

NEW MEXICO OIL CONSERVATION COMMISSION

COMMISSION HEARING

SANTA FE, NEW MEXICO

Hearing Date AUGUST 1, 1984 Time: 9:00 A.M.

NAME	REPRESENTING	LOCATION
Genl. L. Paul	X T Y T / T W	SF, NM
DAN KLEUGER	ANADARKO	MIDLAND
BILL SULLIVAN	"	"
Paul E. Hannon	"	"
SCOTTY ALCOCK	"	"
Time 2:00	Guernsey & Hannon	Denver, CO
Paul E. Hannon	"	"
Ken ...	Kellogg - ...	...
Cliff S. Hearn	Chama Petroleum	Dallas, TX
Lois MAZZULLO	Chama Petroleum	MIDLAND, TX
Donner Merine	Merina Oil & Gas	Farmington, NM
Donny Endsley	Merine Oil & Gas	"
William F. ...	Campbell & ...	Antelope
W. T. ...	Y. O. ...	Santa Fe
Bob Fuller	Byram	Santa Fe
Dan ...	...	Santa Fe

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BLDG.
SANTA FE, NEW MEXICO

1 August 1984

COMMISSION HEARING

IN THE MATTER OF:

Application of Anadarko Production Company for salt water disposal and an unorthodox location, Eddy County, New Mexico.

CASE
8234

BEFORE: Commissioner Joe Ramey, Chairman
Commissioner Ed Kelley

TRANSCRIPT OF HEARING

A P P E A R A N C E S

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Division:

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A P P E A R A N C E S

For Chama Production: William F. Carr
Attorney at Law
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I N D E X

STATEMENT BY MR. KELLAHIN	5
STATEMENT BY MR. CARR	7
SCOTTY ALCORN	
Direct Examination by Mr. Kellahin	9
Cross Examination by Mr. Carr	30
WILLIAM D. (BILL) SULLIVAN	
Direct Examination by Mr. Kellahin	47
Cross Examination by Mr. Carr	67
LOUIS J. MAZZULLO	
Direct Examination by Mr. Carr	68
Cross Examination by Mr. Kellahin	79

I N D E X

WILLIAM D. SULLIVAN (RECALLED)

Redirect Examination by Mr. Kellahin 112

Recross Examination by Mr. Carr 122

STATEMENT BY MR. CARR 126

STATEMENT BY MR. KELLAHIN 129

E X H I B I T S

Anadarko Exhibit One, Structure Map 10

Anadarko Exhibit Two, Isopach 10

Anadarko Exhibit Three, Cross Section A-A' 10

Anadarko Exhibit four, Production Map 10

Anadarko Exhibit Five, C-108 48

Anadarko Exhibit Six, Graph 56

Anadarko Exhibit Seven, 61

Anadarko Exhibit Eight, 61

Anadarko Exhibit Nine, 61

Anadarko Exhibit Ten, 61

Anadarko Exhibit Eleven, Land Plat 64

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2
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4
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E X H I B I T S

Chama Exhibit One, Location Plat	70
Chama Exhibit Two, Log	72
Chama Exhibit Three, Cross Section	73
Chama Exhibit Four, Cross Section	75

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2
3 MR. RAMEY: Call next Case
4 9234.

5 MR. PEARCE: That case is on
6 the application of Anadarko Production Company for salt
7 water disposal and an unorthodox well location, Eddy County,
8 New Mexico.

9 Ask for appearances in this
10 matter.

11 MR. KELLAHIN: If the Commis-
12 sion please, I'm Tom Kellahin of Kellahin and Kellahin, San-
13 ta Fe, New Mexico, appearing on behalf of Anadarko and I
14 have two witnesses to be sworn.

15 MR. CARR: May it please the
16 Commission, my name is William F. Carr, with the law firm
17 Campbell and Black, P. A., of Santa Fe, appearing on behalf
18 of Chama Production Company, Inc.

19 I have one witness.

20 MR. PEARCE: Are there other
21 appearances in this matter?

22 (Witnesses sworn.)

23 MR. KELLAHIN: Mr. Chairman, I
24 have a brief opening statement.

25 You can note on our proposed
Exhibit Number One, which is the structure map, Sections 21

and 22, identified on that structure map.

The evidence will demonstrate to you that the well in Section 21 is the Anadarko operated well. It's called the Osage No. 1. It produces oil from the Cisco Canyon. That well also produces a significant amount of water.

This matter was the subject of Commission hearings last summer in July and September of '83. The subject matter of the prior hearings was a proposed disposal well for Anadarko's use for the water produced out of the Osage Well.

You will recall that in Section 22 there is a gas well symbol. That was the Antweil Well in which Chama and Anadarko competed for rights to the wellbore and Anadarko desiring to use that wellbore for disposal of water into the Cisco Canyon and Chama desired to re-enter that well and test for gas production in the Morrow formation.

The Commission entered an order giving Chama the first opportunity to re-enter that wellbore and in the event that that well was abandoned by Chama, Anadarko will have the rights to use that wellbore for disposal purposes.

Subsequent to that hearing Chama re-entered the well and has completed a well in the Morrow.

The application before you to-

1
2 day is our second effort to obtain an acceptable location
3 for a disposal well. The evidence will demonstrate to you
4 that the Cisco Canyon well produced in Section 21 has its
5 economic life considerably shortened if the operator has to
6 continue to truck away the produced water.

7 Evidence will also show you the
8 operator is of the opinion that the proposed unorthodox lo-
9 cation in this 40-acre tract in Section 22 is the optimum
10 location in which to drill a disposal well and to dispose of
11 water into the lower portion of the Cisco Canyon.

12 The evidence will demonstrate
13 to you that there is no impact on oil production from that
14 formation, if any is present, and will not violate anyone's
15 correlative rights.

16 We have two expert witnesses to
17 present to you today. One is a geologic expert witness that
18 will talk about the geologic reasons and justifications for
19 the location. The second witness is a reservoir engineer
20 that will talk about the reservoir engineering aspects of
21 the location.

22 We believe that at the conclu-
23 sion of the evidence we will be able to justify to you the
24 reasonableness of the location at this point and will re-
25 quest at that time your approval.

MR. CARR: May it please the
Commission, Chama Petroleum Company will present evidence
which will show that they have a substantial acreage posi-

1
2 tion in the west half of Section 22; that in fact they own
3 acreage in every 40-acre tract over there except the 40 ac-
4 res on which Anadarko proposed to locate its proposed dis-
posal well.

5
6 As Mr. Kellahin indicated, they
propose to dispose of produced waters in the Cisco Canyon.
7 We will present evidence that will show that disposing in
8 the Cisco Canyon will result in the watering out of zones
9 which are capable of producing in commercial quantities. We
10 submit that although there will be a conflict in the evi-
11 dence as to the producing capabilities of the Cisco Canyon
12 under the west half of Section 22, we will present a way in
13 which this matter can be resolved, and we will show you that
14 granting the application as filed by Anadarko would impair
correlative rights, would result in waste, and even though
15 there is a need for disposal of produced waters in this
16 area, that the proposal before you today is simply not the
17 answer.

18
19 SCOTTY ALCORN,
20 being called as a witness and being duly sworn upon his
oath, testified as follows, to-wit:
21

22 DIRECT EXAMINATION

23 BY MR. KELLAHIN:

24 Q Mr. Alcorn, for the record would you
25 please state your name and occupation?

1
2 A My name is Scotty Alcorn and I'm the Di-
3 vision Geological Engineer for Anadarko Production Company
4 in Midland, Texas.

5 Q Mr. Alcorn, have you previously testified
6 before the Oil Conservation Commission of New Mexico and had
7 your qualifications as an expert petroleum geologist ac-
8 cepted and made a matter of record?

9 A Yes, sir, I have.

10 Q Would you describe for us generally what
11 your duties and responsibilities as a petroleum geologist
12 for Anadarko are?

13 A My duties as a petroleum geologist are to
14 supervise the development geology for the company and with
15 three geological engineers that I supervise, we handle all
16 the operations in the West Texas/New Mexico Area. I'm thor-
17 oughly informed of the township in question, 19 South, 25
18 East, as we have, Anadarko has various operations in this
19 township.

20 Q Is one of three petroleum geologists un-
21 der your direct supervision and control, Mr. Alcorn, is that
22 Mr. Rick Erickson?

23 A Yes, sir, he's our -- our expert in this
24 area.

25 Q Mr. Erickson prepared, subject to your
supervision, certain exhibits for you to discuss today?

 A He did, yes.

 Q And have you -- and, Mr. Alcorn, have you

1 reviewed Anadarko Exhibit Number One, which is the structure
2 map --

3 A Yes, sir.

4 Q -- to determine whether in your own opin-
5 ion it's true and accurate?

6 A Yes, sir, I have.

7 Q And is that true also of the Isopach,
8 which is Anadarko Exhibit Number Two?

9 A Yes, that's true.

10 Q And Exhibit Number Three, which is the
11 cross section that we've placed upon the wall?

12 A Yes, sir.

13 Q And have you also reviewed and concur in
14 the correctness of the data projected on the production map,
15 which is Exhibit Number Four, I believe?

16 A I have, yes.

17 Q All right. Mr. Alcorn, how long have you
18 been a practicing petroleum geologist?

19 A Since 1950.

20 Q And how long have you been employed by
21 Anadarko?

22 A Approximately four years.

23 MR. KELLAHIN: We tender Mr.
24 Alcorn as an expert petroleum geologist.

25 MR. RAMEY: He is so qualified,
Mr. Kellahin.

A Thank you.

1
2 Q Mr. Alcorn, let me direct you to Anadar-
3 ko's Exhibit Number One.

4 A All right.

5 Q And have you identify that exhibit for
6 us.

7 A This is a structure map of the four town-
8 ship area with 19 South, 25 East in the southwest quadrant
9 of the map, that Sections 21 and 22 are approximately seven
miles southwest of Dayton, New Mexico.

10 The structure map is contoured on top of
11 the Canyon Lime, which we will refer to in the cross section
12 as the top of the carbonate bank in the area, the Cisco Can-
13 yon carbonate bank.

14 Q Mr. Alcorn, are you of the opinion that
15 the top of the Cisco -- of the Canyon Lime is a readily
16 identifiable geologic marker upon which to map the struc-
ture?

17 A Yes, sir. It's recognized in the area.
18 I don't think there's any trouble with the contouring of
19 this. It's basically a regionally one-foot per mile -- I
20 mean 100 feet per mile southeast dip in the area. The
21 strike is on a northeast/southwest direction in the -- in
the township.

22 Q Let me direct your attention to Section
23 21 and have you identify and describe the Anadarko well
24 that's located as the oil well symbol in Section 21.

25 A Section 21 was originally drilled by Co-

1
2 quina as their Osage No. 1. The well was drill stem tested
3 on the way to the Morrow and found that there was an oil
4 zone identifiable on a drill stem test in what we are refer-
ring to as the Cisco Canyon A Zone.

5 Subsequent to their plugging the well
6 out, Anadarko acquired the rights in the area, re-entered
7 the well, and made a Cisco Canyon producer. The rate is, on
8 a 10-day producing rate, it was capable of making 50 barrels
9 of oil and 1000 barrels of water a day from the upper zone
10 in the Cisco Canyon.

11 Q All right. Directing your attention to
12 Section 22, the section to the east of 21, would you identi-
13 fy and describe for us in a general way the gas well symbol
located in that section?

14 A The gas well symbol is -- was originally
15 drilled by Antweil as their B & B No. 1; was subsequently
16 plugged and abandoned. Chama re-entered it and made a, as I
17 understand, a shut-in Morrow gas well, and I do not have the
18 production history of that. They are presently perforated
19 in the Morrow.

20 Q All right, sir, and the red arrow indi-
21 cates what, Mr. Alcorn?

22 A The red arrow indicates an area of inter-
23 est of the proposed salt water disposal well that we would
24 like to drill down dip from our Section 21 well to dispose
25 in the Lower Cisco Canyon, that we deem is a non-productive
zone.

1
2 Q All right, sir, are you aware of the sig-
3 nificance, if any, of the yellow shaded area and then the
4 yellow hatch marked area?

5 A Yes, sir, the yellow shaded area is bas-
6 ically controlled by Anadarko and the hatched mark area is
7 -- we have a significant interest in this, in those leases.

8 Q What is the current number of acres dedi-
9 cated to wells that produce out of this Cha Cha Cisco Canyon
10 Pool?

11 A In the -- our well?

12 Q I'm sorry, we're in -- this is the Dagger
13 Draw. I'm thinking of something else. What is the spacing
14 pattern for the Cisco Canyon well?

15 A 160 acres spacing pattern in the North
16 Dagger Draw.

17 Q And what is the acreage dedicated to the
18 Osage, Anadarko Osage No. 1 Well?

19 A 160 acres.

20 Q And is that the northeast quarter?

21 A Yes, sir, the northeast quarter.

22 Q Would you help orient us now, Mr. Alcorn,
23 to, confining your comments to the Cisco Canyon production,
24 would you identify where the closest Cisco Canyon oil pro-
25 duction is, apart from your Osage No. 1 Well?

26 A It would be in the North Dagger Draw
27 Field, approximately a mile to the northwest. Now the well
28 in Section 16, I believe, has been plugged out, but the

1
2 North Dagger Draw is producing from what Anadarko deems is
3 the C and B Zone of the Cisco Canyon.

4 Q All right, are those wells the ones gen-
5 erally located up in Section 5 and 6 over there to the north
6 and west?

7 A The wells in Section 5 and 6 are Yeso
8 wells that we will show on a production map and I think it
9 will be Exhibit Four.

10 Q Okay. Of the sections surrounding Sec-
11 tion 21 and 22 --

12 A Yes, sir.

13 Q -- confining your comments to those sec-
14 tions, would you identify any wells in each of those adjoin-
15 ing sections that produce oil out of the Cisco Canyon?

16 A In adjacent, the section to the north of
17 Section 21, which is 16, was a well that has subsequently
18 been plugged and abandoned after .6 MBO was produced out of
19 that well, and it was out of the B and C Zone.

20 Q All right, let's go to Section 15, are
21 there any Cisco Canyon wells in 15?

22 A No, sir. The well that's producing in
23 the northeast quarter is a Morrow well.

24 Q All right.

25 A In Section 14 there's a Morrow well pro-
26 ducing.

27 Q Going down to Section 23, are there any
28 Cisco Canyon oil wells in that section?

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A No, sir.

Q Section 26?

A No, sir.

Q Going across to Section 27?

A No, sir.

Q Going across to Section 28?

A The well in the north half of 28 is dedicated to the Atoka and the well in the south half is a Morrow test.

Q Are there any Cisco Canyon oil wells in Section 29?

A No, sir.

Q Going north, then, to the west section offset for 21, we'd be in Section 20. Are there any Cisco Canyon oil wells in that section?

A No, sir, there's a producing well in the south half of 20, which is a dual out of the Strawn and the Morrow.

Q All right, let's look at Section 17. Are there any producing Cisco Canyon oil wells in 17?

A At the present time there are four wells that are completed that were completed from the Cisco Canyon. The northwest well in the northwest quarter of Section 17 is the only one currently producing from the Cisco Canyon.

Q What's the status of the others?

A The well in the northeast quarter is

1 plugged and abandoned. The well in the southeast of 17 is
2 shut-in and the well in the southwest quarter of 17 is tem-
3 porarily abandoned.
4

5 Q Would you describe for us, Mr. Alcorn,
6 whether or not you have an opinion about the structural rela-
7 tionship or the significance of structure in determining the
8 appropriate disposal location in Section 22?

9 A It is my opinion that structure is --
10 consists of an integral part of the area and that as these
11 are stratigraphic zones within the Cisco Canyon, the struc-
12 ture does play a great part in that the water -- down dip,
13 we feel, as though are water bearing to the producing zones.

14 In the North Dagger Draw it is evident
15 that the down dip wells are now noncommercial from the as-
16 sumption of a water drive that has probably watered them out
17 in the -- as to being oil productive on a commercial basis.

18 So we feel as though we would like to go
19 at a rate down dip from any oil production to dispose of any
20 water in a zone that is not significant to develop oil.

21 Q I believe in your discussion of the Cisco
22 Canyon you identified or divided the Cisco Canyon into four
23 possible producing zones?

24 A Yes, sir, for Anadarko's purposes we have
25 divided it into four definite zones that we'll be seeing in
26 our cross section A-A'.

27 The zones are separated by shale, shale
28 zones approximately 10 feet thick or more that separates the

1
2 A, B, C, and D zones from each other.

3 Q And we'll discuss in a moment in detail
4 those zones, Mr. Alcorn. For purposes of my -- of your tes-
5 timony now, though, my question is what is the shallowest
6 zone? How is that identified in the Cisco Canyon?

7 A The shallowest zone is, we identify it as
8 the A Zone.

9 Q And then the deepest zone would be the D.

10 A The deepest zone would be the D Zone.

11 Q All right, sir. Let's go now to Exhibit
12 Number Two, Mr. Alcorn.

13 A Yes, sir.

14 Q Would you identify Exhibit Number Two for
15 us, please?

16 A All right, the Exhibit Number Two is an
17 Isopach map on the Canyon A Zone, prepared by Rick Erickson
18 under my supervision.

19 It is -- pinches out or thins to the
20 northwest and also thins to the southeast. This is merely
21 the A Zone that we deem productive in the area.

22 Q All right, let me go back and have you
23 explain to us what you mean by the Canyon A Zone in terms of
24 mapping this Isopach.

25 A Yes, sir.

Q On the cross section, Exhibit Number
Three, I note that you have labeled an interval as Cisco
Canyon A Zone.

1
2 A Yes, sir, I have.

