

CASE 5571: ROBERT G. COX FOR
AMENDMENT OF ORDER NO. R-4561,
EDDY COUNTY, NEW MEXICO

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see case 4970
L-207-1

CASE NO.

5571

APPLICATION,
TRANSCRIPTS,
SMALL EXHIBITS,

ETC.

Surveying And Steering While Drilling With A Mud Motor

by Gailen D. Marshall,
Senior Staff Engineer,
Sperry-Sun Well Surveying
Co., Sugarland, Tex.

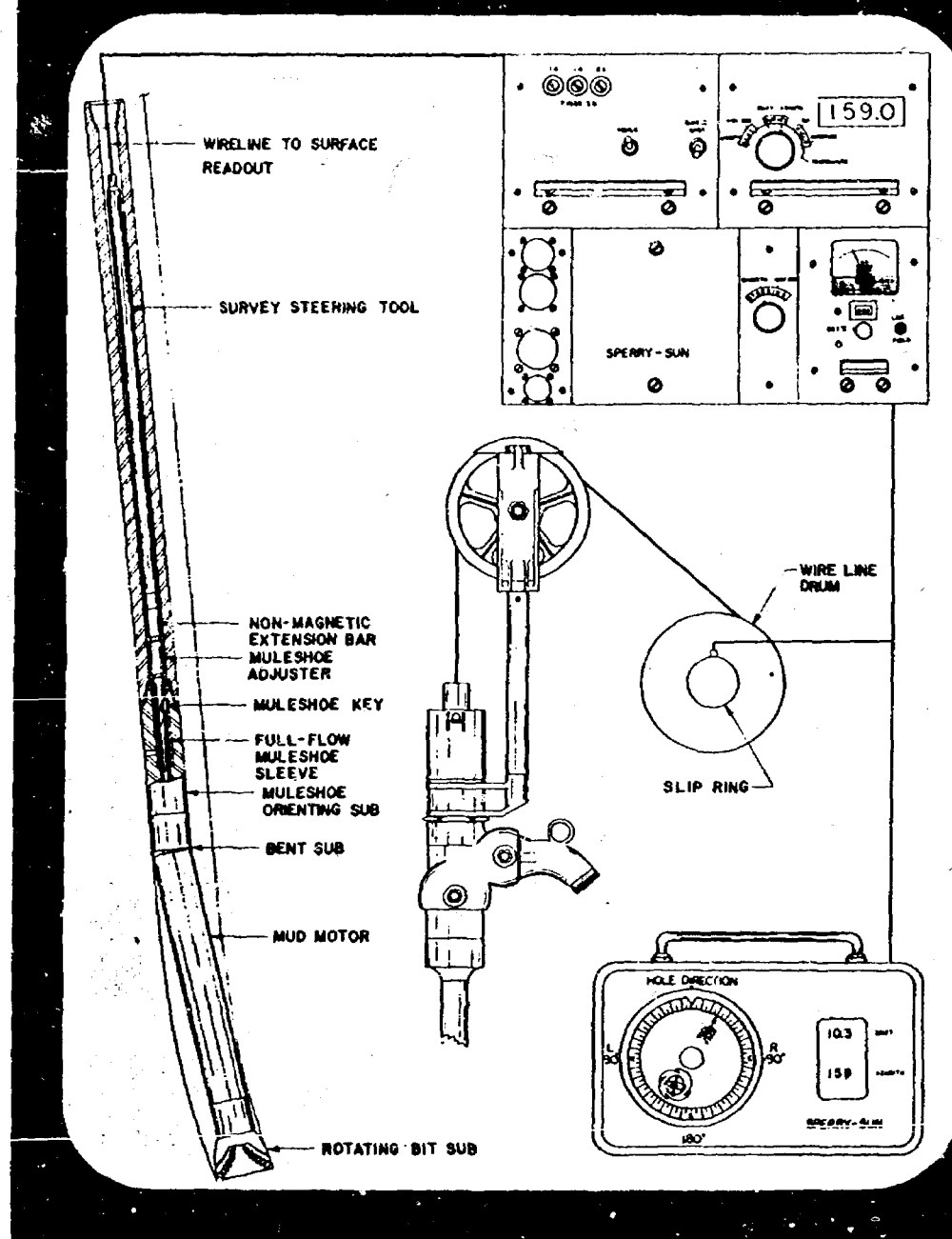


Fig. 1. Components of a survey steering tool operation.

