ROBBERSON: R. T. Robberson, attorney for Shell Oil Company.

CHAIRMAN DOWNING: Is anyone else here interested in this controversy?

MR. RAMSEY: The State Land Board.

CHAIRMAN DOWNING: Anyone else here interested or not who wants to be heard? All right, no other appearances, so you may proceed.

MR. ROBBERSON: This is the application of Shell Oil Company for approval by the Commission of a proposed pressure maintenance operation through gas injection in Dune Ridge Field, Logan County, Colorado. I should like at this time to amend Shell's application in so far as it shows Mr. E. L. Doheny as owning the lease in the east half of the west half of Section 33. Subsequent information from our records has shown that Mr. Patrick A. Doheny was the owner of that leasehold. I should like to amend our application and exhibit only in so far as it pertains to that ownership. For the purposes of the record, I should like to offer two registered mail receipts, one to Mr. E. L. Doheny and the other to Mr. Olen F. Featherstone, and also a letter from Mr. Patrick A. Doheny, the owner just referred to, in which he acknowledges service of process under Rule 403.

CHAIRMAN DOWNING: Any objection to the amendment?

It's just substituting one name for the other and giving proper notice to the new man?

MR. ROBBERSON: Yes, sir.

CHAIRMAN DOWNING: All right, there is no objection, the amendment will be granted.

MR. ROBBERSON: I should like at this time to call Mr. V. P. Porter.

MR. ROCCHIO: Mr. Robberson, before you proceed, there is a letter here from the Skelly Oil Company that I should like to read into the record. This letter is addressed to the Commission: "Re Cause No. 54, Dune Ridge Field. On Friday March 18, the Commission will hear the application of Shell Oil Company for approval of the pilot pressure maintenance program through gas injection in a part of the area defined as being in the Dune Ridge Field. As an interested operator in the field and owning adjacent acreage to the area involved, we wish to advise the Commission of our approval of the proposed plan and urge the Commission to approve the application." Signed George W. Selinger, Skelly Oil Company.

V. B. PORTER

called as a witness for the Shell Oil Company, being first duly sworn according to law, upon his oath testified as follows:

DIRECT EXAMINATION

BY MR. ROBBERSON:

Q. Mr. Porter, will you please state your name and address.

A. V. B. Porter, 935 East 8th Avenue, Denver.

Q. Would you please state by whom you are employed and in what capacity?

A. I am employed by the Shell Oil Company as a Reservoir Engineer.

Q. You testified previously, did you not, Mr. Porter, in Cause No. 11?

A. I did.

MR. ROBBERSON: Will the Commission accept Mr. Porter's qualifications?

CHAIRMAN DOWNING: Yes, sir.

Q. Mr. Porter, have you made a study of the Dune Ridge Field from an engineering and geological standpoint?

A. Yes, I have.

(Whereupon, documents were marked as Shell's Exhibits A and B for identification.)

Q. Mr. Porter, I hand you a plat marked Shell's Exhibit A and ask you if you are familiar with the data it contains?

A. I am.

Q. Are the entries thereon correct to the best of your knowledge?

A. Yes.

Q. Would you please explain Shell's Exhibit A in detail.

A. Exhibit A is a plat showing the Dune Ridge Field and its immediate environs, lease outlines and ownerships, and the

locations of all wells and dry holes. The legend in the lower left-hand corner identifies the type well. Appearing adjacent and under the well spots on the plat are the well number, elevation, subsea depth of the Muddy sandstone, total depth, casing points, plugged back total depth, producing interval, date of completion, and the initial potential. The limits of productivity are shown, and the contours that are shown on the plat are the subsea depth of the top of the porosity in the Muddy sandstone. The well proposed to be used as an injection well is indicated by an arrow. On the right side of the plat is the electric log of Shell's State of Colorado 688-1, which is the proposed injection well. The principal geological markers in that well, the total depth, plugged back total depth, casing type and depth, perforated interval, and calculated top of cement are clearly shown.