3 Q What portion of the Cisco Canyon A Zone
4 has been Isopached on Exhibit Number Two?

5 A The gross interval, to show where it's
6 thickening to the northwest into the North Dagger Draw. We
7 feel as though it's, well, it's in the type log for the
8 North Dagger Draw shows that the porosity lenses out as you
9 go up dip to the northwest. It is carried downward to the
10 southeast and can be correlated clear to 19 South, 25 East,
the well in question, or the Ralph Nix well.

11 Q All right. This is not an Isopach of the
12 B, C, or D Zones?

13 A No, sir, simply the A that we deem is the
14 producing zone in the Osage Well.

15 Q All right, and this is a gross Isopach of
the total interval.

16 A Yes, sir.

17 Q In the A Zone.

18 A Yes, sir, the carbonate Isopach.

19 Q With regards to Sections 21 and 22, do you
20 have an opinion as to whether or not there is any reasonable
21 expectation of oil production from the B, C, and D Zones?

22 A We do not feel from the studying the logs
23 that the B, C, and D Zone would contribute any hydrocarbons
on a commercial basis.

24 In our well Coquina tested the Osage No.
25 1 and got a -- recovered 100 percent salt water out of the C

1
2 Zone.

3 Q All right.

4 A It is very definite that that well is --
5 that zone is porous.

6 Q In your opinion is the A Zone the only
7 zone in the Cisco Canyon that is likely to be oil productive
8 in paying quantities?

9 A Yes, sir, but you get an extensive amount
10 of salt water when you produce out of the A Zone.

11 Q Let me have you go to Exhibit Number
12 Three at this point, Mr. Alcorn, and it would be helpful if
13 you'd use the pointer and go to the one we've put on the
14 board.

15 Thank you, if I may move over here, with
16 your permission, I would like to show our cross section A-A'
17 from the Dagger Draw type log in the Dagger Draw Field
18 through the Anadarko Osage Well No. 1 to the Chama Morrow B
19 & B No. 1, over to 19 South, 26 East, the Ralph Nix A No. 1,
20 which is currently a disposal well in the area.

21 Q All right, let's don't get too far ahead
22 of me, now.

23 A Okay.

24 Q On Exhibit Number One, which is the
25 structure map --

26 A Yes, sir.

27 Q -- would you locate for us the Ralph Nix
28 Well?

1
2 A The Ralph Nix Well is in Section 18 of 19
3 South, 26 East, approximately one, two, three miles in an
4 easterly direction from the area in question.

5 Q Describe for us the geologic information
6 about the Ralph Nix Well, Mr. Alcorn.

7 A All right. The Ralph Nix Well was taken
8 as -- is a salt water disposal well that's been plugged back
9 from the Morrow to a depth of 8127 -- pardon me for getting
10 in the way.

11 The packer is set in the top of the D
12 Zone and water is being disposed in the D Zone and 5-1/2
13 casing is at 8259. The packer is set at 7978. The perfora-
14 tions are within this zone. The top of the cement is below
15 the porosity. So the D Zone is a recognized salt water dis-
16 posal zone in the area.

17 Q All right, let's go to the east, then --
18 I'm sorry, to the left of the cross section moving to the
19 west. What is the next well?

20 A The next well is the -- presently the
21 Chama, formerly the Antweil B & B No. 1. The well, when it
22 was drilled to the Morrow, on the way down tested the com-
23 plete Cisco Canyon section, the carbonate section, and re-
24 covered 100 feet of free oil, oil and gas cut mud, and 5900
25 feet of salt water.

26 The Morrow was abandoned and was plugged
27 back and not -- the Morrow was abandoned, a straddle packer
28 test was made to attempt to find where the water was. The

1
2 upper zone was straddle pack tested in the Upper A porosity
3 and recovered 6500 feet of sulphur water.

4 They then abandoned the operations on
5 that well.

6 Q Using -- what kind of a log do you have
7 projected on the cross section for the Chama well?

8 A Compensated neutron formation density
9 log.

10 Q And you can read porosity from that log,
11 can you not?

12 A Yes, sir.

13 Q What have you indicated in the Cisco Can-
14 yon by the shaded blue areas, Mr. Alcorn?

15 A The shaded blue area is basically an area
16 on the -- I forget which log it is, may I look at my notes,
17 please?

18 The shaded blue area is merely the four
19 percent line on the compensated neutron log to show in ex-
cess of four percent porosities on the compensated neutron
log.

20 When we --

21 Q All right, let me ask this, sir.

22 A All right.

23 Q What is the vertical distance in feet
24 from the top of the A Zone to the base of the D Zone?

25 A The top of the B --

Q D, base of the D.

1
2 A Top of the A to the base of the D, approximately 400 feet.
3

4 Q Within that 400 foot interval can you
5 identify for us how many zones have been indicated as having
6 porosity of four percent or greater?

7 A On this map, this by the compensated neutron,
8 no, the compensated neutron log, we have the upper A,
9 the lower A, a couple of zones, minor zones in the B, consistent zone in the C, and a zone in the D.

10 So that is one, two, three, four, five.

11 Q Do you have an opinion based upon your
12 study of the geology as to which of those zones has the
13 greatest possibility of being oil productive?

14 A Yes, sir.

15 Q And what zone is that?

16 A That is the lower portion of the A Zone,
17 which is correlative to a zone, the A production in the
18 Osage No. 1.

19 Q All right, prior to abandoning -- prior
20 to Antweil's abandoning the well, did Antweil conduct a
21 second drill stem test over the A Zone?

22 A Over the upper portion of the A Zone.
23 They did not test the lower portion of the A Zone on the
24 straddle packer test.

25 Q All right, on the straddle packer test
for the second drill stem test, what did that drill stem
test show?

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A 100 percent water and 6500 feet of sulphur water.

Q All right, let's move across then to the Osage Well, the Anadarko Well log.

A Yes, sir.

Q All right, would you identify for us those areas in which you have shaded blue and tell us what the blue shading identifies?

A The blue shading identifies any porosity on the density log, which was run by Welex, and the shading is in the compensated neutron log, which is more optimistic. We've shaded anything in excess of four percent on the neutron log.

The difference in the color, now, shows that the red indicates the drill stem test that Coquina made in the A Zone and recovered 840 feet of oil and 930 feet of salt water, so that's why the red is deemed potentially productive.

Q All right, let's start at the bottom and work up.

A Okay.

Q The lowest shaded area with porosity of four percent or greater, has that zone been subject to a drill stem test?

A No, sir.

Q In your opinion, based upon the log analysis, is that likely to be oil productive?

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A No, sir.

Q Why not?

A Because the evidence of the high resistivity that we could not get an accurate calculation. It did not show that the -- by the high resistivity it did not indicate permeability to any great extent in that area.

As coming up the zone in the C Zone, on the original well in the open hole the C Zone was drill stem tested very adequately by the mark here that carried through the porosity; recovered 5795 feet of salt water with no show of hydrocarbons in the C Zone.

Q All right, let's go up to the B Zone now. Has that been tested?

A No, sir. The B Zone has not been tested, but we ran calculations and feel as though it does not indicate hydrocarbons.

Q All right, sir, let's go up to the A Zone.

A Yes, sir.

Q Is that where the well is now completed and capable of producing 50 barrels of oil a day?

A Yes, sir, from two blips, this is perforated in this zone and this zone. We -- the better porosity zones in the A were perforated. In the lower A we did not perforate that because we were fearful of a high volume of water.

Q All right. Let's go across to the last

1
2 well, the Hanks Well.

3 A The Hanks Well --

4 Q Where is that well?

5 A The Hanks Well is a type log in the North
6 Dagger Draw Field. Hanks subsequently sold his interest to
7 Conoco, so those are carried as Conoco wells in North Dagger
8 Draw.

9 It is merely a type log to show that
10 their productive zones in the field are from the B and the C
11 Zones. They are -- these wells were drill stem tested and
12 recovered oil and gas cut mud and oil and gas cut water in
13 the B Zone and in the C Zone recovered -- had gas to sur-
14 face, fluid to the surface in 20 minutes, and recovered 630
15 feet of oil and gas cut mud on the drill stem test, so that
16 was a flowing well in the B Zone of oil and no -- no nota-
17 tion of salt water; the C Zone showing that from this area
18 was 100 percent water up dip, 100 percent oil, so we feel
19 that the structure is very indicative in that zone.

20 Q Let me ask you some comparisons between
21 the Anadarko Osage Well and the Chama B & B Well in the A
22 Zone.

23 A All right.

24 Q You've told us that there are portions of
25 the A Zone that are productive in the Anadarko Well.

26 A Yes.

27 Q Would you correlate -- do those zones
28 correlate to the Chama Well?

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A The upper zone that is perforated in the Osage Well was -- we do have oil and water out of the upper zone.

 The upper zone in the B & B Well was straddle pack tested and recovered 100 percent sulphur water, reported.

Q All right, in your opinion would that portion of the A Zone in the Chama Well be productive of oil?

A No, sir, I feel as though this zone has oil and water and in the Chama Well it has 100 percent water by drill stem test and by calculation.

Q Do you see any other comparisons in the A Zone between the Osage Well and the Chama Well?

A Yes, sir. In our lower part here, we are also producing oil and water and in the Chama Well we feel as though by calculations, I think this is calculated as 30 percent water saturation, which is within the limits of industry. We think that 45 percent water saturation is the breakover point. We feel as though this could be perforated and become a well of sorts. We don't know what the water cut would be because we're cutting 1000 barrels a day out of this one.

Q Identify for us what will be the disposal interval in the Cisco Canyon disposal well.

A We have listed here as the proposed location, which can be, over to the map, the surface structure

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2 map question, it will be between the Osage and the Chama
3 Well and the cross hatched interval from the top of the C
4 Zone through the D. We will not perforate anything above
5 the C Zone, which was water wet in our well on drill stem
6 tests.

7 Q Would you describe for us why you have
8 divided the Cisco Canyon into four separate zones?

9 A The four separate zones were merely a
10 correlation and I think various companies divided them by
11 the shale breaks. We can correlate these markers across the
12 area and it's for convenience of isolating zones of poros-
13 ity.

14 The -- some companies may label them 1,
15 2, 3, or something else, and we label them A, B, C, and D
16 for significant correlations on these shale markers that are
17 correlative from 19, 26, over to the west half of 19, 25.

18 Q What will be the structural relationship
19 between the disposal interval and the Cisco Canyon A Zone in
20 the Chama Well?

21 A The disposal interval will be consider-
22 ably lower than any production that could be encountered in
23 the A Zone subsurfacewise. The C would be here and it would
24 be approximately, oh, 100 feet below the potential producing
25 interval in the A Zone.

26 Q All right. What are your geologic
27 reasons, Mr. Alcorn, for picking the proposed location at
28 this point in Section 21 and 22?

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2 A The geologic reasons are of a sound bear-
3 ing because we do have control, well control, between the
4 Osage and the B & B, the Chama Well. We do have very good
5 well control and we do have a drill stem test that condemned
6 the C Zone in the Osage No. 1 that calculates wet in the B &
7 B No. 1, also. So we feel as though we would not be conta-
8 minating any of the potential pay in the A Zone by leaving
9 -- we are not even attempting to contaminate the B Zone at
10 all, so we're just C and D Zones and by history of the area,
11 this is noted as a dolomitized carbonate bank with each zone
12 having sealed, nonporous limestones between it. So each
zone is -- is separated by impervious limestone.

13 Q All right, sir, thank you.

14 A Yes, sir.

15 Q All right, sir, let's go to Exhibit Num-
16 ber Four, and have you identify that exhibit for us.

17 A The Exhibit Number Four is a production
18 map of the Township 19 South, 25 East, in Eddy County. All
19 of the information derived is from public record from the
20 engineering report of production past and present in the New
Mexico area.

21 The -- each well that has produced or is
22 producing is identified by a recognized producing interval
23 on color code, which is found in the legend on the bottom
part of the map.

24 Q Let me direct your attention to the wells
25 colored in red. I'm sorry, colored in blue, which are the

1
2 Cisco Canyon wells?

3 A Yes, sir.

4 Q I want you to identify those in terms of
5 the zone in the Cisco Canyon that is productive.

6 A All right.

7 Q You don't have to do each one of them but
8 tell me generally what the trend is.

9 A Okay. The trend in, say, the Tier 16,
10 17, and 18, 19, 30, and 31, which comprises the North Dagger
11 Draw Field, is producing from the B and C Zones of the Cisco
12 Canyon.

13 As you will note in 16 and the easterly
14 part of Section 17, down in 30 and 31 those wells are either
15 plugged or temporarily abandoned, it is apparent that the
16 possible water encroachment on the -- out of the C Zone is
17 going in a northwesterly or up dip direction, which really
18 it gives more credence of an interval from the A Zone in
19 Section 21 that is not connected in any way with the North
20 Dagger Draw.

21 It looks like the -- it's very evident
22 that the C Zone is watered out down dip.

23 Q Let me show you something, Mr. Alcorn. I
24 want to show you paragraph out of the New Mexico statute,
25 which is 70-2-12, and it's a paragraph (4).

26 This is part of the enumerated statutory
27 responsibilities of the Oil Commission, Mr. Alcorn, and it
28 says in 70-2-12: (4) to prevent the drowning by water of

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2 any stratum or part thereof capable of producing oil or gas,
3 or both oil and gas in paying quantities, and to prevent the
4 premature and irregular encroachment of water, or any other
5 kind of water encroachment, which reduces or tends to reduce
6 the total ultimate recovery of crude petroleum oil or gas,
or both such oil and gas, from any pool.

7 A Yes, sir.

8 Q With regards to that responsibility, Mr.
9 Alcorn, do you have a geologic opinion as to whether or not
10 the use of a disposal well as Anadarko proposes in the lower
11 D and Z -- C and D Zones at this location will violate that
12 statutory responsibility?

13 A I have an opinion. I feel as though it
14 will not violate it in any sense.

15 Q All right, sir, would you give us the
16 reasons you believe that to be true?

17 A The reasons being that the C Zone has
18 been adequately tested by drill stem test; shows to be water
19 bearing, void of hydrocarbons, and that it is in no way in-
20 terconnected with the B or A Zones above by nonpervious
limestones.

21 We feel as though it would be contained
22 within the C and D and would enhance opportunities for drill-
23 ing for oil in the A Zone in the area.

24 MR. KELLAHIN: That concludes
25 my examination of Mr. Alcorn.

(Thereupon a recess was taken.)

MR. RAMEY: The hearing will come to order.

Are there any questions of Mr. Alcorn?

MR. CARR: I have a few.

MR. RAMEY: Mr. Carr.

CROSS EXAMINATION

BY MR. CARR:

Q Mr. Alcorn, if I understand the general drift of your testimony it is that you do not believe that there are reserves under the west half of Section 22 that would be impaired by your disposal plans.

A That's correct.

Q Now, your Exhibit Number One, which was prepared by Mr. Erickson, is your or Anadarko's geological interpretation of this area, is that correct?

A That's correct.

Q And what data was used in preparing this exhibit?

A The top of the Cisco Canyon.

Q And did you plot that using the wells which are depicted on this exhibit?

A Yes sir. The points are below each well designation, the points available in the section, in the

1 township.

2 Q So when I look at the Antweil B & B Well
3 and you have a -4184, that's where the top of the Cisco was
4 encountered in that well.

5 A Yes, sir.

6 Q Did you have any data on the South Boyd
7 Well which is -- has been drilled by Chama in the north half
8 of Section 27?

9 A No, sir, it was not available to us.

10 Q Data from that well concerning commercial
11 production or potential for that in the Cisco might change
12 your interpretation, is that correct?

13 A Until I see it would not know how to an-
14 swer that question.

15 Q But if it did show commerical production
16 in the upper zone, that would change this interpretation,
17 would it not, if it did?

18 A If anything showed commercial production
19 it would have to be reiterated into the mapping and it would
20 have to be taken into consideration, because we don't know
21 in which zone it would be productive.

22 If it was in the A Zone, then it would go
23 along with our thinking that possibly there is some A Zone
24 production in -- down dip from the North Dagger Draw.

25 Q Now I believe you testified that in re-
entering the B & B Well that there was a -- they made as
shut-in Morrow Well.

1
2 A That is the information I have. I'm not
3 familiar with their production. That's all I've heard.
4 That's the only --

5 Q And you do not have any current produc-
6 tion history on that well?

7 A I do not. Maybe our reservoir engineer
8 might. I -- I was not charged with finding the current sta-
9 tus of that.

10 Q Now the proposed disposal well, is that
11 more than half a mile from the B & B Well?

12 A Yes, sir.

13 Q About how far would you say that is?

14 A Oh, it's approximately a mile and, oh, a
15 half a mile, 1000 feet over a half a mile.

16 Q You testified in reference to Exhibit
17 Number One that the yellow shaded area indicated Anadarko's
18 ownership in the area.

19 A Yes, sir.

20 Q Do you happen to know what ownership
21 Chama may have in the northwest quarter of Section 22?

22 A I do not have. We have a landman. I
23 could consult with him if you care for me to.

24 Q Would you agree that they have an owner-
25 ship interest in each of the 40-acre tracts in the west half
26 of Section 22 except for the tract on which the disposal
27 well is located?

28 A I'd not agree unless I had consultation

1
2 with our landman.

3 MR. KELLAHIN: Let me interject
4 a comment.

5 We have an exhibit in the pack-
6 age that Mr. Sullivan will testify to --

7 MR. CARR: All right.

8 MR. KELLAHIN: -- about owner-
9 ship.

10 MR. CARR: Okay, we'll defer
11 that.

12 Q If I ask you other questions, Mr. Alcorn,
13 that Mr. Sullivan should handle, by all means send me that
14 direction.