Mud motors now available to the drilling industry have two basic designs — the positive displacement and turbine powered. Both have their distinct characteristics and applications. In domestic service, the positive displacement mud motors seem to have a wider acceptance by the drilling industry.

Directional drilling has become standard practice in helping keep a borehole on a desired course in drilling through faults, highly dipped formations, etc. The first use of a deviated borehole was a relief well drilled to kill

a blowout in the 1930's. The mud motors became a natural for deviating a borehole in that the directive force, a kick sub, causing the course of the hole to change along a desired plane was directly above the mud motor.

Mud motors with a deflecting device came into common usage in medium depth boreholes and were quite successful. The use of a mud motor and a deflecting device required some method of orienting the tools and keeping them oriented along the desired course that

the borehole was to be drilled.

Mud motors, while quite successful, introduced variables of their own which were not measurable and were quite unpredictable in practice. All mud motors have a common characteristic known as reactive torque, a resultant force due to the mud motor turning to the right and supplying power to turn the drill bit. The reactive torque is difficult, if not impossible, to accurately predict.

The instrument industry has kept pace with drilling technology. One development, for example, was the magnetic method of orientation, which introduces some new terms such as orientation, the angular relationship between the toolface and some fixed reference, magnetic north, high side of borehole, and true north or grid north. Toolface was originally the plane of the physical angle built into a whipstock and has, by common usage, come to mean the deflection reference of the down-hole tools, which is to say that the borehole will be deviated along a new vertical axis established by the deflecting device.

Torque lag is the condition when torque is applied to the drilling string at the surface of the borehole to achieve a turn of the toolface down hole at the deflection device on top of the mud motor. There have been many observations where the drill pipe was turned 180 deg at the surface and the drill pipe had to be worked up and down as many as 15 to 20 times before the mud motor turned the complete 180 deg in order to start drilling along the desired course. The deeper the borehole, the greater the torque lag. The smaller diameter drilling strings that are becoming more and more common due to the high tensile loading of the rigs compound the torque lag problem. The worst case is when a hole is being drilled with small diameter drill pipe and the kick off point is very deep. The torque applied to the drilling string at the surface is very difficult to work down to the relatively short section of drill pipe in the deviated borehole. The kick off point acts as a fulcrum which does not allow the torque, introduced at the surface, to be evenly distributed throughout the total drilling string. The mud motor is virtually impossible to control by conventional drilling practices when these borehole conditions exist.

Torque balance is directly related to the reactive torque introduced into any drilling string by a mud motor while drilling.

The reactive torque from the mud motor causes the complete down-hole drilling assembly to turn to the left as mud circulation is started. As drilling weight is applied to the drill bit, the tendency to turn left is even more severe.

There is another torque balance condition that has been observed many times in practice. The reactive torque developed by the mud motor is balanced by the drilling string and rig surface equipment while drilling a hard formation with the desired toolface setting. The

mud motor has been drilling satisfactorily for many hours with no tendency to change when it slowly starts walking to the right; or, it may take a sudden turn with no change in drilling weight. By analyzing available hole conditions, including logging information from similar boreholes, it was determined that a drilling break caused the mud motor to unload the torque balanced between the hard formation and a soft sand section. If torque balance is not maintained at all times while drilling with a mud motor, it is next to impossible to keep the mud motor drilling along the desired course.

The course of a borehole may be determined by two measurements — the azimuth position of the borehole referenced to magnetic north and the drift of the borehole referenced to the gravity vertical. Before the development of the survey steering system, the course of a borehole was determined by making a series of inclination and directional records using a magnetic single shot type surveying instrument after the portion of the hole was drilled. This method required drilling to be interrupted while the survey was made. The very nature of this type drilling required that the portion of the hole being drilled had to be drilled blind. If the mud motor turned off course while this portion was being drilled, the fact was not known until it was too late. Many hours of expensive rig time were required to get the borehole back on the desired course. The frequency of losing the portion of hole being drilled blind and having to plug back and re-drill became higher and higher as deeper drilling with smaller drilling strings came into common usage.