Q. Mr. Porter, I hand you a graph marked Shell's Exhibit B and ask you if you are familiar with the data it contains?

A. I am.

Q. Are the entries thereon correct to the best of your knowledge?

A. Yes.

Q. Would you explain Exhibit B in detail.

A. Exhibit B is a graph showing cumulative stock tank oil and cumulative reservoir volume of oil and gas removed from the reservoir versus reservoir pressure at minus 350 feet subsea.

Also the graph in the lower left hand corner shows the producing gas-oil ratio versus cumulative stock tank production.

Q. Mr. Porter, referring to both Exhibit A and Exhibit B, would you please give the Commission the results of your study of Dune Ridge Field and explain the proposed operation by Shell Oil Company.

A. The Dune Ridge Field, located in Townships 6 and 7 North, Range 52 West, Logan County, Colorado, was discovered June 21, 1954, by the completion of Shell's State 688-1, located in the northwest southeast of Section 32, Township 7 North, Range 52 West, which flowed 249 barrels of oil and no water in 24 hours from five feet of net oil pay in the Muddy sandstone. As can be seen on Exhibit A the field now consists of 11 Shell Muddy sandstone oil producers, three dry holes drilled by Shell, and one dry hole drilled by Mr. Featherstone. Four of the producing wells are flowing while the other seven are pumping.

The hydrocarbon accumulation is the result of an updip permeability pinchout within the Muddy sandstone reservoir being associated with a structural nose. The original gas-oil contact is estimated to be at 337 feet subsea, and the oil-water contact is estimated at 390 feet subsea. The reservoir dips to the northwest at the rate of 60 feet per mile, has an average porosity of 20%, average permeability of 396 millidarcies, and contains an oil column of about 53 feet. However, the net oil pay thickness in individual wells varies from three to six

feet with the average being four and one-half feet.

Now Exhibit B shows the production and pressure history of the field. It can be seen that the original Muddy sandstone reservoir pressure was 1145 pounds per square inch gauge at a datum of 350 feet subsea. In October, 1954, the reservoir pressure had declined to 1020 pounds per square inch gauge after the production of 87,000 barrels of oil. On January 23, 1955, the reservoir pressure was 833 pounds per square inch gauge after producing a total of 191,000 barrels of oil. Now to January 23, the field had produced only 612 barrels of stock tank oil per psi pressure drop; however, to that date the field's cumulative gas production was 213,000 MCF. This quantity of gas is equivalent to 743,000 barrels of reservoir fluid and amounts to 2380 barrels per psi pressure drop. It is believed that the rapid rate of pressure decline in this field is largely due to the withdrawal of this large quantity of gas.

I believe the following characteristics make this reservoir amenable to gas injection: (1) it is a continuous reservoir with a relatively thin producing interval, (2) it contains a small gas cap, and (3) it exhibits the traits of a depletion type reservoir drive. Therefore, Shell proposes to gather the casing head gas produced in the Dune Ridge Field at a central station, compress it to 1300 pounds per square inch, and inject it into the Muddy sandstone reservoir in State 688-1, which is located at a high structural position, shown on Exhibit A.

Now in February, 1955, the four wells in the field that were producing the greatest amount of gas were shut in to conserve reservoir energy. The field is now producing 260 MCF per day as compared to the 1783 MCF per day being produced prior to shutting in of these four wells. With the commencement of gas injection, approximately 80% of the reservoir volume of hydrocarbons being withdrawn daily will be returned to the reservoir, which will maintain the reservoir pressure, allow increased recovery of oil, and also conserve the gas now being flared for disposition at a later date.

In addition, it will be possible to produce the wells now shut in. Experience in fields of this nature has shown that increased gas production first occurs in the wells nearest the gas cap and under controlled gas production these wells, of necessity, must be shut in or restricted at an earlier date than the structurally lower wells. We do not expect to alter this trend under gas injection; however, we do expect to be able to produce the up-structure wells for a longer period of time and leave less oil in place than under primary means of depletion.

From our preliminary calculations it appears that the reservoir now has a free gas saturation of about 10%. The characteristics of this reservoir are such that the relative permeability to gas reaches higher values at a lower free gas saturation than in a more permeable reservoir. We expect the

mobility of gas to be such that the injected gas will occupy the ever increasing free gas space and therefore the amount of oil migration due to gas injection will be negligible. The primary movement of oil within the reservoir will continue to be a result of the pressure differential existing between reservoir pressure and the producing well bore pressure, and therefore we do not expect the drainage pattern in this field to be substantially altered by this gas injection program except, of course, in the near vicinity of the injection well.