15 A Okay.

16 Q Is the Osage Well currently producing?

17 A Yes.

18 Q And you gave me some -- I believe testi-
19 fied that it was producing at a certain rate over a ten day
20 period, 50 barrels of oil and 1000 barrels of water.

21 A That was a ten day rate of our produc-
22 tion. Right now we are producing at -- I wrote a note here,
23 let me -- we're now producing it as a skimming operation to
24 minimize expenses until this request is acted upon.

25 Q Are you producing it every month?

A Yes, sir.

Q And does the figure of 10 barrels -- I'm
sorry, 1000 barrels of water and 50 barrels a day, is that

1
2 an accurate figure based on your --

3 A That is an accurate figure on a ten day
4 well test, to show the capabilities of the well.

5 Q You talked about a drill stem test that
6 had been run on the Osage Well.

7 A Yes, sir.

8 Q Was a substantial volume of water pro-
9 duced with that, during that drill stem test?

10 A There were two drill stem tests, one in
11 the Canyon A Zone and one in the Canyon C Zone. Which zone
12 are you referring to?

13 Q Did both of those tests produce substan-
14 tial volumes of water?

15 A The upper zone produced 930 feet of salt
16 water. The lower zone produced 5795 feet of salt water, so
17 the A, the test in the A Zone was within reason, 840 feet of
18 oil and 930 feet of salt water. That was approximately 50
19 percent.

20 Q When you produce that much water can it
21 affect the actual reading of the DST, your actual reading of
22 the oil?

23 A The reading of the oil?

24 Q Can the --

25 A When you produce the --

Q When you produce this much water, can't
it actually mask the true limits of the oil zone in the
well?

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2 A If you produce that much water it is de-
3 pendent upon your pumping capacity whether it masks the oil
4 or not.

5 Q Do you know --

6 A If you put a -- if you put a small pump
7 on, you might produce 100 percent water.

8 Q Do you know the details of how this test
9 was taken?

10 A The pumping test, the 10 day pumping
11 test?

12 Q On the A Zone, the drill stem test on the
13 A Zone?

14 A No, this was conducted by Coquina and it
15 was public information that was available to us. We took it
16 as the information that they had allowed to the industry.

17 Q Now I believe your testimony, and correct
18 me if this is wrong, indicated that you anticipated oil pro-
19 duction to be from the upper zone, the top zone, or the up-
20 permost portion of the Canyon interval, is that correct?

21 A It is in the A Zone of the Canyon inter-
22 val that we perforated. We felt as though we were trying to
23 maximize the potential of oil by produce -- by perforating
24 two zones in the A.

25 Q And that would apply to the Roger Hanks
Barbara No. 1 Well in the Dagger Draw Pool?

 A In what method do you mean would it apply
to?

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Q Your statement that the production would come from the uppermost zone, you would anticipate that that statement would apply to wells in the Dagger Draw?

A No, it would not apply to the wells in the Dagger Draw because they are not producing from the same recognized interval as the Osage No. 1. They're producing from the B and C Zones and we're producing from what we call the A Zone.

Q So the -- on your Exhibit Number Three, the R. C. Hanks that you indicated as a type log, that -- that indicates just B and C production.

A Yes, sir. You can see that the A production does not have any porosity and -- or the A zone, pardon me, the A Zone did not have any porosity indicated on the log.

Q Are you aware of production from the D Zone in the Dagger Draw Pool?

A No, we evaluated and did not see any D Zone.

Q Did you evaluate the log on the Barbara Federal No. 2 in Section 18?

A No, sir. Oh, which one are you -- which Section 18 are you talking about?

Q I'm sorry, I'm talking about 18, Township 19 South, Range 25 East.

A No, sir.

Q Have you evaluated other zones in this

1
2 area for possible disposal?

3 A We've attempted to, yes, sir.

4 Q Have you evaluated the Devonian as a pos-
5 sible disposal well?

6 A The way I understand it, the Devonian is
7 a possible disposal, but the wells are so sparsely carried
8 and this is my understanding, that in 20 South, 25 East,
9 there is a Devonian disposal well operated by Conoco and the
10 well was carried 500 feet into the Devonian and I assume
11 that it was because of the porosity was so erratic that it
12 would lead you to believe that by simply drilling a Devonian
13 well you do not have a disposal well, just because of the
14 penetration.

15 So it would, at that depth it would --
16 until we found more information available on the history of
17 the Devonian, it would be drilling a wildcat for a disposal
18 well.

19 Q Are you familiar with the Roger Hanks
20 King disposal well in 9, 20 South, 25 East?

21 A I think that is out of the Devonian, that
22 I said 5, I believe it's in that area and it had to pene-
23 trate 500 feet.

24 Q Is that the well you're talking about?

25 A Yes, sir.

Q The Conoco well?

A I don't have it on the map so I was
trying to refer to it from memory.

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2 Q Now if we had a zone that was capable of
3 producing oil in commercial quantities, and if you disposed
4 water in that zone, in your opinion would it damage that
5 zone?

6 A Well, you're talking about the possibil-
7 ity of -- of going against any idea of water injection in
8 your water injection fields. We're either getting into the
9 disposals or the injection part and so I can't broadly say
10 that -- that, We're using injection wells all around Loco
11 Hills for -- to enhance production.

12 So I can't say that anything that's dis-
13 posed in a system is going to actually ruin it, but we don't
14 feel as though the C Zone is productive in the area and
15 being 100 feet removed from the A Zone, Mr. Carr, we -- we
16 don't feel as though there's going to be any contamination
17 whatsoever.

18 Q To be sure I understand your answer, was
19 your answer that just injection per se to a zone that has
20 commercial oil wouldn't necessarily damage that zone? Was
21 that your testimony?

22 A My testimony was it has to stand on indi-
23 vidual. The -- you're talking -- are you talking about in-
24 jection or water disposal?

25 Q I'm talking about if you dispose of water
in, say, the C Zone in the proposed well in the Canyon --

A All right, sir.

Q -- and if that zone had commercial oil in

1
2 it, would you be damaging the reservoir at that location?

3 A If it had commercial oil in it, we would
4 attempt to get the oil. We do not feel from our calcula-
5 tions that it does -- that it has commercial oil or we would
6 not be asking for this.

7 Q We have your interpretation that shows
8 the west half of 22 will not be commercial, will not contain
9 commercial oil.

10 A In the C and D Zones.

11 Q We really won't know that until you ac-
12 tually drill the well, isn't that true?

13 A Well, from the information we have avail-
14 able, that's what we have to go by, is that we are between
15 two wells that have calculated, one has drill stem tested
16 wet, and the other one calculates wet in the C Zone.
17 We feel as though that's about as good a control as we're
18 going to get in any area, and I don't believe that commer-
19 cially anybody would want to drill to the C Zone between a
20 water well and one that calculates wet.

21 That's why we're not feeling as though
22 we're condemning anything that hasn't already been condemned
23 by geologic methods.

24 Q So your interpretation is based on your
25 geologic control.

26 A Yes, sir.

27 Q And that that will be confirmed or dis-
28 puted when you actually drill through those zones, will it

1
2 not?

3 A Yes, sir.

4 Q And wouldn't the best way to determine
5 whether or not there's commercial oil in those zones be for
6 Anadarko to agree to run drill stem tests in certain inter-
vals in the Canyon when they drill the well?

7 A If it does not become prohibitive cost
8 just for the sake of academics, forcing us to do it. If we
9 -- we would certainly not want to pass up an oil zone and
10 though we would evaluate it in a prudent manner, we consider
11 ourselves a very prudent operator, and we certainly wouldn't
12 run anything if -- if we did run a -- drill a disposal well,
we would evaluate it, certainly.

13 Q You'd evaluate the zones for oil produc-
14 tion in --

15 A In a prudent manner. We're not talking
16 about any exotic \$250,000 evaluation of the zones, of
17 course. We would certainly evaluate to our own considera-
18 tion. We're not in the water business, we're in the oil
19 business.

20 Q If you were able to drill a well and got
21 a show that indicated oil in a volume somewhere between the
22 Osage, the volume encountered in the Osage and the volume
23 encountered in the B & B Well, would you be willing to pro-
duce that as an oil well?

24 A In what zone?

25 Q In any of the zones in the Cisco?

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A If we are contracting to drill a salt water disposal well to dispose in the C and D Zones, that would be evaluated for oil, but we would take into consideration offsetting any good shows that would enhance our position.

 We'd have to have a disposal well in the area to do any drilling any more, anyway. We're just barely holding our own.

Q Would Anadarko be willing to test each of the intervals, run a drill stem test in the Canyon if Chama offered to farm out its interest to Anadarko if there were oil shows in the range between those encountered in the B & B and in the Osage Well?

 MR. KELLAHIN: I'm going to object to that question. That's a management decision for --

A I'm not qualified to make anything other than recommendations, Mr. Carr. I wish I were. I wish I could answer it.

Q Now is it your testimony that throughout this area the C and D Zones are not capable of commercial production?

A It is my interpretation and my geologic opinion that between the Osage and down dip to the B & B, that the C and D are not capable.

Q Does that opinion hold up dip from the Osage?

A We have no control up dip, sir.

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Q So you just don't know; there may be production up dip.

A There may be production up dip and if we got a disposal system in there we would certainly evaluate the possibilities of drilling.

We're not talking about up dip in the C. We're talking about up dip in the A; possibly the B. The only information we have is the C Zone in that and that the wells are being plugged out in the C Zone up dip in the North Dagger Draw and so we could not justify drilling a well to the C Zone for commercial purposes.

That's all I can say about that.

Q You also are ruling out drilling a disposal well in the C Zone to the east of the proposed location.

A To the east of the proposed --

Q I'm sorry, to the west.

A We feel as though we don't have the significant control that we do here. The control is the factor that we'd like to stay with and take advantage of.

And as we don't feel -- we don't feel as though we're hurting anybody's potentiality there and that's why we're putting it there.

Q There are four wells in Section 17.

A Yes, sir.

Q That are in the, I believe, North Dagger Draw Pool.

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A Uh-huh.

Q If I understand your testimony, they have been, I believe, and correct me on this, certain of those wells have been abandoned in the C Zone.

A They have been abandoned in the producing interval of the North Dagger Draw. We are not privy to subsequent work in those wells in 17. We, all we have is the information of production, Mr. Carr, and found that they were deemed as noncommercial and nonproductive at the present time. It's on this Exhibit Four.

Q Are they completed in the Cisco Canyon?

A Yes, sir, they are by the nature of the North Dagger Draw, they are completed in that field.

Q Are they -- do you know what zones, A, B, C, or D, they're producing from?

A It is my opinion through Mr. Erickson that they are producing from the B and C Zones. He, I asked him specifically before I left if there are any in the lower zone. He said that he had no record of it, and the A Zone is not porous up there.

Q So do you know whether or not -- what the problem is in the A Zone? Is it porosity or is there water also in the A Zone?

A We're in the assumption that the water, it is watered out. This is our assumption from hearing from Conoco. I would defer that to our reservoir engineer because this is just information I heard while he was discus-

1
2 sing his position in here as a reservoir analysis.

3 Q If they are watered out in the A Zone and
4 you have the same zone, the A Zone, from which you believe
5 you can produce your Osage that's watered out up dip from
6 you.

7 A No, sir, I did not say that. The A Zone
8 is nonporous in that area.

9 Q And you stated that it was also watered
10 out.

11 A No, I said the C Zone. If I said the A
12 Zone, then I stand corrected.

13 Q I believe you indicated that there was
14 impervious limestone separating the zones.

15 A Yes, sir.

16 Q Upon what do you base that conclusion?

17 A From analysis of samples in the area and
18 the history of the area, and then I would like to refer to
19 The Roswell Geological Society Symposium of the North Dagger
20 Draw Field, written by Robert E. Murphy in August of 1976,
21 and I quote, "Type Trap, Stratigraphic, porosity and dolo-
22 mite sealed by nonporous limestones. Gross and net porosity
23 in pay zone is highly variable."

24 And that is a matter of public record
25 through the Geological Society Symposium written about the
North Dagger Draw, and the information that I have seen
samples in the area there is nonporous and evaluating some
of the logs of the Chama Well and the Osage Well, we feel as

1
2 though the nonporous zones are separating and are in no way
3 interconnected to one porous zone to the other.

4 Q Mr. Erickson, if I understand your testi-
5 mony, you're talking about the wells in Section 17 and you
6 stated that the C Zone was watered out, not the A Zone.

7 A The C Zone appears to be by the analysis
8 of the production. We would have to assume that. I do not
9 have privy to the Continental records, but anything that's
10 down dip that's water bearing, you assume that it's going to
be watered out.

11 Q And those wells are up dip from your ac-
12 reage in Section 21.

13 A Yes, sir.

14 Q And the zones are separated by impervious
limestone.

15 A The C Zone that is -- that was productive
16 in there is not separated from the C Zone or could possibly
17 not be separated from the C Zone in our area. It could be
18 separated from B or A Zones or D Zones. As you go up or
19 down in the Cisco Canyon carbonate bank, you will find im-
20 pervious zones.

21 Q If the C Zone up dip from your acreage in
22 21 has been watered out, why can't you locate a disposal
well in 21?

23 A Because we do -- we -- this is hearsay
24 information and it is -- we would have to only make an as-
25 sumption that the distance between there is so much more

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2 than the distance between two noted locations in 21 or 22,
3 that we would have to make such an assumption that we don't
4 feel it warrants that when we've established that we're not
5 going to hurt any potential producing zones, anyway.

6 Q Yet you're assuming that you can locate
7 where you're proposing and that you won't have any adverse
8 effect.

9 A Yes, sir, because that's about as close
10 as you can get two wells on the spacing in there.

11 MR. CARR: I have no further
12 questions.

13 A Thank you, Mr. Carr.

14 MR. RAMEY: Any other questions
15 of Mr. Alcorn?

16 MR. KELLAHIN: No, sir.

17 MR. RAMEY: He may be excused.

18 MR. ALCORN: Thank you.

19 WILLIAM D. (BILL) SULLIVAN,
20 being called as a witness and being duly sworn upon his
21 oath, testified as follows, to-wit:

22 DIRECT EXAMINATION

23 BY MR. KELLAHIN:

24 Q Mr. Sullivan, for the record would you
25 please state your name and occupation?

A I'm Bill Sullivan. I'm a Division Reser-

voir Engineer for Anadarko Production Company in Midland.

Q Mr. Sullivan, have you previously testified as a petroleum reservoir engineer on behalf of Anadarko involving testimony before the Oil Conservation Division in this same Cisco Canyon Area?

A Yes, I have.

Q And pursuant to your employment by Anadarko have you made a study of the reservoir and engineering situation involved in Sections 21 and 22 in Eddy County, New Mexico?

A I have, and I've supervised the work by other members of our staff.

MR. KELLAHIN: We tender Mr. Sullivan as an expert petroleum reservoir engineer.

MR. RAMEY: He is so qualified, Mr. Kellahin.

Q Mr. Sullivan, let me direct you to Exhibit Number Five and have you identify for us what Exhibit Number Five is.

A This is a package of data, principally the Division Form C-108, Application for Authorization to Inject, and the required supporting data is attached to it.

Q Did you supervise and coordinate the tabulation of documents pursuant to the requirements of the C-108?

A Yes, sir.

Q Let me direct your attention to the ap-

1
2 plication itself in the Form C-108, and have you generally
3 outline for us what you propose to have the Commission ap-
4 prove for you as a result of this application.

5 A Our application is for a permit giving us
6 the right to drill a salt water disposal well into the Cisco
7 Canyon Zone at an unorthodox location as we've noted, giving
8 us the right to dispose of produced water in a specific zone
in the Cisco Canyon.

9 Q All right, let's turn to the plat that's
10 attached as the first attachment to the C-108. What's the
11 purpose of this plat, Mr. Sullivan?

12 A This is a land map that identifies, as
13 required, all wells within, I believe, a two mile area.
14 It's basically a copy of the land map, indicating ownership.

15 There is a circle drawn with a one-half
16 mile radius from our applied for location in the northwest
17 corner, northwest quarter section of Section 22. That
18 circle identifies the area of review of this application
with which we have to consider all wells.

19 Q Within that area of review, the half mile
20 radius circle, have you identified any producing wells or
21 plugged and abandoned wells that have penetrated the Cisco
Canyon?

22 A There is one producing well, it being our
23 Osage No. 1 Well in Section 21, immediately west. It is a
24 producing well, as we know, and it's the only well that has
25 penetrated the Cisco Canyon within that area of review.

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Q Immediately outside that area of review going to the east is the Chama operated B & B No. 1 Well?

A Yes, sir.

Q What is the propose disposal interval for the disposal well to be drilled at the location you requested?

A The specific interval is approximately 7800 feet to 8080 feet, which represents on the cross sections we've seen the C and D Zone of the Cisco Canyon.

Q With regards to the casing and cementing program that has been required on the Chama operated B & B Well, notwithstanding the fact that that well is more than a half mile away, has that well been adequately cased and cemented across the disposal interval?

A Yes, my understanding is it has been cemented across the disposal interval.

Q Let's turn to the tabulation of well information data after the plat itself, in which you've identified the location of the well data and the formation data. Let's go on down and discuss the system itself. Will this be a closed or an open system?

A I believe you'd call it an open system and it will be produced -- dispose of produced water from another well.

Q And let's direct your attention to the injection pressure. I assume you're aware the Commission without further proof limits surface injection pressures to

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2 forations.