The survey steering system is the latest in a series of developments that have been going on for several years. It is particularly applicable to surveying and deviating a borehole while it is being drilled. The course of a borehole that is being drilled must be determined for many reasons. Some of the more important ones are physical considerations such as drill pipe fatigue as well as the casing, tubing rods, etc., being unduly stressed after the well is completed because of severe course changes. Geological considerations include faulting of the earth's formations. Many regulatory bodies require that the course of a borehole be determined before the well is allowed to produce.

The survey steering system uses magnetic sensors for both surveying and steering. The magnetic sensors indicate the azimuth position in degrees of the down-hole probe relative to magnetic north. The drift sensor indicates the inclination of the down-hole probe, in degrees, from the gravity vertical. The down-hole probe is related to the toolface by a mechanical connection. The probe contains power supplies and associated electronics to gather the surveying and steering parameters along with signal conditioning to transmit the required intelligence over a single conductor wireline to the surface electronics package. The surface package

contains the necessary power supplies for the associated signal conditioning electronics including a computer section. The survey and steering information is displayed on a display module contained in the surface package. There is a surface readout unit positioned at the driller's station on the rig floor so that the directional driller may observe the action of the toolface as the mud motor is steered along a desired course. The readout unit indicates, instantaneously, any turn of the toolface which obviously is related to mud motor torquing as drilling is in progress. The directional driller, by observing the toolface position on the readout, has positive control of the down-hole mud motor at all times. The surface readout unit also contains a numerical display of both drift and azimuth.

The drilling operation using the system is basically the same as any mud motor drilling operation in that the bottom hole assembly consists of a mud motor, kick sub, mud motor orienting sub, and a nonmagnetic drill collar. The drilling assembly is run to bottom and then the probe is lowered into the orienting sub by a single conductor wireline and seated on the muleshoe key. The kelly is not used when drilling with the survey steering system. A circulating head is used to allow the drill pipe to be turned for orienting the mud motor and for drilling fluid circulation. A hydraulic packoff is used to seal off the wireline on the top of the circulating head. Fig. 1 is a schematic representation of a survey steering tool operation.

When controlled directional drilling is required, the desired course of the hole is predetermined by the directional engineering company working with the operating company's geological, engineering and drilling departments. The steering capability of the system makes it relatively simple to change the existing course of a borehole to a required new course. The surveying capability allows the directional engineer to maintain the new course until the new section of borehole being drilled is on the required course to intersect the desired target.

The surveying and steering system has been helpful in drilling many holes from offshore platforms, and for deep redrills. A West Texas oil well, for example, was to be completed as a gas producer in another zone, but the desired course of the well to the new zone was parallel to the fault and somewhat perpendicular to the dip of formations being drilled. Before the steering tool was brought into play, approximately 30 days were used in drilling a small amount of hole, during which time the mud motor had flopped over and drilled up a whipstock.

The first run of the steering tool required only 34 ft and 10 hours of drilling to turn the hole. The hole continued to drift up the dip toward the fault, however, and the steering tool was used to turn the hole back on course four more times before total depth of 15,429 ft was reached. In all, the steering tool took a total of 50

hours to drill 306 ft of the 3,459 ft involved in the deep redrill.

One of the more ambitious undertakings using the steering system was done in the following manner. The well had a liner set below 18,000 ft, but did not have commercial production. The bottom hole location needed to be moved for geological considerations. The operator had two choices — plug back and redrill or turn the hole with the steering system and a mud motor. The plug back would have wiped out several months of drilling as well as the liner. The operator chose to turn the hole, drilling out from under the liner. There were many tool runs on this hole, but the hole was turned in excess of 150 deg in approximately 2000 ft of drilling. The hole was not completed due to other mechanical problems, but comparative cost figures showed that the choice of using the steering system and mud motors was a sound and economical one in that less money was spent than would have been lost on the plug back alone.

The survey and steering system is coming into quite common usage in townsite-type drilling where the cost of developing and maintaining only one surface location to drill eight or ten wells is much less than having to develop and maintain individual locations for each well.

It has also become the accepted method of aiding the directional engineer when drilling relief holes to control the few blowouts that do occur. ■

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About the Author



Gailen Marshall is a senior staff engineer, Technical Services, serving on the advisory staff of the vice president of marketing, U.S.A. for Sperry-Sun. A member of the Society of Petroleum Engineers of AIME, he attended the University of Houston and has 30 years experience in oil well service related to wireline instrumentation and is holder of several patents. Prior to his present assignment, he was involved in research and development at Sperry-Sun. For the last 3½ years, he has had complete responsibility for the operation of the steering tool service, which has become a major service of Sperry-Sun.