Now if the field were to be depleted utilizing primary reservoir energy with controlled gas production, it is estimated that the ultimate oil recovery should be about 700,000 barrels. If however, the field were to be depleted under a program of pressure maintenance by gas injection as we propose, it is estimated that the ultimate recovery will be about 900,000 barrels or a 28% increase over the ultimate recovery by primary means. Further, this program may serve as a basis for other projects of this nature in the Denver Basin.

Q. Mr. Porter, in view of your testimony, would you then recommend to this Commission that in the interest of conservation and for the prevention of waste that the Applicant's proposed pressure maintenance project be approved?

A. I would.

MR. ROBBERTSON: Any questions from the Commission?

CHAIRMAN DOWNING: Any questions?

COMMISSIONER VOLK: I would like to compliment the Shell Oil Company on this application. It's a fine way that it has been presented and I think it's a real conservation move.

CHAIRMAN DOWNING: I want to join very strongly in that and compliment the Shell Oil Company for what they are doing in that field.

MR. ROBBERSON: Thank you, sir.

CHAIRMAN DOWNING: And I hope the same pattern will be followed in a number of the other fields. Any questions?

BY MR. HOUSTON:

Q. You said you had 250 barrels of oil brought in. What size choke did you use on it?

A. I don't recall what size choke that was.

Q. Was it open?

A. No, sir, it's not an open flow potential.

Q. You did have a choke on it?

A. Yes, sir.

Q. What happened to the gas when you got through flowing it, did you flare it?

A. Yes, sir. The gas produced in the field has been and is now being flared.

Q. How much a day is being flared, do you have any idea?

A. You see in February we shut in the four highest because our pressure was declining at such a rate we wanted to conserve what pressure we had left.

Q. What's the well making now?

A. I have this right here, sir. The State 688-1 is presently shut in and I don't have the last well test here -- wait a minute, I do too. The last test on that was on the 12th of January this year, and it produced 163 barrels per day of oil and 609.8 MCF of gas for a gas-oil ratio of 3741.

Q. That would show right off the bat then that the gas pressure is depleting?

A. Yes, sir.

CHAIRMAN DOWNING: Any further questions? Does anyone here have anything to suggest to the Commission in this matter?

MR. ROCCHIO: Is anyone here representing Mr. Featherstone or Mr. Doheny?

CHAIRMAN DOWNING: They have been properly notified?

MR. ROCCHIO: Yes, Judge. If they were present I would like to have it put into the record is all.

MR. JERSIN: Mr. Porter, what was the per cent of the porosity for plotting this contour map, do you remember off hand?

THE WITNESS: No, I forgot the porosity. I think that was oil bearing porosity from the shows in the wells and electric logs and radioactive logs, and based on micrologs a lot too.

MR. HOUSTON: When is this plan going in, Mr. Porter?

THE WITNESS: We hope to have things in operation in

the early part of April.

MR. ROBBERSON: If there is no further questions, I would like to enter Exhibits A and B into the record.

CHAIRMAN DOWNING: There's no objection, they will be received.

(Witness excused.)

MR. ROBBERSON: That concludes our testimony.

CHAIRMAN DOWNING: Would the State Land Board like to enter appearance on this and to have any comments?

MR. RAMSEY: No comments, we are here just to get educated.

CHAIRMAN DOWNING: All right, the petition is granted.

(Whereupon, the hearing in Cause No. 54 adjourned at 11:10 a.m., March 18, 1955.)

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C E R T I F I C A T E

I, Donald E. Weimer, Certified Shorthand Reporter, hereby certify that I personally recorded in shorthand the proceedings in the foregoing matter in the first instance and that I later transcribed the same and that the foregoing record is true and correct to the best of my knowledge and belief.

Done at Denver, Colorado, this 21st day of March, 1955.

Phone
FR7-0358

Donald E. Weimer
Certified Shorthand Reporter
2027 Newport Street
Denver, Colorado