3 A Yes, sir.

4 Q Are you familiar with that requirement?

5 A Yes, sir.

6 Q And what is your proposal with regards to
7 that surface limitation pressure?

8 A Our proposed maximum injection pressure
9 is 1500 pounds at the surface, which would be within com-
10 pliance of that .2 per pound -- .2 pound per foot gradient,
11 based on our 7800-foot top perf.

12 Q And for purposes of this application,
13 what are you seeking to be the maximum volume of water in
14 barrels per day to be disposed of into this well?

15 A Our application states up to 10,000 bar-
16 rels per day.

17 Q What are your current immediate needs for
18 a disposal well, Mr. Sullivan?

19 A Approximately 1000 barrels per day pro-
20 duced from our Osage No. 1 in conjunction with the oil pro-
21 duction.

22 Q All right, sir, would you generally de-
23 scribe for us your anticipated future needs for disposal in
24 the area?

25 A If we're able to establish watr disposal
capacity, we believe we have prospective locations to drill
additional Cisco Canyon wells in Section 21 that would be
development wells from our Osage. They would potentially

1
2 contribute to the additional injection volumes on this well.

3 Anadarko does also operate other wells in
4 the area that do produce some water.

5 Q Let's go then to the proposed completion
6 schematic on the salt water disposal well and have you de-
7 scribe that for us, the method to complete this for dispo-
8 sal.

9 A Of course, this well will have to be
10 drilled from the ground level. We would set surface pipe at
11 350 feet and circulate cement. We would plan to set an in-
12 termediate string at 1200 feet, which will comply with the
13 Commission guidelines in the area. I believe it requires it
14 to 1100 feet, more or less. That cement would likewise be
15 cemented to the surface behind the intermediate string.

16 We will plan to drill the well to approx-
17 imately 8150 feet and set a 5-1/2 inch string of casing and
18 make our best effort to circulate cement behind that string
19 and in any event we will tie the cement behind that string
20 back to the intermediate casing at 1200 feet.

21 We would then perforate the indicated
22 zone from 7800 to 8030 feet, discrete porosity zones in that
23 interval, and dispose through lined tubing with a packer set
24 on the bottom of it into the perforations in the C and D
25 Zone of the Cisco Canyon.

26 Q In your opinion will the proposed method
27 of casing and cementing for the disposal well be adequate to
28 isolate the disposal water and confine it to the Cisco Can-

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2 yon formation?

3 A Yes.

4 Q Where -- is there any fresh water pro-
5 duced in the area, Mr. Sullivan?

6 A There are some fresh water wells, wind-
7 mills, in the area produced for stock grazing water.

8 Q Approximately what is the depth of the
9 produced fresh water?

10 A I believe it's around 800 feet. It's
11 certainly above 1100 feet, which is the casing requirement.

12 Q In your opinion is the proposed method of
13 completion and casing adequate to insure that water disposed
14 of in the Cisco Canyon will not migrate through this well-
15 bore up into shallow fresh water aquifers?

16 A Yes, I believe it is sufficient.

17 Q Are you aware of any faulting or hydrolo-
18 gic connections between the Cisco Canyon and any fresh water
19 aquifers that would serve as sources of migration for dis-
20 posal water in the Cisco Canyon to contaminate those fresh
21 water aquifers?

22 A No, I'm not aware of any such factors.

23 Q Let's go to the tabulation, as required
24 in the C-108, of the wells within the half mile radius, and
25 that's your next attachment, is it not?

26 A Yes. Again there are two wells identi-
27 fied, one being the Anadarko Osage No. 1 in Section 21.
28 It's a productive oil well. It does produce out of the Cis-

co Canyon, certainly penetrates it.

Our casing string is set slightly above 8000 feet and adequately cemented across the Cisco Canyon zone.

The second well identified, well, I'm sorry, there's only one well identified. The original quote on there was Coquina's Osage No. 1. It's one and the same wellbore. Coquina drilled their well in 1973 and abandoned it without attempting completion.

Q Directing your attention to the Anadarko Osage Well, Mr. Sullivan, has that well been completed, cased and cemented, in such a way that water disposed of in the Cisco Canyon formation will not use that wellbore as a source to migrate fluids into fresh water aquifers?

A Yes, it has been.

Q All right, following the schematic is the geologic and engineering affidavit about the open faulting. You've already testified to that.

What is the next attachment, Mr. Sullivan?

A It will be a water analysis of produced water taken from our Osage No. 1. It would be produced water from the Cisco Canyon perforations.

It indicates that relative to other produced waters it is a somewhat of a, I'll call it brackish water. It's not certainly fresh water but it's not as saline or contaminated as other produced waters are.

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Q Okay. All right, and following the first one, what is the next water analysis?

A Immediately following that water analysis there are -- there are two water analyses, one taken from a tank at a windmill in Section 15; the second taken from a tank and windmill in Section 22. They are simply water analyses and by examination it can be seen that the comparison of the produced fresh water in the stock tanks is substantially different from the produced water of the Cisco Canyon, and we could readily identify the two waters and tell them apart.

Q Okay. Have you caused, pursuant to the C-108, to have all offsetting operators and the surface owner at the surface location for the disposal well notified as required of the pending application?

A Yes, we have.

Q And apart from the objection by Chama, are you aware of any objection by any of these people or companies that you have notified?

A There has been no other objection.

Q And then you've also included in your Exhibit Number Five the return receipt cards showing the service of the application on all these parties.

A That's correct. I do have the originals if you need them.

Q Let me ask you about the -- what, if any, rights Anadarko has obtained from the surface owner to drill

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a disposal well at the proposed location.

A We're negotiating principally with one of the joint surface owners who's representing the joint ownership and we believe we have negotiated an agreement. It, of course, would have to be contingent on our ability to get a permit to do this. We believe once that permit is granted the surface right-of-way will be shortly executed under the terms as it now stands.

Q Why has Anadarko sought the proposed unorthodox location in this 40-acre tract, Mr. Sullivan?

A The surface ownership of that -- it's related to minimizing inconvenience to the surface ownership of that 40-acre tract. An orthodox location would essentially be in the middle, more or less, of the 40-acre tract, and we moved out of the middle just to the corner of it so we wouldn't tie up the entire 40-acre tract.

 In fact, our surface location that we have negotiated the right-of-way will actually bound on the western section line and the northern line of that 40-acre tract and then our well location would be within the surface location, the surface pad.

Q Let's go to Exhibit Number Six, Mr. Sullivan, and let's discuss the Osage No. 1 Well.

A Exhibit Number Six is a daily plot of production testing during the first four months of 1983. This was our initial assessment period for the Osage Well.

 As we previously indicated, it produces

oil and water from the Cisco Canyon, from the A Zone of the Cisco Canyon, through two perforated intervals.

In January of 1983 both intervals were perforated and placed on test with a high volume downhole pump. Very shortly the well stabilized in the range of 65 barrels of oil per day and 900 to 1000 barrels of water per day, and that initial test was run for a period of slightly more than one month.

Subsequent to that test we wanted to assess the possibility that most of the water was coming out of the lower of the two sets of perfs and we moved back on the well, set a retrievable bridge plug between the two perforation zones and tested the upper perforation only. That testing period lasted about three weeks and it's shown in approximately the first three weeks of March of 1983.

Q Was that an attempt by Anadarko to minimize the water produced from the A Zone of the Cisco Canyon?

A Yes, it was.

Q And were you successful in minimizing the water production in the well?

A Not very. We apparently reduced water production only very slightly, but we also reduced oil production by about 20 to 25 barrels a day, almost half of our oil production.

Q In your opinion has Anadarko taken all reasonable methods to minimize the water production from the well?

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A Yes, I believe we have.

Q What is your opinion about the capacity of this well to produce oil on a continuing basis?

A Let me refer again to Exhibit Number Six. After testing only the upper zone by itself, we wanted to restore production from both zones and we did. We removed the retrievable bridge plug, placed both zones back on production and tested it for approximately ten more days continuously and that's shown during the middle part of April of 1983.

And during that ten day test the well made more or less 50 barrels of oil per day and 1000 barrels of water per day, and that is what we think the well will produce on continued operations.

Q What are you currently doing with the water produced from the well, Mr. Sullivan?

A It is hauled -- hauled away by a commercial water hauling company.

Q And where were they hauling that water to?

A Currently?

Q Well, in the past.

A Historically it has been hauled to a Ralph Nix water disposal well in Section -- in Section 18 of, I guess it would be 19 South, 26 East.

Q Is that the well identified on the cross section, Exhibit Three?

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A Yes, it's the far right well on Exhibit Three.

Q All right. You said historically the water produced has been trucked and disposed of in the Ralph Nix well. Has that continued to happen?

A No, it doesn't any more.

Q Why not?

A Ralph Nix apparently has developed his own water production and has closed the well to outside water being trucked in. Our water currently is trucked to one of two locations. The most common location is a water disposal facility in the townsite, essentially, of Loco Hills. It's possibly 40 miles from this location by highway.

Q At the time the water was being disposed of in the Ralph Nix disposal well, what was the disposal fee charged per barrel by the Ralph Nix disposal system?

A The disposal system charged us a quarter per barrel for disposal and our trucking company charged us Seventy-seven Cents per barrel for trucking it.

Q What are the current charges for disposing of the water some 40 miles away?

A The current charges are still a quarter per barrel for disposal and generally Ninety Cents per barrel for the trucking charge, since it's a much more substantial distance.

Q What will the availability of a disposal

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2 well in the immediate area do for you in terms of your abil-
3 ity to produce oil reserves from the Cisco Canyon?

4 A By eliminating the necessity of the
5 trucking costs, it will reduce operating expenses on this
6 well, allow us to produce it continuously and certainly for
7 a much longer period of time and in any event increase the
8 ultimate recovery substantially from our Osage Well, and po-
tentially from other locations.

9 Q Do you have an opinion as to whether or
10 not that will allow you to produce oil reserves that will
11 not otherwise be economically recoverable?

12 A Yes, I have an opinion and I believe it
13 will allow us to increase oil reserves.

14 Q Have you examined on behalf of your com-
15 pany other proposed ways of disposing of produced water from
the Cisco Canyon?

16 A Yes, we have.

17 Q And what has been the result of that
18 study and effort, Mr. Sullivan?

19 A As we know, our initial choice was an at-
20 tempt to re-enter the B & B and we were unable to get a per-
21 mit to do that.

22 We reassessed our options at that point
23 and this is at this point the most preferable option, as un-
24 preferable as it is to drill a \$400,000 water disposal well.

25 This is our most -- most desirable option,
least undesirable option.

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Q All right, sir, let's go to Exhibit Number Seven.

A Exhibit Number Seven should be headed log and volumetric data on the Osage No. 1, and it's a simple volumetric calculation of original oil in place and potential reserves at various recovery factors for our Osage well.

Q All right, Exhibits Seven, Eight, Nine, and Ten, are these all exhibits representing calculations and conclusions that you have done yourself?

A Yes, sir.

Q All right, let's start with Seven, then, and have you describe for us what you've done.

A Okay. Seven, again, is volumetric determinations based on the logs from our Osage Well. As has been stated, the Osage is attributed to a 160-acre spacing unit in the northeast corner of Section 21. On that 160-acre area we believe there are 488,000 barrels, or almost half a million barrels of oil in place within the two zones of the Cisco Canyon A that we've perforated.

We believe that 20 percent recovery factor is certainly reasonable given the drive mechanism evident and that potentially 90,000 barrels can very reasonably be recovered from this well, or 97, as indicated on this exhibit.

As is indicated with our ability to experience greater recovery factors, potentially 200,000 bar-

rels, or more, could be produced by this well.

Q In your opinion, however, the 20 percent reserve recovery number, the 97-million, is the one that's most likely to occur.

A 97,000 --

Q Sorry.

A It's a very reasonable estimate and, yes.

Q All right, sir, let's go to your Exhibit Eight.

A Exhibit Eight is headed Operating Break Even Analysis to Haul Produced Water. The intent is simply to show that our current operations are very marginal. I'll go through it very -- relatively rapidly with you.

We produce 1000 barrels of water per day. The hauling/disposal charges, the power cost to lift the fluid, and other operating expense total approximately \$34,000 per month. With monthly oil production or daily oil production of 48 barrels per day at current oil prices, it's essentially a break even operation.

We believe under continued operations we could produce 50 barrels of oil a day. Again, we won't enjoy continued operations without a lesser disposal fee.

In summary, a break even oil production under continuous operations would be about 48 barrels of oil per day.

Q All right, let's look at Exhibit Number Nine and have you describe what you've done here.

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2 A Exhibit Number Nine is a computation of
3 the monthly revenue to the owners of the Osage Well if we
4 can enjoy the access to a water disposal system at a lesser
5 cost, specifically, that we will eliminate the trucking
6 charge.

7 Again, with oil production of 50 barrels
8 per day, the revenue to the working interest owners in the
9 Osage Well will be \$1180 per day, approximately. If we can
10 dispose of water for only the disposal fee, again by elimin-
11 ating the trucking charge, our daily operating expenses will
12 be \$380 per day, leaving net revenue before taxes, of
13 course, to the working interest owners of \$800 per day or
14 \$24,000 per month, as compared to essentially zero if we
15 tried to operate the well now.

16 Q Let me make sure I understand this.
17 These are the economics of a disposal well and the economics
18 are done in terms of the value to the working interest own-
19 ers in the Osage No. 1.

20 A Yes. It's this revenue increment that
21 justifies our disposal well investment.

22 Q What is the cost of the disposal well?

23 A We estimate it to be \$420,000.

24 Q How does Anadarko recoup the cost of that
25 expenditure?

 A The Osage Well will be charged a quarter
per barrel by the water disposal well for -- the disposal of
produced water, and that's evidence on this exhibit.

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2 Q Let's go to Exhibit Number Ten, Mr. Sul-
3 livan, and have you describe that for us.

4 A Exhibit Number Ten is an assessment of
5 additional Cisco Canyon drilling in the area based on a pre-
6 sumtion of reasonable recovery of 90,000 barrels. There are
7 two cases summarized here. One is the case where a company
8 would drill a well and have to truck produced water away, as
9 we do now, and the second case is where the company enjoys a
10 more convenient water disposal system and does not have to
11 pay the trucking cost.

12 The case under the economics heading on
13 the left is where the water disposal costs are simply
14 Twenty-five Cents a barrel. The economic indicators indi-
15 cated for such an investment is possibly a 48 percent rate
16 of return and at the very bottom a present value of the pro-
17 ject of \$155,000, these would be acceptable economics to
18 Anadarko, and to our knowledge, most other industry competi-
19 tors.

20 The column on the right in the same area
21 designated with a water handling cost of \$1.00 per barrel,
22 shows a zero percent rate of return, no pay out, and a sub-
23 stantial negative present value of such a project, and would
24 be unacceptable to Anadarko and anybody else, in our judg-
25 ment.

26 Q Let's turn to Exhibit Number Eleven, Mr.
27 Sullivan, and have you identify for us what that exhibit
28 contains.

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2 A It's a land plat of only Sections 21 and
3 22. The solid yellow colored tracts are indicative of loca-
4 tions which Anadarko owns 100 percent of the mineral lease-
5 hold rights.

6 The outlined yellow areas is where Ana-
7 darko owns something less than 100 percent of the leasehold
8 rights.

9 Also indicated on there is to the best of
10 our knowledge the ownership of the balancing interests in
11 other tracts.

12 Q Let me direct your attention to Section
13 22 to the northwest quarter and then again the southwest
14 quarter of the northwest quarter --

15 A Okay.

16 Q -- the 40-acre tract on which the dispo-
17 sal well is to be located.

18 A Yes.

19 Q Is the working interest ownership in that
20 40-acre tract 100 percent Anadarko?

21 A Yes, it is.

22 Q We look at the tract to the north. What
23 is the ownership interest on that 40-acre tract?

24 A Anadarko owns 20 percent of the lease
25 rights. We believe Chama owns approximately -- 20 acres,
I'm sorry, not 20 percent -- 20 acres, or 50 percent of the
leasehold rights.

 We believe Chama owns approximately 15

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2 acres that Flag-Redfern owns a balancing 5 acres, to our
3 knowledge.

4 Q The 80-acre tract to the east of that,
5 being the east half of the northwest quarter, the ownership
6 there is divided between you and Chama.

7 A Yes, I believe so.

8 Q All right, sir. With regards to a Cisco
9 Canyon well in the northwest quarter of Section 22, what is
10 the approximate division of working interest between Anadarko
11 and Chama for a well in that quarter section?

12 A If the northwest quarter of the section
13 were a spacing unit for a Cisco Canyon well, Anadarko would
14 own slightly over half of the working interest. Flag-Red-
15 fern would have a nominal interest, and we believe Chama
16 would own or represent the balance of the working interest.

17 And, again, Anadarko would have over half
18 and I believe approximately 55 percent of the working inter-
19 est.

20 Q Okay. When do you propose to commence
21 the drilling of your disposal well, Mr. Sullivan?

22 A As soon as practicable after we would ob-
23 tain a permit and an executed surface right-of-way. We do
24 have the immediate need for the well.

25 MR. KELLAHIN: That concludes
my examination of Mr. Sullivan.

We move the introduction of
Anadarko Exhibits One Through Eleven.

MR. RAMEY: Anadarko Exhibits
One through Eleven will be admitted.

Any questions of Mr. Sullivan?

Mr. Carr.

CROSS EXAMINATION

BY MR. CARR:

Q Mr. Sullivan, I think your Exhibit Number
Five indicates that to drill this disposal well you'd go to
a depth of approximately 8030 feet.

A That would be our -- that would be the
bottom of the perforated zone we anticipate completing in.

Q How much farther down would you have to
drill if you were going to attempt to complete in the Devon-
ian?