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BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
February 24, 1976

COMMISSION HEARING

IN THE MATTER OF:

Application of Robert G. Cox for
amendment of Order No. R-4561, Eddy
County, New Mexico.

CASE
5571
(De Novo
Cont.)

BEFORE: Joe D. Ramey, Director
Phil Lucero, Member
Emery Arnold, Member

Daniel S. Nutter
Richard L. Stamets

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the New Mexico Oil
Conservation Commission:

William F. Carr, Esq.
Legal Counsel for the Commission
State Land Office Building
Santa Fe, New Mexico

For the Applicant:

James E. Day, Jr. Esq.
FREEDMAN, DAY & IVY
Attorneys at Law
Adolphus Tower
Dallas, Texas 75202

APPEARANCES CONTINUED

1

2

For Atlantic Richfield
Company:

3

4

Clarence Hinkle, Esq.
HINKLE, BONDURANT, COX & EATON
Attorneys at Law
Hinkle Building
Roswell, New Mexico

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For Amoco Production
Company:

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Guy Buell, Esq.
Legal Counsel for Amoco Production
P. O. Box 3092
Houston, Texas

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1 MR. RAMEY: The hearing will come to order.

2 This is a continuance of Case 5571 which was heard
3 on January 21.

4 I want the record to reflect that Commissioner
5 Arnold has read the transcript of the previous day and is
6 familiar with the case and will actively participate this
7 day.

8 Mr. Day?

9 MR. DAY: Yes, sir. May it please the Commission,
10 we have an associate with us, Mr. George Hunker of Roswell,
11 New Mexico, a licensed attorney practicing before the New Mexico
12 Bar.

13 MR. RAMEY: All right.

14 Okay, are Mr. Howard, Mr. Currens and Mr. Ricks
15 here, I assume? All right, would these three, plus any other
16 witnesses please stand and be sworn at this time.

17 (THEREUPON, the witnesses were duly sworn.)

18 MR. RAMEY: You may proceed, Mr. Day.

19 MR. DAY: Thank you, Mr. Ramey. At the last hearing
20 in January of 1976, we took up the matter of the circumstances
21 surrounding the drilling of the well and the matter was
22 continued as to the reservoir part of the hearing. At this
23 hearing we would now go into the characteristics of the
24 Empire-Abo Reef field and the relationship of the subject
25 wells to the adjoining well or wells.

1 MR. RAMEY: All right.

2 MR. DAY: If the Commission please, I would like
3 to call as the first witness, Mr. Hugh Christianson. I believe
4 the Commission recognizes and we so call him as an adverse
5 witness.

6 MR. RAMEY: Mr. Christianson.

7
8 HUGH CHRISTIANSON

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

11
12 DIRECT EXAMINATION

13 BY MR. DAY:

14 Q Would you state your name for the record, please?

15 A Hugh Christianson.

16 Q And where do you reside, Mr. Christianson?

17 A Midland, Texas.

18 Q How long have you resided there?

19 A About five-and-a-half years.

20 Q Okay. Mr. Christianson, you have testified before
21 the Oil Conservation Commission of the State of New Mexico
22 before, have you not?

23 A That is correct.

24 Q Several times?

25 A Yes, sir.

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1 Q I know that your qualifications have been proven
2 several times, but very briefly would you state for the
3 record your educational background?

4 A Yes, sir. I have a degree of Bachelor of Science
5 in petroleum engineering, with a major in reservoir engineering
6 from the University of Houston in 1954. I received a degree
7 of Bachelor of Arts in geology from the University of Houston
8 in 1953. Since that time I have, of course, worked with
9 Atlantic Richfield, first here in the Permian Basin from 1954
10 to '58, then up to Tulsa, Oklahoma City and Amarillo, where I
11 was working primarily with midcontinent, Oklahoma, Kansas,
12 Colorado and the Texas Panhandle production.