A We would have to go on to 9400 feet and
then I believe at least probably another 1000 feet, which
would make it approximately 10,500 feet. It would be more
or less 2500 additional feet, and that's a loose number.

Q Did you compare pressure data on the
Osage Well and the B & B Well in that zone?

A What pressure data is that?

Q Any pressure data on -- was there any
pressure data available to you on the A Zone in your Osage
Well or in the A Zone in the B & B Well?

A There's drill stem pressure data from a
drill stem test in the A Zone in our well and also in the A

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2 Zone in the B & B Well.

3 Q Did you compare those?

4 A We've looked at them. They're posted up
5 here and could tell you exactly what they are. I believe
6 they're -- they're basically compatible.

7 MR. CARR: I have no further
8 questions.

9 MR. RAMEY: Any further ques-
10 tions of Mr. Sullivan?

11 MR. KELLAHIN: No, sir.

12 MR. RAMEY: He may be excused.

13 Anything further, Mr. Kellahin?

14 MR. KELLAHIN: Not at this
15 time, Mr. Ramey.

16 MR. RAMEY: Mr. Carr, would you
17 like to call your witness?

18 MR. CARR: Yes, sir, Mr. Ramey.
19 At this time I'd call Louis J. Mazzullo.

20 LOUIS J. MAZZULLO,
21 being called as a witness and being duly sworn upon his
22 oath, testified as follows, to-wit:

23 DIRECT EXAMINATION

24 BY MR. CARR:

25 Q Will you state your full name and place
of residence?

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A My name is Louis J. Mazzullo and I reside in Midland, Texas.

Q Would you spell your last name, please?

A M-A-Z-Z-U-L-L-O.

Q By whom are you employed?

A I am a geological consultant with Chama Petroleum Company.

Q Have you previously testified before this Commission and had your credentials as a geologist accepted and made a matter of record?

A I have.

Q Are you familiar with the application of Anadarko in this case?

A I am.

Q And are you also familiar with Chama's interest in this case and in the general area?

A Yes, I am.

MR. CARR: Are the witness' qualifications acceptable?

MR. RAMEY: Yes, they are, Mr. Carr.

Q Would you please state, summarize why Chama is appearing in this case?

A Chama is appearing in this case because they believe that by granting the application of Anadarko to drill a salt water disposal well in the west half of Section 22, would impair their correlative rights to producing oil

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2 in commercial quantities in this area.

3 Q Have you prepared certain exhibits for
4 introduction in this case?

5 A I have four exhibits.

6 Q Would you please refer to what has been
7 marked for identification as Chama Exhibit Number One,
8 identify this and review it for the Commission?

9 A Exhibit Number One is a location plat en-
10 compassing part of Township 19 South and 25 East in Eddy
11 County, New Mexico.

12 It shows several things. First of all it
13 shows the locations of the two cross sections which are sub-
14 sequent exhibits here, C-C' and west to east cross section
15 indicated by the solid line.

16 It also shows the location of the pro-
17 posed salt water disposal well of Anadarko in the northwest
18 quarter of Section 22.

19 It shows the down dip producing well of
20 Chama, B & B in Section 22, which is currently producing
21 from the Morrow.

22 It also shows down dip the producing zone
23 of the -- the producing well, the Chama No. 1 South Boyd in
24 Section 27, also producing from the Morrow.

25 And it also shows the location of the An-
adarko No. 1 Osage, which is producing from the Canyon for-
mation in Section 21.

The line that envelops some of the wells

1
2 in Sections 21, 16, and 17 encompasses the wells that are
3 part of the Dagger Draw North Canyon Field.

4 Q I'd like to now direct your attention to
5 the B & B Well and ask you what is its current producing
6 status?

7 A The Chama No. 1 B & B in Section 22 is
8 currently producing from the Morrow formation and it has
9 been since it was completed in late 1983.

10 Q Does Chama have additional plans for the
11 B & B Well?

12 A As we will show in subsequent documents,
13 we believe that Chama can document that we have zones in the
14 Chama No. 1 B & B which is, incidentally, down dip from the
15 proposed salt water disposal well, that we have zones in the
16 Canyon formation which are capable of producing oil in com-
17 mercial quantities and that these zones extend into the west
18 half of Section 22 at the location of the proposed salt
19 water disposal well.

20 Q Mr. Mazzullo, when was the South Boyd No.
21 1 Well drilled and completed?

22 A The South Boyd Well was drilled in Sep-
23 tember of 1983 and completed between late last year and ear-
24 ly 1984, in the Morrow.

25 Q How does the South Boyd Well and the Cha-
ma B & B Well, how do these two wells compare structurally?

A By my geologic evaluation I find the
South Boyd No. 1 and the No. 1 B & B to be comparable in

structural position.

Q Would you now refer to what has been marked as Chama Exhibit Number Two, identify this and review it for the Commission?

A Exhibit Number Two is a composite exhibit and the first page is a log section, a compensated neutron formation density log section through the Canyon formation in the No. 1 South Boyd Well.

This well is identified on Exhibit One in Section 27, the northwest quarter.

The log section shows the zones which were perforated by Chama, two major zones perforated, one around 7800 feet and a lengthy zone above that, from which oil has been produced on production tests.

It also shows the location of a drill stem test which begins at the top of the Canyon at 7700 feet and proceeds about 25 feet down into the Canyon, again on which oil has been produced.

This well, the No. 1 South Boyd, again, is comparable in structural position, as far as I can tell, to the Chama No. 1 B & B. Both of the wells are down dip from the proposed salt water disposal well. They're down structural dip from the salt water disposal site.

The perforated zones that are shown on page one of Exhibit Two were tested over a total of 16 hours and recovered more than 100 barrels of oil to the surface.

Both the zones were tested individually

1
2 and both recovered oil.

3 The results of the drill stem test which
4 are on page two of this exhibit show that we recovered 300
5 feet of oil in the Upper Canyon, as well.

6 Q Would you now go to Chama Exhibit Number
7 Three, identify this and review it for the Commission?

8 A Chama Exhibit Number Three was previously
9 -- which was previously entered into testimony before this
10 Commission, is a west to east stratigraphic cross section
11 which is indexed on Exhibit Number One by the solid line.

12 There are, and this section encompasses
13 the Cisco Canyon section across the Dagger Draw area and in-
14 to the areas of which we are discussing this morning.

15 There are two major -- there are two
16 major reasons for re-presenting this cross section, the
17 first of which is to indicate on the B & B Well, which is
18 the third from the left, the drill stem test which was run
19 across the Canyon, a rather lengthy drill stem test of 300
20 -- approximately 310 feet -- on which there was a recovery
21 of 100 feet of oil.

22 The other fact to point out from this
23 cross section is on the first -- from the first log on the
24 west side of the cross section, the Roger Hanks Barbara Fed-
25 eral No. 1. On that log I have indicated where other wells
in the Dagger Draw North Field have produced. I agree that
these wells mainly produce from what Anadarko might consider
the B and C Zones, what they would term the B and C Zones,

1
2 but also the No. 2 Barbara Federal, which is also in Section
3 18, has produced in what appears to be equivalent to Anadar-
4 ko's Zone D.

5 Again the B & B, we're getting back to
6 the B & B Well for a moment. Again this is, this well was
7 structurally equivalent, I believe, to the No. 1 South Boyd
8 and although it's down structural dip to the salt water dis-
9 posal well, it indicates the potential for oil production by
the results of the drill stem test.

10 Q How does the producing zone in the B & B
11 Well compare to the producing zone in the Osage Well?

12 A Well, the B & B is presently not pro-
13 ducing from the Canyon but by conventional log calculations,
14 we believe that the oil is coming from one or both of two
15 possible zones, the zone being correlative to Anadarko's
16 producing zone in the No. 1 Osage and another zone which we
17 will show in the next exhibit, which is towards the base of
18 the Canyon section in what Anadarko might consider the D
Zone.

19 Q Do you happen to know how much oil is
20 produced from the Barbara Federal No. 2 Well?

21 A The Barbara Federal No. 2 Well has pro-
22 duced in excess of 179,000 barrels of oil from that lower
Canyon zone.

23 Q What conclusions can you draw from this
24 exhibit, Mr. Mazzullo?

25 A The main conclusions that I could -- the

1 two main conclusions that I draw from this exhibit are (a),
2 we have a substantial -- what I consider to be a substantial
3 show of oil on a drill stem test through the Canyon section
4 in the No. 1 B & B, which I believe is not limited to just
5 the upper Canyon zone or what Anadarko terms the A Zone.

6 The second major conclusion, and this
7 goes along with the first, is that production is capable
8 from perhaps the lower part of the Canyon section down
9 around what Anadarko considers the D Zone.

10 Q Would you now refer to Chama's Exhibit
11 Number Four and review this, please?

12 A Chama's Exhibit Number Four is the shor-
13 tened structural cross section between the Chama No. 1 B & B
14 westward to the Andarko No. 1 Osage, and also indicates the
15 location and the perforated -- the proposed perforated in-
16 tervals of their proposed salt water disposal well, Anadar-
ko's salt water disposal well.

17 You could refer to Exhibit Number One for
18 the location of this section. It's indicated by the dashed
19 line. This cross section shows the proposed TD, or the pro-
20 posed perforated interval of Anadarko's water -- water dis-
21 posal well. It also shows four zones which we have calcu-
22 lated to be porous, three of which we believe are capable of
producing oil.

23 Of particular interest, aside from the
24 obvious one at the top of the unit, which we all agree is
25 potentially productive, there's another zone at the base of

1 the Canyon section which calculates as possibly oil and
2 water productive, as well as another thinner zone towards
3 the top of the proposed perforated interval.

4 We do agree that the zone in the middle
5 of the Canyon is probably water bearing, the one at the very
6 top of the proposed perforated interval.

7 Q Now, Mr. Mazzullo, we're talking about an
8 A Zone that everyone agrees might be commercially produc-
9 tive.

10 A That's right.

11 Q That is down dip from -- in the west half
12 of Section 22 from where it appears in Section 21 in the
13 Osage --

14 MR. KELLAHIN: Mr. Chairman,
15 I'm going to object for the record. I don't believe the
16 testimony is that Anadarko agrees that the A Zone in the B &
17 B Well is commercially productive.

18 We would dispute that state-
19 ment.

20 MR. CARR: Okay, we are not
21 trying to misstate the testimony and would like the record
22 to reflect that.

23 Q Mr. Mazzullo, it is your opinion that the
24 A Zone in the B & B Well is capable of commercial oil pro-
25 duction.

26 A In my opinion the A Zone in the B & B is
27 capable of commercial oil production.

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Q And that is down dip from the zone as it appears in the Osage Well.

A Down dip from a comparable zone in the Osage Well.

Q Do you also believe there's potential for production in the B Zone?

A I believe, based upon established conventional log calculations, yes, that's true, the B Zone is potentially productive.

Q And that's down dip to where the zone appears to the west.

A To the west in the Dagger Draw Field and in the Osage Well.

Q Does Chama plan to attempt a completion in these zones in the B & B Well and in the South Boyd Well?

A When the Morrow production is exhausted in the B & B Well, Chama intends to attempt completion in the D Zone as well as the other zones in the Canyon section.

Q What would be the effect on Chama if the Oil Commission grants Anadarko's application?

A We believe that granting Anadarko's request would impair Chama's correlative rights to producing the Canyon formation in the west half of Section 22 because of the potential of flooding a potentially oil productive -- productive reservoir with produced water.

It would result in reserves left in the ground which would otherwise be produced and hence would re-

1
2 sult in waste.

3 Q And you 're talking about in the west
4 half of 22.

5 A In the west half of Section 22.

6 Q Do you believe there are other zones
7 available in this area into which water could be disposed?

8 A I believe the Devonian, which is known to
9 be a disposal zone in the area, and which is also known not
10 to be productive locally in the area, would be able to ac-
cept large amounts of produced water.

11 Q Do you have a recommendation to make to
12 the Commission concerning this application?

13 A I would recommend that the application
14 not be approved as it would impair Chama's correlative
rights.

15 Q Are you prepared to make a recommendation
16 as to any testing in the area if they do go forward with the
17 -- and approve the application?

18 A I would recommend that drill stem tests
19 of all potentially productive zones in the Canyon be con-
20 ducted prior to disposal operations if the application is
accepted.

21 Q Were Exhibits One through Four prepared
22 by you or under your direction?

23 A They were prepared solely by me.

24 MR. CARR: At this time I would
25 offer Chama Exhibits One through Four into evidence.

MR. RAMEY: Chama Exhibits One through Four are admitted.

MR. CARR: That concludes my direct of Mr. Mazzullo.

MR. RAMEY: I think we'll recess till 1:15.

(Thereupon the noon recess was taken.)

MR. RAMEY: The hearing will come to order.

Are there any questions of Mr. Mazzullo?

MR. KELLAHIN: Yes, Mr. Chairman, thank you.

MR. RAMEY: Mr. Kellahin.

CROSS EXAMINATION

BY MR. KELLAHIN:

Q I'd like to cover some of the points that you discussed in your testimony this morning, Mr. Mazzullo.

Let's begin with the last series of answers you gave concerning the establishment of a requirement in this order that drill stem tests be conducted after the well is drilled to evaluate the Cisco Canyon.

What is your reason behind requesting that that kind of requirement be placed in the order?

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2 A Simply that we -- simply that upon com-
3 pleting -- or upon drilling through the Canyon that Anadarko
4 doesn't overlook any potentially productive zones that may
5 be damaged through injection -- through injection of water
6 into the formation.

7 Q In your opinion is a drill stem test an
8 adequate and reliable method from which to evaluate the po-
9 tential productivity of any particular zone in the Cisco
Canyon?

10 A Insofar as it gives us some indication of
11 the presence of hydrocarbons, drill stem test interpreta-
12 tions are -- can get very subjective, but as long as that's
13 the only means by which we can adequately and inexpensively
14 test it, that's what I would recommend.

15 Q All right, sir. I'd like to spend some
16 time talking with you about your opinions concerning the
17 Chama B & B Well in Section 22, and I think it would be
18 helpful for purposes of my questions to have you go to the
wall here where I've placed your Exhibit Number Three.

19 Would you identify for all of us so we
20 can follow you which well on the cross section is the B & B
21 Well now operated by Chama?

22 A This one right here.

23 Q All right, it's the second one from the
24 left.

25 A The second one from the left as it's
hung. The third one from the left on the one you have.

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Q I'm sorry, I folded in the --

A Yeah.

Q -- Nix Well, so -- the Roger Hanks Well.
All right.

What, in your opinion is the vertical distance between the top of the Cisco Canyon and the base of the Cisco Canyon?

A The top of the Cisco Canyon as I have correlated it, and this will vary from operator to operator, is approximately 7650 feet, or so, and the base of the Cisco Canyon, as I have indicated, or the top of the Strawn, is down at about 8180 feet, or so. That's not exact footage down there but it's just below the base of the log.

Q We're dealing with a Cisco Canyon interval that's approximately how many feet?

A The entire interval is approximately 500 feet, or so.

Q Within that interval, Mr. Mazzullo, I believe you've indicated on your direct examination you had identified by looking at the logs certain intervals or zones in the Cisco Canyon that you thought might be productive of oil.

A Right.

Q Let me give you my pen, sir, and have you indicate on the exhibit approximately where each of those zones occurs on the log.

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2 A Okay, Exhibit Number Four has them speci-
3 fically stated, if I might be allowed to drag that one out
4 real quick it would be lot faster and easier for me.

5 Here you go. As a matter of fact if you
6 want to put it on this one right here.

7 Okay, the primary, the zone that's equi-
8 valent to what you or what Anadarko would refer to as Zone A
9 would be up here. That one right there, and that's one --
10 that's one zone that I -- that we believe is productive, or
probably productive of oil.

11 Q Understanding that I don't want you to be
12 accurate to the absolute footage --

13 A Uh-huh.

14 Q -- but indicate with the red horizontal
15 line the range within that A Zone that you think is possibly
oil productive.

16 A Okay. That is complicated by the pre-
17 sence of water throughout the system, which might be attri-
18 butable to the local fracturing of the unit.

19 Q I appreciate that.

20 A Okay, and it's hard to say, but when the
21 log calculations were performed for us by an independent log
22 analyst, he, I believe, he calculated a 14 foot zone through
23 there which he subsequently identified as oil productive,
24 and I can't exactly pin it down right now without looking
back into my files.

25 Q I don't want you to go to that degree of

1 difficulty but I do want you to identify for us generally
2 where that 14-foot thickness was for the A Zone.

3 A It's within this porosity zone right in
4 there.

5 Q All right, sir, can you draw those lines
6 a little more broadly across the log so we see where that
7 one is?

8 A Right in here.

9 Q All right, sir, would you do that again
10 with the next zone down that you identify as possible oil
11 productive?

12 A Okay. That one right there which we de-
13 cided was six or seven feet of porosity, oil potential poro-
14 sity.

15 Q All right, and that will correlate to
16 which of the lettered zones in the Cisco Canyon?

17 A I would -- I believe it would correlate
18 to the B or here we go, right, here, we can look right over
19 here and that is that 7900 feet, that correlates to the C
20 Zone.

21 Q All right.

22 A What you all call C Zone.

23 Q All right, sir, if you agree, would you
24 put the letter "C" there?

25 A All right, sir, what's the next zone
down?

A Okay, the next zone down would be this

1
2 one down in here. Okay, this one is here and here, actually
3 split right here.

4 Q All right, sir, and that will correlate
5 to what zone?

6 A That would correlate to -- well, Anadarko
7 shows it to -- shows it down below the B Zone. Oh, wait a
8 minute, no I'm not reading those numbers right.