13 Q Was this also in the employment of Atlantic Richfield?

14 A Yes, all of this was with Atlantic Richfield.
15 During my period at Oklahoma City I took some advanced courses
16 at the University of Oklahoma in reservoir engineering and
17 moving on from Oklahoma City in 1965 to Denver where I worked
18 for a period of two years, primarily with Colorado and the
19 Texas Panhandle, still located in Denver. In 1967, about
20 March, I was transferred down to Roswell, New Mexico, which
21 is where Arco then had its District Office, handling New Mexico
22 production for the specific purpose of beginning work on a
23 study which was hoped would lead to the eventual unitization
24 of the Empire-Abo Pool.

25 Q Excuse me, that was when, sir?

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1 A That was in March of 1967. From that period forward,
2 until today, I have had various responsibilities involving the
3 engineering supervision of the pre-unitization work and of the
4 operations of the unit once it was unitized October 1st of
5 1973 to the present time. And at this time I am supervising
6 an engineering group that has the responsibility for engineer-
7 ing recommendations as regards the Empire-Abo Unit and Pool.

8 Q Then since you secured your degree from the
9 University of Houston you have had one employer and that is
10 Atlantic Richfield?

11 A That is correct.

12 MR. DAY: May I submit to the Commission the
13 qualifications of the witness?

14 MR. RAMEY: Yes, the witness is qualified.

15 Q (Mr. Day continuing.) Mr. Christianson, you have
16 testified before and I have asked you questions before on this
17 Empire-Abo Field?

18 A Yes, sir.

19 Q And the relationship of the subject well of Cox,
20 The Federal EA Well, to the other wells adjoining it, do you
21 recall that testimony, sir?

22 A I hope to the best of my ability.

23 Q I'm not going to ask you questions about what you
24 may or may not have testified, I'm just familiarizing yourself
25 or reminding you of our previous claimship.

1 You made certain comparisons of the Cox Well to the
2 surrounding wells?

3 A Yes, sir.

4 Q And as I recall you used a gas-oil ratio and gravity
5 in those comparisons?

6 A Yes, sir.

7 Q If you would please, give us the indications on those
8 matters, why you feel that the Cox Well is in communication
9 with the surrounding wells?

10 A As far as --

11 Q Sorry, sir, feel free to use any exhibits you might
12 have brought, such as your log studies.

13 A I'm not sure about procedure on that, could I talk
14 to my counsel on this?

15 MR. HINKLE: If the Commission please,
16 Mr. Christianson, of course, will be our principal witness
17 on the reservoir and one of our exhibits will be along the
18 line that Mr. Day is questioning about now. If he wants to
19 refer to that exhibit there, it will be all right. It will
20 be a little out of order, but that's fine with us.

21 Q (Mr. Day continuing.) You had an east-west log
22 study, I believe?

23 A Does this mean that I'm to put this up on the board,
24 or just talk about it?

25 Q That would be fine with me, so that you can expand

1 on your studies of this matter.

2 A Well, now, again I would like to talk to counsel.
3 This is a little out of order with anything I have run into
4 before.

5 MR. RAMEY: Are you asking a real general question
6 of Mr. Christianson?

7 MR. DAY: No, I'm going to get into specifics and
8 even though it is out of order I would be willing to submit
9 the exhibits to the record.

10 THE WITNESS: Well, of course, the exhibits will
11 all be presented later and he will have an opportunity to
12 cross examine. I don't understand it.

13 MR. BUELL: If it please the Commission, that is the
14 comment I'm going to make. Everything that Mr. Day has
15 mentioned so far, I think that Mr. Christianson intends to
16 go into in his direct presentation. It looks like it would
17 be more appropriate and we would have a much clearer record
18 if Mr. Day would handle matters that Mr. Christianson is going
19 to testify to on direct on cross rather than his posture now
20 as an adverse witness.

21 MR. DAY: If the Commission please, we called this
22 witness ourselves and I feel that we are entitled to examine
23 him as to matters that he feels have a bearing on the
24 communication of this well to the field.

25 MR. RAMEY: What are you trying to prove, Mr. Day,

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1 at this time?

2 MR. DAY: I wish for the witness to state, sir, the
3 wells in which he feels the gas-oil ratio comparisons to the
4 Cox Well, the gravity comparisons that he said were indicative
5 of showing that the Cox Well is in communication with the other
6 wells and from that point to go into the relationship of the
7 logs and the corresponding zones of production from this
8 witness.