9 I'm sorry, I'm -- I'm getting ahead of
10 myself here. I'm getting too far down.

11 All right, that one right over here, I'm
12 sorry. Strike that one from the record.

13 Okay, and that corresponds to Anadarko's
14 B Zone.

15 Q I believe those constitute all of the
16 areas that you identified in the log as being potential oil
17 zones.

18 A That's right. That's correct.

19 Q All right. When you do your evaluation,
20 are you using any particular range of porosity from which to
21 determine if that porosity number is high enough for which
22 you might think it to be oil productive?

23 A Our logs and log analyst believe that oil
24 productivity in the area uses a cutoff zone of, I believe, 5
25 or 6 percent.

26 Q All right, sir.

27 A This is -- this is all, you know, it
28 varies. One operator might think that 5 or 6 percent is too

1
2 low and others might think it's too high. There might be
3 saturation cutoffs that are too high or too low. It varies
4 with the operator.

5 Q I just want to understand --

6 A Right.

7 Q -- the basis for your numbers.

8 In terms of the water saturation percent-
9 age, what in your opinion is the range of percentage that
10 would justify from log analysis and calculation a high
11 enough number or a low enough number, whatever it is, to
12 thereby drill stem test that interval?

13 A Our log analyst believes that the cutoff
14 could be as high as around 55 percent for oil production to
15 be commercial.

16 Q All right, using those general ranges,
17 Mr. Mazzullo, within each of those three zones, A, C, and D
18 that you've identified on the log, have you had your log
19 analyst make the calculations of the porosity and the water
20 saturation percentages?

21 A Yes, he did.

22 Q All right, sir, have you put those num-
23 bers on your logs?

24 A They are not on this log-- yes, they are.
25 There you go. Well, they are up in here. They're not on
the log all the way down here, and I cannot say what they
are offhand. This had been entered into testimony last year
at the hearing and I believe we stated it then. I don't

1
2 know what it is now.

3 Q I'm trying to understand the basis for
4 your opinion that these zones are potentially oil produc-
5 tive.

6 A Oh, I understand.

7 Q All right. Can you give us what the log
8 analyst calculated for you for the D interval?

9 A I believe it was -- it was 53 percent
10 water saturation down in there and 6 to 7 percent porosity
11 within the range that he has specified as being potentially
12 productive.

13 Q Going up the log I see an indication on
14 the exhibit that there is a 3 percent porosity and a 57 per-
15 cent water saturation calculation.

16 A Yeah, that probably corresponds to this
17 over here. This one over here, which is not on this log
18 calculated in the range of 35 to 37 percent water satura-
19 tion. Let me put that down. The A Zone was, I believe, 32
20 percent.

21 Q All right, sir, and what was the porosity
22 range for the C Zone so we'll have that number?

23 A I believe it was around 10 or 11 percent
24 for that zone.

25 Q All right, is -- in the A Zone is the
corresponding number on the log the 7? Is that the porosity
number?

A That's 7 percent porosity, 30 percent

1 water saturation.

2 Q All right, sir. On the top edge of the A
3 Zone, or just above it, I see another number in here.
4 There's an 18 percent porosity, 22 percent water saturation
5 number?

6 A Yeah, but I'm not quite sure that that's
7 right. We calculated that as potentially wet. Do you know
8 off-- oh, never mind.

9 Q Mr. Mazzullo, I have put on the wall here
10 Exhibit Number Six from the July 27th hearing in 1983. Do
11 you recall that exhibit?

12 A Yes, I do.

13 Q That is your exhibit, is it not?

14 A Yeah, that's my exhibit.

15 Q Let me refresh your recollection about
16 some of our discussion back in July. I note on the log for
17 the Antweil B & B Well there are four sets of numbers on
18 that log, are there not?

19 A That's right.

20 Q And those are numbers that you testified
21 back in July of '73 that corresponded to the porosity and
22 the water saturation calculations.

23 A That's right.

24 Q Are those the same numbers that you have
25 talked about this afternoon?

A They are part of the same numbers. There
are others that do not appear on the log.

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2 Q Back looking at your Exhibit Number
3 Three, the cross section from today's hearing, just above
4 the A Zone there is a calculation of 18 percent porosity and
5 22 percent water saturation, is there not, sir?

6 A That's right.

7 Q And of all the conventional log calcula-
8 tions for porosity and water saturation, those numbers are
9 the best numbers of any of those indicated on the log, are
10 they not?

11 A They're the highest. They're the most
12 encouraging numbers. That doesn't mean that they are neces-
13 sarily the best.

14 Q Those most encouraging numbers are in-
15 cluded within the interval that was subject to the second
16 drill stem test on the Antweil Well, isn't it?

17 A That's true.

18 Q And what did the second drill stem test
19 show?

20 A It recovered all water.

21 Q All right, sir. Would you return to your
22 seat, please, sir?

23 A Also covered another porosity zone above.

24 Q Now, Mr. Mazzullo, I guess I understand
25 that the calculations of the water saturation are not calcu-
lations that you made.

A They are not. No, I did not make them.

Q Can you tell us how the porosity was de-

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2 terminated for the water saturation calculations?

3 A I assume that it was determined through
4 the CNL/FDC logs but I didn't do the calculations.

5 Q Can you tell us what the log analyst used
6 to determine the resistivity of the formation?

7 A He has -- he had privy to some water in-
8 formation that I didn't, so I would assume that it's infor-
9 mation that was not available to me.

10 That's where the subjectivity might come
11 in .

12 Q Mr. Mazzullo, have you had your log ana-
13 lyst calculate the porosity and water saturation numbers for
14 the Osage No. 1, the Anadarko well?

15 A I can't answer that. I'd have to -- I'd
16 have to check into that.

17 Q Let me show your Exhibit Number Two,
18 which is the photocopy of your South Boyd No. 1 Well in the
19 Section 27.

20 A Uh-huh.

21 Q This was a well Chama drilled as a Morrow
22 test, was it not?

23 A That's right, as -- well, it was a Morrow
24 and a Canyon test. That's what it was originally proposed
25 for.

26 Q All right, sir.

27 A It's completed in the Morrow at the pre-
28 sent time.

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2 Q All right. Let me take my copy of your
3 Exhibit Number Two and for sake of clarity in what we're
4 been discussing, I'd appreciate you taking that exhibit and
5 drawing horizontal lines across the log and separating out
6 the Cisco Canyon into the A, B, and C, and D Zones, if you
7 please.

8 A Okay, this takes a little bit more time
9 than just sitting over here and doing it like this. I'd
10 have to do it on a time scale that's a little bit more in-
11 volved than just the ten or fifteen minutes or three hours
12 that we have over here. I don't know if we'd want to get
13 into that right now.

14 Q Well, it's important to me insofar as
15 you've indicated that there is some potential for production
16 of oil in the upper portion of the Cisco Canyon in that
17 well.

18 A That's true.

19 Q All right. I want to know what zone let-
20 ter that corresponds to.

21 A I could make a rough correlation right
22 now but I don't know if -- if it would hold out without the
23 detailed work that I'm accustomed to carrying out.

24 MR. CARR: May it please the
25 Commission, I'm going to object to this line of question.

26 I think that Mr. Massullo can
27 indicate on the logged areas where he believes the well
28 would be capable of commercial production, but he's being

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asked now off the top of his head to take standards which are actually Anadarko standards, things which he has had no input on and there's nothing in this record shows he even agrees with and take a log and apply these standards in a short time frame.

I think that certainly he can indicate what intervals he believes are capable of commercial production, but I think it's actually unfair in this proceeding here today to ask him to apply these standards that are Anadarko's to this exhibit.

MR. KELLAHIN: Mr. Chairman, Mr. Mazzullo has testified that water disposed of in the zone that Anadarko proposes to dispose of are going to be up structure to zones that he thinks are oil productive. We have found out thus far that he did not do the water saturation calculations and I think it's essential to test his credibility and his understanding to find out exactly how he thinks the zones in the South Boyd No. 1 Well are going to correlate to the intervals that are going to be subject to disposal, and I think it's a fair question and I'm entitled to the answer.

MR. CARR: Well, I believe the testimony of Mr. Mazzullo was that in other wells in the area there was commercial production from what amounts to the B Zone. He was talking at that time about the Barbara Federal No. 2, the Roger Hanks Barbara Federal No. 2, which is not on the log presented by Anadarko nor on the log pre-

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2 sented by Chama, and I think it's unreasonable now to expect
3 him to take a short period of time, these individual stand-
4 ards announced by Anadarko here today, and apply them to
5 this log.

6 I think what they're obviously
7 attempting to do is lead him into error, and I object to it.

8 MR. RAMEY: It's obvious from
9 the log here that it doesn't cover the whole section of the
10 Canyon.

11 MR. KELLAHIN: That's right.
12 And I cannot tell without having the full log and the bene-
13 fit of Mr. Mazzullo's expertise about his own well what por-
14 tion of the Canyon he's indicating as being oil productive.
15 He has simply told us that some portion of the upper Cisco
16 Canyon, and I think, if he's able to do so, he ought to tell
17 us where it is.

18 MR. CARR: I think Mr. Mazzul-
19 lo's answer was with the time constraints that are imposed
20 on him he's unable to do that.

21 MR. RAMEY: Well, I thought he
22 said that he had -- there were two perforated intervals in
23 the Canyon in this well.

24 Did he also say that there were
25 other areas in this -- in this particular well that are pos-
sibly productive, or just those two perforated intervals?

MR. KELLAHIN: I don't want to
put words in his mouth about the record.

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2 A I said that we produced oil from the two
3 perforated intervals that you see on that log. That's all
4 --

5 MR. KELLAHIN: My question is I
6 want to know in what zone of the Cisco Canyon are those two
7 perforated intervals.

8 A Oh.

9 MR. RAMEY: Can you answer
10 that, Mr. Mazzullo?

11 A I could approximate it but this is a
12 highly complex stratigraphic area and you can make mistakes,
13 you know, if you do it too hastily. I spend a lot of time
14 doing these types of correlations. I don't do them in five
15 or ten minutes. It's very hard to correlate a sequence of
16 -- a 500-foot sequence of dolomites, you know, that quickly.
17 I indicated that those zones I feel to be oil productive and
18 that's all I'm going to say.

19 MR. RAMEY: It would be -- it
20 would be safe to assume that they're at the most A and B,
21 according to Anadarko.

22 A Perhaps, but I --

23 MR. RAMEY: If your top line
24 there at 7700 is the Canyon.

25 A Remember that this builds -- the system
builds deposition and there might very well be C. One of
them might very well be C. It builds depositionally. They
show it themselves in their Isopach map.

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MR. RAMEY: All right, but you
-- you don't think you can do it.

A I wouldn't want to do it because I would
be subject to possible error.

MR. RAMEY: All right, Mr. Kella-
lahin, I think the witness has said he can't do it.

MR. KELLAHIN: All right, sir,
we'll try something else.

Q On Exhibit Number Two, Mr. Mazzullo, have
you indicated all of the perforations in the Cisco Canyon
that have been made in that well?

A No. I've indicated the perforations that
-- from which we have produced oil thus far.

Q All right. Did you put on that exhibit
any other perforations that have been made in the Cisco Can-
yon section?

A Is this yours?

Q Yours to draw on.

A Mine to draw on, okay. If I can have a
minute to go through our well records, I'll put them down
exactly.

Okay, the additional perforations are in-
dicated in red.

Excuse me for the art work.

MR. KELLAHIN: Mr. Chairman, I
show you on Exhibit Number Two on which the witness has in-
dicated additional perforations in the Cisco Canyon section.

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Q Mr. Mazzullo, with regards to those additional perforations, what was the result?

A The result was a one day test in which water was recovered.

Q Did you recover any oil at all in that interval.

A No.

Q Are you able to correlate that perforated interval and tell us if it's in the A, B, C, or D Zone of the Cisco Canyon?

A Well, with the same reasoning behind my previous refusal to do so, I can't do it in this --

Q All right, sir, let's go back up to the drill stem test, I believe it is.

A Uh-huh.

Q For the Cisco Canyon section and tell us about the first drill stem test.

First of all, what was the interval tested?

A Okay, the interval tested on the first drill stem test was 7702 to 7726 or 7, the exact figures are here also.

Q All right, sir, again let me show you Exhibit Number Two that we're doing a little art work on.

A All right.

Q And have you indicate on that exhibit where the first drill stem test was run.

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A Okay, 7702-26.

Q All right, sir, and while you have that exhibit you might as well put where the second one was, please.

A What second one?

Q Wasn't there a second drill stem test?

A In the South Boyd No. 1?

Q Yes, sir.

A No.

Q Just the one.

A Just one test.

Q All right. With regards to the drills tem test at that interval, what did the drill stem test show?

A The drill stem test recovered -- was open for two hours and recovered 300 foot of oil and sulphur water and 870 feet of gas cut sulphur water. The sample chamber recovery of gas, oil, and sulphur water.

Q Have you subsequently completed and perforated the interval that was the subject of the drill stem test?

A We perforated on part of it, the lower half, I would say.

Q And did you have an initial potential?

A We never had initial potential. We had a recovery of oil on a total of sixteen hours of testing.

Q All right, under -- on that perforated

1
2 interval we have a 16-hour test. We've got 100 barrels of
3 oil and what was the water recovery?

4 A I don't recall offhand.

5 Q You don't remember what the water produc-
6 tion was?

7 A No, we could look it up real quickly.

8 Q I'd sure like to hear it.

9 A We'll have to pause and dig through the
10 records and add it all up.

11 We had up to a 6 percent oil cut.

12 Q A 6 percent oil cut would translate into
13 about a 1600 barrel of oil a day -- barrel of water a day
14 production.

15 A If you say so. I didn't make the calcu-
16 lation.

17 Q My question is what is the water pro-
18 duced, then, under the 16 hour test in barrels of water.

19 You say you have a 16 percent oil cut.

20 A No, a 6 percent oil cut.

21 Q 6 percent oil cut.

22 A That's right.

23 Q Let's make the calculation if there's any
24 disagreement about the 1600 barrels of water.

25 A We had a 6 percent cut and we didn't
actually measure the water, but if you say it's 15, I'll be-
lieve you.

Q Was this 16 hours of continuous test or

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was that run over several days?

A Run over two days.

Q And how many hours each day, then, simply 8 hours a day?

A Around 8 hours a day.

Q All right. I believe you've indicated that you've tested each of these zones separately. Were they tested separately?

A Yes, they were.

Q All right, tell me which was the first test and which was the second test.

A As I've indicated on the log, there are two separate blocks of perforated interval, the first block down here clustered around 7800 feet was the first interval tested. The second block up here was the second interval tested. They tested approximately the same water to oil ratio on the two -- on the separate days of testing.

Q That will then be the first and second day of the 16-hour test for those perforated intervals?

A Come again?

Q Did you run the two day test on each of those perforated intervals or is that the combination of --

A That's the combination, approximately eight.

Q All right. All right, Mr. Mazzullo, let's look at the structural relationship of the South Boyd No. 1 Well to the structure map that Anadarko has -- has

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2 presented.

3 Mr. Mazzullo, I'm showing you what is
4 marked as Anadarko Exhibit Number One, which is the struc-
5 ture map on top of the Canyon lime, and I would ask you to
6 locate for us your South Boyd No. 1 Well and give us the --
7 the depth of that well in terms of its structural position.

8 A Okay. First of all, it's location is
9 1980 -- 1980 feet from the north and west line of Section
10 27. I will mark it approximately on here because I don't
11 have a ruler.

12 As far as the top of the Canyon lime in
13 here, I don't know what Anadarko's top is. We might use a
14 different top of the Canyon in this instance. It would have
15 to be identified for me.

16 Q All right, sir would you simply indicate
17 for us what you think is the top of the Cisco lime, is that
18 indicated for you on the log?

19 A It's already on the log, 7700 feet.

20 Q Do I understand -- do you know what the
21 structural relationship is of the top of the Cisco Canyon in
22 the South Boyd Well in relation to the proposed disposal lo-
23 cation?

24 A It's structurally lower somewhat to the
25 proposed location.

26 Q When we compare tops of the Canyon it
27 will be somewhat lower structurally.

28 A Yes, I said that before.

1
2 Q All right, sir. Are you able to tell us
3 if the C and D portion, or the lower portion of the Cisco
4 Canyon, the proposed disposal interval is going to be higher
5 or lower structurally from the upper portion of the Canyon
6 which you think is oil productive in the B & B Well?

7 A No, I can't tell you that and the reason
8 is because this is a, again, a highly complex stratigraphic
9 type of build-up here in the Canyon.

10 Some of the structure that is actually
11 shown on Anadarko's map might in fact reflect depositional
12 build-up as well as structural build-up, so it's hard to say
13 without mapping them in detail well by well and mapping in-
14 dividual zones in detail well by well.

15 So I cannot offer an answer to that ques-
16 tion without doing a lot of detailed mapping because it's a
17 complicated stratigraphic problem, and I've mentioned that
18 at a previous hearing.

19 Q Let me have -- ask you some questions
20 about your last exhibit. I believe it was Exhibit Number
21 Four, if you have a copy of that.

22 A Yeah, I do.

23 Q Looking at Exhibit -- looking at Exhibit
24 Number Four, your Exhibit Number Four, Mr. Mazzullo, I no-
25 tice that on the exhibit you've indicated the word "frac-
tures". Do you see that?

A Uh-huh.

Q Would you explain to us what you mean by

1 the fractures? Are these fractures between the A, B, C, and
2 D zones, or are these fractures within each of those zones?

3 A In some instances they appear to be with-
4 in the zones but again, this is a subjective interpretation.
5 my interpretation of the geology over here, based upon what
6 I see in electric logs.

7 I think I see fracturing over there. Of
8 course, the only way you're ever going to know for sure is
9 to core the rocks and find out, but I'm not quite sure
10 whether the fractures would extend from one zone to the
11 other. There is a possibility.

12 Q What is your purpose, then, in placing
13 the word "fractures" on the exhibit? What are you trying to
14 portray?

15 A I'm trying to show perhaps why we have so
16 much water associated with the oil and why some of the cal-
17 culations that we do for water saturations are masked by
18 such high numbers, masked by such -- why they come out so
19 high, perhaps, because of internal mingling of water and
hydrocarbons due to migration along fractures.

20 Q Am I correct in understanding that you
21 cannot form a geologic opinion at this time that any of the
22 four zones we've been discussing in the Cisco Canyon are
fracture communicated one to the other?

23 A There is always that possibility.

24 Q I realize it might be a possibility but
25 do we have enough geologic information from this -- at this

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point for you to reach that geologic opinion?

A I could only reach that opinion based upon some of the -- some of the production testing characteristics we have seen in our No. 1 South Boyd and from information that we have received from other operators in the area, that suggest that fracturing might be a problem.

Q All right. Let me see if I can understand what your concerns are, Mr. Mazzullo.

Mr. Alcorn testified this morning that Anadarko intends to dispose of water in the lower section of the Cisco Canyon, these D and C zones.

A Uh-huh.

Q Is it your opinion and concern that water disposed of in the C and D Zones is going to migrate up into these upper zones that you think are oil productive?

A I testified that my main concern is that the D -- what they call the D Zone, or some lower zone which I cannot readily identify but -- readily identify with their terminology, but some lower zone in the Canyon may be potentially oil productive.

In answer to the question of whether I think that the water might migrate, there's always that other possibility, but I cannot be sure right now, but that's always a possibility.

My main concern is flooding out a potentially commercial reservoir towards the base of the Canyon.

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Q And the zone you've identified as being exposed to that problem is the D Zone in the B & B Well?

A What -- yes, what Anadarko identifies as the D Zone in that well.

Q And what was the porosity and water saturation calculation for that interval?

A In the D Zone approximately 6 percent and 53 percent water saturation.

Q In the South Boyd No. 1 Well that lower portion of the Cisco Canyon was perforated and was tested by Chama and produced nothing but water.

A That's right.

Q And that is a similar structural position to the Chama B & B Well.

A I didn't say that bottom zone was in a similar structural position. I said the top of the Canyon would be.

Q All right, what is the relative structural position of the bottom of the Canyon in the South Boyd Well and the B & B Well?

A I wouldn't know without doing detailed mapping. I don't have that answer readily available.

Q Okay.

A May I inject one more factor as previously mentioned at other hearings and through my cross sections, that we're dealing with a complex stratigraphic trap here with secondary structural considerations, so I believe

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2 stratigraphy is most important here and structure secondary,
3 so we shouldn't harp on the structural as much, perhaps, as
4 stratigraphy, in my opinion.

5 Q Mr. Mazzullo, are you still of the same
6 opinion as you testified on July 27th, 1983, on page 119 in
7 which you say, I quote: There are other zones in the area
8 in the same interval that was tested by the drill stem test
9 --we're talking about the B & B Well -- each one of these
10 zones can be considered independent reservoirs. A study of
11 carbonate lithology will tell you that each one of these,
12 that even though you have a thick sequence of dolomite,
13 those are generally foreign from overlapping -- different
14 overlapping reservoirs separated by impermeable dolomite
15 shale.

16 A That's -- that was an opinion that I made
17 a year ago that may still hold.

18 Q Do you have any reason not to express
19 that same opinion?

20 A Since that -- since we had that hearing
21 we have drilled the South Boyd No. 1 in which we have some
22 indication of possible vertical migration of fluids, but I
23 do not know for sure whether or not we could apply that.
24 It's a possibility here by the salt water disposal site, but
25 I'm not entirely certain that it is at this time.

26 I have not had enough experience drilling
27 and trying to produce the well, the other wells, to tell you
28 whether or not it's a problem.

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2 Q What is the exact factual basis for that
3 concern, Mr. Mazzullo? I missed the point.

4 A What concern is that?

5 Q The fact that there may be communication
6 from these -- from the experience you've derived from the
7 drilling of the South Boyd No. 1 Well, now gives you some
8 concern that there is the ability of fluids to migrate out
9 of the lower --

10 A It's been expressed to me that that's a
11 possibility. It's been expressed by the operator to me.

12 Q That's not a concern that you have your-
13 self identified and --

14 A I haven't evolved the engineering aspects
15 of this area. I'm not an engineer and I haven't evolved it
16 enough yet to tell you whether it is or not.

17 Q Now, the zone in the B & B Well -- well,
18 let me start over.

19 The zone in the South Boyd No. 1 Well,
20 this lower Cisco Canyon, that's the one that tested water.

21 A That's right.

22 Q All right, let's look at the D Zone, or
23 the lower zone, in the B & B Well.

24 A Not saying they're the same zone.

25 Q The lower portion of the Cisco Canyon.

A Well, I don't know whether it's the same
D Zone. I told you before I couldn't correlate them unless
I had a long enough time to do so.

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2 Q You've indicated on the B & B log,
3 though, on this exhibit, a D interval.

4 A Uh-huh, that's Anadarko's D interval
5 taken right of their cross section.

6 Q All right, and is there any other lower
7 Cisco Canyon interval that represents the log properties to
8 be tested for oil production?

9 A I don't quite understand that question.

10 Q You've identified in the lower Cisco Can-
11 yon --

12 A Uh-huh.

13 Q -- a D Zone that has 6 percent porosity
14 and 53 percent water saturation.

15 A Right. Right.

16 Q All right, is there anything else in the
17 lower --

18 A Oh, in the lower zone?

19 Q Yes, sir.

20 A Not that I -- not that has been shown to
21 me by our analyst.

22 Q All right, and that interval was subject
23 to a drill stem test by Antweil when he --

24 A That's right.

25 Q -- owned that well.

26 A And there was 100 foot of oil recovery on
27 a 310-foot drill stem test.

28 Q And he thereafter plugged and abandoned

1 the well and didn't produce the Cisco Canyon.

2 A His problem.

3 Q All right, sir. Do you know Mr. Antweil?

4 A No, I don't.

5 Q Mr. Mazzullo, back in July 27th, 1983, on
6 page 121, your testimony continues and says, "The fact re-
7 mains that there are favorable zones calculated up here
8 which can be isolated and tested independently of everything
9 else down here, which is what the drill stem test did.

10 Again, because of the fact that these are
11 stratigraphic traps in nature, there should be no dependence
12 upon structure, a structure in the area, even though these
13 are not on structure, structure has very little to do with
14 activity or deliverability in these reservoirs."

15 Is that still your testimony?

16 A Not very. I might change that to secon-
17 dary control instead of very little to do. We learn a lot
18 as we work the area more and more and I've learned a lot and
19 we've all learned through our experiences out here.

20 MR. KELLAHIN: May I have just
21 a minute, Mr. Ramey?

22 Q Before I turn you loose, Mr. Mazzullo, I
23 want to see if I can understand what you've told us.

24 I don't care what the operator's opinions
25 are or what your engineering people have told you. I want
you to synthesize for us, if you can, as an expert petroleum
geologist what is it that you find in doing this study that

1 gives you concern about the proposed location for this dis-
2 posal well from a geologic point of view. What is it that
3 bothers you in the area?
4

5 A My detailed regional studies of the area
6 have shown -- have indicated to me that the basal part of
7 the Canyon section at the proposed location of the salt
8 water disposal well, the basal part which Anadarko would
9 identify as Zone D, has the potential for oil -- for commer-
10 cial oil production and my main concern is that injection of
11 produced water into this part of the Canyon section would
12 severely and -- would severely limit or in fact possibly
13 wipe out Chama's chance to produce oil in commercial quanti-
14 ties from that zone. It would impair their correlative
15 rights in the area.

16 Q All right, sir. The closest producing
17 well that produces from this lower Cisco Canyon reservoir or
18 zone that we're concerned about is in the Dagger Draw over
19 in Section 18, I believe it is --

20 A That's correct.

21 Q -- some two miles or more than two miles
22 to the north and to the west. That's the closest estab-
23 lished production from that interval.

24 A That's right.

25 Q All right. If we look at the wells in
the immediate proximity of the disposal well, we have first
of all the Anadarko well in Section 21.

A Uh-huh.

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Q Do you agree that there is no reasonable probability that the lower Cisco Canyon in that well is going to be oil productive based upon what you've studied and learned?

A I believe that there's a chance that it may be oil productive according to my cross section over here. Possibly oil productive.

Q All right, sir.

A Would possibly be oil productive.

Q Simply because those lower sections have a range of porosity in excess of the 6 percent we're talking about?

A That's -- it's -- it's based upon what our log analyst has suggested to me is -- would be reasonable according to the regional norm.

Q Well, Mr. Mazzullo, I asked you if your log analyst or you had done water saturation calculations on the Anadarko well and you told me you didn't have that information.

A I don't have that information.

Q Well, how can you now tell me that you think the lower portion of the Anadarko well is going to be oil productive?

A Just by -- by correlation from our well in an up dip direction, perhaps.

Q How have you made that correlation, Mr. Mazzullo?

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2 A We are dealing with something more than a
3 simple up dip structural situation -- oil trap with straight
4 oil/water contact. We may possibly be dealing with some-
5 thing that's a little bit more complex in terms of the hy-
6 drologic regime of this reservoir. We might be dealing with
7 hydrodynamic traps, for instance, which would put another --
8 another factor into the -- into considering what these re-
9 servoirs are doing. There's always a possibility of produc-
10 ing water up dip from an oil producer in a hydrodynamic
11 trap, for instance. That's something that we could consider
12 is going on over here. It's something which has been sug-
13 gested by other workers in the area.

14 Q Well, I can appreciate how complicated
15 this is. I know you've been working the area more than a
16 year; you testified last year, and there's lots of things to
17 investigate.

18 What I want to know is what specific geo-
19 logic certainty do you have that the lower Cisco Canyon in
20 the Anadarko well is going to be other than what --

21 A I don't have any certainty in that well;
22 only in the B & B where I have a lot more knowledge.

23 Q All right, sir, let's go to your well,
24 it's the South Boyd Well. Your concerns about the lower
25 Cisco Canyon in that well don't bear out, do they?

26 A That might not be the same zone and even
27 if it is, you know, you can have isolated pools of oil away
28 from the B & -- from the South Boyd Well which are in the

1
2 B & B, not in the South Boyd, you know, you're just moving
3 to a different well. Things can change very drastically in
4 this type of a system.

5 Q All right.

6 A It's not a simple -- it's not a simple
7 reservoir, and there are a lot of geologic and hydrologic
8 factors involved here.

9 Q Thank you very much.

10 MR. KELLAHIN: I have nothing
11 further.

12 MR. RAMEY: Anyone have any
13 further questions of Mr. Mazzullo?

14 MR. CARR: No questions.

15 MR. KELLAHIN: Mr. Chairman, I
16 would like to recall Mr. Sullivan, reservoir engineer for
17 Anadarko, to rebut some of Mr. Mazzullo's statements with
18 regards to the porosity and water saturation calculations
19 between the two wells, and I would attempt to keep it right
20 on point.

21 Mr. Chairman, I'd like the re-
22 cord to reflect that Mr. Sullivan is still under oath, has
23 been sworn and qualified as an expert petroleum reservoir
24 engineer.

25 May the record so show?

MR. RAMEY: The record may so
show.

WILLIAM D. (BILL) SULLIVAN,
being recalled and being still under oath, testified as follows, to-wit:

REDIRECT EXAMINATION

BY MR. KELLAHIN:

Q Mr. Sullivan, let me ask you some questions with regards to work you have done and calculations you have made about water saturation and porosity numbers in the Chama B & B Well and correspondingly in the Anadarko Osage No. 1.

A Okay.

Q Have you made those calculations?

A Yes.

Q Do your responsibilities as a reservoir engineer, Mr. Sullivan, and your expertise in that area, include evaluating logs and making calculations on porosity and water saturations?

A Yes, from time to time they do.

Q On behalf of your company what do you use as a porosity/ water saturation range or cutoff below which you would not further test a well?

A In a dolomite porosity like this we would use approximately a 4 percent porosity cutoff, meaning that if the porosity was less than 4 percent we would not probably consider it productive.

Q Correspondingly, if you had porosity of 4

1 percent or greater, and thereafter made the water saturation
2 calculation, what would be the water saturation percentage
3 cutoff?
4

5 A It's hard to say. It, of course that
6 varies from rock to rock. We've got a zone I'll specifical-
7 ly show you the water saturation calculation on that makes
8 93 percent water. On that basis I would say something in
the range of 40 to 45 percent probably.

9 Q All right. Let me have you go to the
10 cross section that's Exhibit Number Twelve, and directing
11 your attention to the Chama B & B Well, let me first of all
12 ask you how you determined the porosity.

13 A The porosity determination in the Chama B
14 & B Well is essentially from this log, it's a cross plot
15 across the -- of the neutron porosity response and the den-
16 sity to the porosity response. This is a dolomite interval
17 over which the logs were run based on a limestone matrix
18 and they will separate in dolomite, and then the general
19 procedure for determining porosity is a cross plot and it's
very nearly a mathematical average of the two porosities.

20 Q All right, sir, what do you use to deter-
21 mine the resistivity of the formation?

22 A On the B & B Well I believe there was a
23 duolateral log. I believe there is a duolateral log. I've
24 got it right here, just a minute, I'll tell you.

25 There's a duolateral log, microlog, run
by Antweil, which drilled the well. It basically has three

1
2 curves on it, one of which should be representative of a
3 deep investigation of the formation and would represent the
4 resistivity of the total formation.

5 Q Is a duolateral log the appropriate log
6 to run for this type of calculation?

7 A Given the mud they had in the hole, it
8 seems to be a reasonably appropriate log.

9 Q And how do you go about figuring the for-
10 mation water resistivity?

11 A Beyond the porosity and the resistivity
12 from the resistivity log one needs to know the resistivity
13 of the water in the formation and we determined that based
14 on produced water from our producing well.

15 Q All right, sir. What type of calculation
16 or formula did you use to make the computation?

17 A It's -- what we have used is a commonly
18 known equation called Archie's equation, and it's a function
19 that determines water saturation as a relationship of poro-
20 sity, resistivity, and the resistivity of the water in the
21 formation.

22 Q Is the method by which you used to calcu-
23 late the percentage of water saturation a standard method
24 accepted and used by petroleum engineers?

25 A Yes, it's probably the most common
method.

Q All right, sir, let's go to the Chama B &
B Well No. 1 and have you start either at the top or the

bottom and tell us what you have calculated.

A Let me start from the top. Again the top of the Cisco Canyon is roughly at this location that's indicated on the cross section.

The first porous zone apparent is also, and refer to the drill stem test interval, and we consider that it's approximately 18 percent porosity and 30 percent water saturation.

Q In terms of the calculations that you have used to determine zones that would be most likely to produce oil, is that the best number of any of those that you calculated on that log?

A Of all the log calculations I'll refer to down hole, this is the most attractive based on log calculations.

Q And was that interval subject to a drill stem test?

A Yes, it was. It was tested by a drill stem test over an interval approximately 25 or 30 feet.

Q And what was the result of that test?

A As stated right here, recovered 186 feet of drilling mud, approximately 6500 feet of sulphur salt water; no hydrocarbon shows.

Q All right, sir, let's go down the log and have you give us the other numbers that you've calculated.

A Okay. I might point out that all the rest of the zones I'm going to talk about are covered by an-

1 other drill stem test over the rest of the wellbore.

2 The next porous zone is indicated by 8
3 percent porosity and 67 percent water saturation. This zone
4 is indicated to be 7 percent porosity and 38 percent water
5 saturation.

6 Here we have one that's 4 percent porous
7 and 67 percent water; 3-1/2 percent porosity and 84 percent
8 water saturation.

9 In this interval porosity ranges from 4-
10 1/2 to 6 percent and the water saturation is running from 69
11 to 84 percent.

12 I have one here I'm going to skip because
13 it's not meaningful.

14 This zone, I believe, well, this zone our
15 calculations are 3 percent water saturation and 69 percent
16 -- 3 percent porosity and 69 percent water saturation and I
17 believe this is a zone that Mr. Mazzullo's previously pre-
sented somebody else's log calculations on.

18 The bottom zone is about a 15 foot inter-
19 val with porosity of 4-1/2 to 4-1/2 percent and water satu-
20 rations of 75 -- in the 75 and 50 percent range, right in
there.

21 Q As a petroleum engineer and having made
22 those kinds of calculations based upon the log, what would
23 be your opinion concerning taking the next step and having
24 any of those intervals drill stem tested?

25 A In a wildcat well normally you have to

1 drill stem test before you log, drillers do normally drill
2 stem test before they log. In a wildcat well some of these
3 zones may lend some encouragement as to productivity. As a
4 prudent engineer and operator, particularly with a producing
5 well next door with available logs, I think most people
6 would compare the calculations from this well in the un-
7 tested zones to similar calculations in this well from zones
8 that actually had known production.

9 Q All right, let's make that comparison.

10 A On the same basis that we did the analy-
11 sis for the B & B Well, we calculated porosity and water
12 saturations in our well, and I'll just start from the top
13 again and go down.

14 This is one -- is our top perforated
15 zone. It shows to be 7-1/2 percent porosity and 44 percent
16 water saturation, and I'll remind the Commission that on a
17 test of that zone alone it made about 35 barrels of oil and
18 900 barrels of water a day.

19 The next zone, then, is our second per-
20 forated interval, which shows a porosity of 6-1/2 percent
21 with 64 percent water saturation. There is a little zone
22 here that even indicates 12 percent porosity and 19 percent
23 water saturation. That's a little (not understood) but it
24 would need a reasonable analyst to maybe question the poro-
25 sity out there.

There's a zone here that's 6 percent por-
ous with 39 percent water saturation. This interval was a

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2 drill stem test interval in our well that did recover approx-
3 imately 50/50 oil and water.

4 Moving on down there's 10 percent poro-
5 sity and 33 percent water saturation; 4 and 77 percent; 4
6 and 88 in our B Zone; 5 percent porosity and 70 percent
7 water saturations.

8 Getting in now to our disposal zones, the
9 C and D Zones, this zone has porosities of 6 to 7-1/2 per-
10 cent and water saturations fairly consistently from 55 to 70
11 percent, 71 percent right in this zone.

12 Certainly comparing this to our produc-
13 tive zones one would not conclude that's a productive,
14 potentially productive zone.

15 On down below that there are really just
16 minor stringers that are relatively nonporous, in the 3 to 4
17 percent range, that are tremendously high in resistivity and
18 they're so high that we think a water saturation calculation
19 is not meaningful. I admit that if you did it, it would
20 compute to be something of a relatively low water satura-
21 tion.

22 Q In looking at both wells and looking at
23 the D Zone, do you see any violation of correlative rights
24 of Chama if the D Zone is used as the disposal interval at
25 the proposed location for the salt water disposal well?

A No, I don't.

26 Q Does either the Anadarko Osage Well or
27 the Chama B & B Well in the D Zone represent any indications

1 to you as a petroleum engineer that that zone is capable of
2 producing oil in economic quantities?

3 A No. As they stand alone, they certainly
4 don't, and even more certainly as they compare to the zones
5 that we produce tremendous amounts of water out of, they
6 definitely don't look like productive zones.

7 Q All right, let's go up to the C Zone and
8 ask you to make that comparison.

9 A Okay, there does seem to be somewhat of a
10 correlative porosity interval in the C Zone. The porosities
11 and the water saturations seem to be fairly consistent, even
12 between the two wells, and in fact, I believe consistent with
13 calculations Mr. Mazzullo cites of 6 percent porosity and 77
14 percent water in the same interval.

15 Again, there's no encouragement from the
16 log calculations that that zone is potentially productive.
17 There's a drill stem test over that finite interval in our
18 well that again has absolutely no hydrocarbon show with
19 nearly 6000 feet of water recovery, and I would consider
20 that it's not potentially productive.

21 Q All right, let's go up and make the com-
22 parison of the A Zone between your well and the Chama well.

23 A Again, I would say this zone in our well,
24 our top perforated zone, and this high porosity zone in
25 Chama's well, should be roughly correlative and that this
zone is probably roughly correlative to a zone we also have
perforated in our well.

Q Do you have an opinion as to whether or
A Zone in the Chama well is economically productive
n that zone?

Q Directing your attention to your well,
the initial potential on the Osage well?

Q All right, and when --

Q All right, sir, and what has happened
you've produced that well? Has it fulfilled the ex-
pects of the initial potential?

Q Based upon your studies and calculations,

Based upon your studies and calculations,

1
2 Mr. Sullivan, do you have an opinion or can you express an
3 opinion about the reasonable probability of economic oil
4 production in the Cisco Canyon in Section 22?

5 A Let me make sure I've got my section --
6 yeah, in Section 22 I -- my judgement is there is no reason-
7 able potential for producing oil in commercial quantities
8 from the Cisco, from any of the Cisco Canyon zones.

9 Q Do you have an opinion as to whether or
10 not approval of the salt water disposal well at this loca-
11 tion for disposal into the C and D Zones of the Cisco Canyon
12 would violate the correlative rights of Chama or anyone
13 else?

14 A My opinion is it would not violate
15 Chama's correlative rights or anybody's correlative rights.

16 Q Why not?

17 A There is -- there's no potential produc-
18 tion in the Cisco Canyon Zone to be violated, certainly not
19 in the C and D Zones that we would propose to dispose of
20 water into.

21 Q All right, sir. Mr. Sullivan, the statu-
22 tory obligation of the Oil Commission under Section 70-2-12,
23 paragraph (4) is to prevent the drowning by water of any
24 stratum or part thereof capable of producing oil or gas
25 or both oil and gas in paying quantities and to prevent the
premature and irregular encroachment of water or any other
kind of water encroachment which reduces or tends to reduce
the total ultimate recovery of crude petroleum oil or gas,

or both such oil and gas from any pool.

Are you aware of that definition?

A Yes, I am.

Q And in your opinion will approval of this application violate that statutory obligation of the Commission?

A No, it would not violate it.

Q And why not?

A There are -- again, I'll restate, we don't believe there are any potentially commercially productive zones in the Cisco Canyon in Section 22 for us to violate by disposing water into or to be flooded by our water disposal.

Q Okay.

MR. KELLAHIN: No further questions, Mr. Ramey.

MR. RAMEY: Any questions of Mr. Sullivan?

MR. CARR: I have several short questions.

RE CROSS EXAMINATION

BY MR. CARR:

Q This is Exhibit Number Twelve, Mr. Sullivan?

A I believe so.

Q And is this exactly like the previous

1
2 cross section except you have placed on that some water sat-
3 uration and porosity figures?

4 A Yes.

5 Q Now if I look at this exhibit, it appears
6 to me that if we get to the B, C, and D Zones in the Osage
7 Well, that you have porosity figures and water saturation
8 figures which would indicate that those zones are not cap-
9 able of commercial production of hydrocarbons, is that cor-
rect?

10 A They indicate to me that?

11 Q Yes.

12 A Yes.

13 Q Wouldn't that well provide the best evi-
14 dence of the quality of the B, C, and D Zones in the -- in
that portion of -- in that particular acreage?

15 A The best -- I'm not sure what you mean.
16 The best --

17 Q Wouldn't that tell you -- doesn't that
18 tell you that in Section 21 in that particular area that B,
19 C, and D Zones in the Canyon do not -- are not capable of
20 commercial production?

21 A No, there are locations in Section 21
that are even further up dip.

22 Q We're talking about at this well loca-
23 tion.

24 A At this well location, again I'll restate
25 I do not think the B or -- the C or D Zones are prospective

1
2 oil producing.

3 Q But you don't believe it would be wise to
4 drill a well for disposal purposes at a location structural-
5 ly comparable to the Osage Well.

6 A I don't think it would be as wise as
7 drilling it at the location we've recommended.

8 Q Are you aware of any wells in the area
9 where the -- that have a high resistivity and also produce?

10 A Well, what do you mean by high resist-
11 ivity?

12 Q I mean that they're -- when you go in and
13 run a resistivity log it shows that there -- you get a high
14 reading there and the well is also capable of producing in
15 that interval?

16 A Well, according -- it depends on your de-
17 finition of a high reading. By my definition, no, I'm not.

18 Q Now if I understand your testimony, it is
19 your opinion that the A Zone in the B & B Well would not be
20 economically productive of hydrocarbons.

21 A I believe that's right.

22 Q It's also your testimony that there is no
23 reasonable expectation of a well in the west half of Section
24 22 being capable of producing commercial quantities of
25 hydrocarbons in the west half of 22?

26 A From what zone?

27 Q From the Canyon. From the -- any --

28 A I don't believe I've stated that from the

1 Cisco Canyon A Zone. I know I have stated it from the B --
2 from the C and D Zones.
3

4 I don't recall stating it specifically
5 referring to --

6 Q Is it your opinion that there is a --

7 A -- the A Zone.

8 Q -- possibility of producing in commercial
9 quantities from the A Zone?

10 A No, it's not my opinion that there's a
11 possibility.

12 Q Is it your opinion that there is not?

13 A Yes.

14 Q In the west half of Section 22?

15 A Yes.

16 Q Aren't you the same Mr. Sullivan that a
17 year ago testified that in the B & B Well the Morrow zone
18 couldn't be returned to commercial production?

19 A If -- is that quote?

20 Q No, I'm asking you, didn't you testify a
21 year ago that the Morrow Zone couldn't be returned to com-
22 mercial production?

23 A I don't recall my exact words. I recall
24 having very strong concerns that it would be commercial.

25 Q That it would or would not be?

A That it would -- either one, that it
would not be.

MR. CARR: I have no further

1 questions.

2
3 MR. RAMEY: Any other questions
4 of Mr. Sullivan?

5 MR. KELLAHIN: No, sir.

6 MR. RAMEY: He may be excused.
7 Anything further, Mr. Kellahin?

8 MR. KELLAHIN: No, sir.

9 MR. RAMEY: Mr. Carr?

10 MR. CARR: A closing statement,
11 that's all.

12 MR. RAMEY: You may lead off,
13 Mr. Carr.

14 MR. CARR: Mr. Ramey, Anadarko
15 is before you today proposing to dispose of produced water
16 in the Canyon formation. They propose to drill a disposal
17 well between their Osage Well and Chama's B & B Well in
18 zones which Chama believes to be potentially capable of pro-
19 ducing oil in commercial quantities.

20 I think you need to look at the
21 evidence that's been presented here today.

22 Anadarko shows they propose to
23 dispose water on a tract that's surrounded on three sides by
24 acreage in which Chama has a substantial ownership interest.
25 They believe that the D and C Zones should be the proper
zones in which to dispose of the water because they're not
capable of commercial production.

~~Their geologist has testified~~

1
2 that he's mapped the zones on their cross section, that the
3 zones do correlate across this area.

4 They also testified that the C
5 Zone was watered out in the Dagger Draw to the north. It's
6 watered out up dip. They've testified that the zones are
7 separated by impermeable shale. If this is true, we submit
8 they could drill a disposal well in Section 21 and disposed
9 of produced waters in the C and D Zones.

10 They're not willing to do that.
11 What they'd like to do is drill the well at a location where
12 if they're wrong and if what happens is that zones capable
13 of commercial production are damaged, that they will share
14 that damage with others, namely Chama.

15 So they're placing their well
16 on a tract which juts out into acreage in which Chama has an
17 interest.

18 They've testified they can pro-
19 duced more oil if their application is granted. We submit
20 that if the application is granted our opportunity to pro-
21 duce oil in the west half of 22 will be reduced. We think
22 it's important to remember that when we talk in terms of
23 correlative rights you are called upon to afford to each in-
24 terest owner in a pool the opportunity to produce his just
25 and fair share; that you cannot, to accommodate one interest
owner, prejudice or impair the rights of another. We don't
think that you should enter an order that would permit Ana-
darko to benefit at the expense of Chama.

1 Chama has presented evidence
2 which shows that in wells down dip from Anadarko's Osage
3 Well there are zones, particularly in the A Zone, which are
4 copable, they believe, of commercial production.

5 They believe that structure
6 isn't the controlling factor and that even in the D Zone
7 there is a potential for commercial production of oil in the
8 west half of Section 22 and they plan to drill there and
9 complete there in an effort to prove it.

10 Anadarko asks you to enter an
11 order we submit that would impair our correlative rights;
12 that would result in reserves in the west half of Section 2
13 never being produced. We submit it constitutes waste and
14 and an order which is contrary to your duties, as set out in
15 Section 70-2-12, which Mr. Kellahin has read several times
16 during the day to you.

17 Anadarko has testified they
18 don't think there are commercial reserves in the west half
19 of 22. There simply is a conflict in the testimony on what
20 the producing capabilities of the various zones in the Can-
21 yon would be.

22 I think it's important to
23 remember that the burden is on the -- is on Anadarko to show
24 that they won't water out zones.

25 They can resolve the conflict
in the testimony. They can meet their burden showing that
they won't be watering out commercially productive zones.

1 They can do this by drill stem testing each of the zones be-
2 fore they commence disposal in the Canyon formation.

3 If they won't do that, and they
4 don't indicate a willingness to do it, you can carry out
5 your duty to prevent the premature watering out of zones
6 that are potentially capable of producing in commercial
7 quantities by ordering the drill stem test, and we would be
8 happy to provide an order that -- a proposed order that
9 would implement such a recommendation.

10 If this testing requirement is
11 not included in the order we submit that there's no choice
12 if you're to carry out your statutory duty but to deny their
13 application. To permit Anadarko to go forward and drill a
14 well on their acreage in Section 21, or perhaps to go to the
15 Devonian, or perhaps to find some other method of disposing
16 of this water that will not impair correlative rights; that
17 will not constitute waste, and will be consistent with your
statutory duties.

18 MR. RAMEY: Thank you, Mr.
19 Carr. Mr. Kellahin.

20 MR. KELLAHIN: Thank you, Mr.
Chairman.

21 Mr. Carr has postured the tes-
22 timony today as being one of substantial evidence in which
23 you have to resolve some conflicts. I have listened this
24 morning and this afternoon and I'm unable to see the con-
25 flicts in the technical data.

1 MR. Mazzullo says he doesn't like it
2 but despite my efforts to find out why, there is nothing
3 technically to show what precludes the disposal well as we
4 propose.

5 Chama would impose upon us the
6 obligation to drill stem test the well as we cut through the
7 Cisco Canyon and apparently think that a drill stem test is
8 a reliable way to evaluate the productivity of the Cisco
9 Canyon.

10 It happened in their well,
11 drill stem tests of those intervals that had potential for
12 oil production. Mr. Antweil drill stem tested in that well
13 and he plugged and abandoned that devil; wasn't going to
14 make him any money, and I propose it won't make anyone else
15 any money. They're going to have a water well.

16 We can see that the only well
17 in the area that has demonstrated the potential to produce
18 oil is the Anadarko well. Mr. Mazzullo has claimed that we
19 may contaminate the lower section of the Cisco Canyon, but
20 despite my efforts he can establish known production, or any
21 indication of possible production in the immediate area in
22 that lower zone.

23 We look at his South Boyd Well.
24 They tested that interval and they made a water well out of
25 it.

I think it's important to know
that we picked a location based upon some very good informa-

1 tion.

2
3 We are unwilling to drill a
4 wildcat salt water disposal well somewhere else in Section
5 21. I'm not aware of any obligation that requires us to do
6 that kind of thing, \$450,000, or whatever this costs.

7 I think what's important to un-
8 derstand is that there is no conflict in the record. The
9 substantial evidence is that this well is justified at this
10 location.

11 We have established, and it's
12 undisputed, that there is economic production in the Anadar-
13 ko well in the upper A Zone and without an adequate means of
14 disposing of water in this area, we have no other choice but
15 to leave oil reserves in place that could otherwise be pro-
16 duced.

17 Mr. Carr says that Chama has a
18 substantial interest in Section 22. The undisputed testi-
19 mony is that the substantial interest in the northwest quar-
20 ter of 22 belongs to Anadarko. They own 50 percent or 55
21 percent, I've forgotten the exact number, but it's more than
22 50 percent in that very 160. In addition, they own 100 per-
23 cent of the 40-acre tract in which the disposal well is
24 going to be located.

25 They certainly have a signifi-
cant vested interest to make sure that they are not flooding
out a zone in which they have a significant interest that
might be oil productive.

The truth of the matter is that

I haven't put a ruler to it but

I think one way to resolve this

We believe that a disposal well

Thank you.

MR. RAMEY: Thank you, Mr. Kel-

Does anyone have anything fur-

If not, the Commission will

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C.S.R., DO HEREBY CERTIFY
that the foregoing Transcript of Hearing before the Oil Con-
servation Division was reported by me; that the said tran-
script is a full, true, and correct record of the hearing,
prepared by me to the best of my ability.

Sally W. Boyd CSR

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
OIL CONSERVATION DIVISION
STATE LAND OFFICE BLDG.
SANTA FE, NEW MEXICO

20 June 1984

EXAMINER HEARING

IN THE MATTER OF

Application of Anadarko Pro-
duction Company for salt water
disposal and an unorthodox well
location, Eddy County, New Mexico.

CASE
8234

BEFORE: Michael E. Stogner, Examiner

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the Oil Conservation
Division:

W. Perry Pearce
Attorney at Law
Legal Counsel to the Division
State Land Office Bldg.
Santa Fe, New Mexico 87501

For the Applicant:

1
2
3 MR. STOGNER: We'll call next
4 Case Number 8234.

5 MR. PEARCE: That case is on
6 the application of Anadarko Production Company for salt
7 water disposal and an unorthodox well location, Eddy County,
8 New Mexico.

9 Mr. Examiner, applicant has
10 requested continuance of that matter until July the 11th,
11 1984.

12 MR. STOGNER: Case Number 8234
13 will be continued --

14 MR. KELLAHIN: Excuse me, is
15 this the Anadarko case?

16 MR. PEARCE: Yeah.

17 MR. KELLAHIN: We're going to
18 set that for a Commission Hearing on August 1st.

19 MR. PEARCE: Thank you very
20 much, sir.

21 I stand corrected, Mr.
22 Examiner. Applicant has requested continuance of that
23 matter until a Commission Hearing presently scheduled for
24 August the 1st of 1984.

25 MR. STOGNER: Case Number 8234
will be continued to an Oil Conservation Commission hearing
scheduled for August 1st, 1984.

(Hearing concluded.)

C E R T I F I C A T E

I, SALLY W. BOYD, C.S.R., DO HEREBY CERTIFY
that the foregoing Transcript of Hearing before the Oil Con-
servation Division was reported by me; that the said tran-
script is a full, true, and correct record of the hearing,
prepared by me to the best of my ability.

Sally W. Boyd CSR

I do hereby certify that the foregoing is
a correct and true copy of the transcript in
the case of the hearing, or
heard by me on June 20 1984.

Michael P. Shapiro Examiner
Oil Conservation Division