9 MR. LUCERO: Could you bring this out in cross
10 examination if the other side calls him?

11 MR. DAY: The reason I called him was to make an
12 orderly presentation before the Commission. We are getting
13 into the facts of the relationship of the field and the
14 characteristics of the field and I wish to show this now to
15 the Commission as a basis from which we can then develop the
16 rest of the testimony or the finer points.

17 MR. BUELL: May it please the Commission, I must
18 respectfully point out to this Commission that what Mr. Day
19 is trying to do is to shift the burden of proof and the burden
20 of proceeding. He represents the Applicant in this case and
21 in his opening statement at the January 21 portion of this,
22 he said they were ready to come forward with proof that the
23 Cox deviated well is in truth and effect completed in a
24 separate and distinct reservoir, completely separate from
25 any other production in the Empire-Abo Pool. Now, by this

1 maneuver what he is trying to do is switch the burden of proof
2 and the burden of proceeding on Atlantic Richfield by having
3 Mr. Christianson prove his case that they are not separate and
4 I submit to this Commission that you should not let him get
5 by with this. He has the burden of proof and the burden of
6 proceeding.

7 MR. LUCERO: Mr. Day, what do you have to show to
8 this Commission that this man is an adverse witness at this
9 point to your case?

10 MR. DAY: Mr. Lucero, that will be developed. He
11 has already testified that he has been in the employment of
12 Atlantic Richfield for all of these years and Atlantic Richfield
13 is the unit operator of the unit.

14 May I correct, and I believe the record will so
15 support me, I did not state at the prior hearing that I was
16 coming here to show that this was a separate reservoir, nor
17 do I intend to shift the burden. I well know whose burden it
18 is but I believe, and you may refer to the record, that I
19 stated that we were coming here to show that there was poor
20 communications in this field. If this is producing from the
21 Abo Reef as the rest of the wells in the field are, I'm coming
22 here to show that there is a poor communication between the
23 wells, not that we came to prove that this is a separate
24 reservoir. I believe that matter came up at a much earlier
25 hearing sometime back.

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1 MR. LUCERO: Excuse me, Mr. Day, would you be
2 willing to stipulate with the other side that they call this
3 gentleman now as their witness on direct and you can cross
4 examine him. Other than the fact that he is employed by
5 Atlantic Richfield, you haven't shown that he is an adverse
6 witness.

7 MR. DAY: Sir, as I understand the evidentiary rules,
8 you have to announce that it is an adverse witness before you
9 start examination. The testimony would develop him as an
10 adverse witness. The only reason really to identify him as
11 an adverse witness is so that we can ask leading questions
12 of the witness.

13 MR. LUCERO: You can do that on cross examination.
14 As I understand you want to call him now in the interest of
15 order.

16 MR. DAY: In my presentation of the case.

17 MR. BUELL: May it please the Commission, until we
18 see Mr. Day's direct case on separation or as Mr. Day pleases,
19 poor communication, if his case is poor communication it
20 could be that both Atlantic Richfield and Amoco will not take
21 an adverse position to that. I think we should see Mr. Day's
22 direct case, it is entirely possible that if his witness is
23 just going to talk about poor communication we may be in
24 complete agreement.

25 MR. DAY: Well, sir, then we can ask the witness to

1 so testify.

2 MR. RAMEY: Mr. Hinkle?

3 MR. HINKLE: I think this is entirely out of order
4 and he should elicit this information on cross examination
5 rather than trying to put it on as part of his direct. As
6 Guy has said, we need to know what their position is. They
7 have stated what their position was before and now it seems to
8 be a little different, so I think they ought to make it clear
9 to the Commission what they are contending and then we will
10 put on our evidence accordingly.

11 MR. RAMEY: I think you are right, Mr. Hinkle.
12 Mr. Day, I think if you can ask this witness some general
13 questions, I think that is fine, but to expect him to go into
14 his exhibits and such at this time when we don't know what his
15 exhibits are, I think that is out of order.

16 MR. DAY: All right, sir, thank you.

17 Q (Mr. Day continuing.) Mr. Christianson, you have
18 made a study of this field, would you describe to the
19 Commission the origins or beginnings or formations of this
20 reef? You may feel free to go back to the limit of time or
21 whatever time is appropriate.

22 A Well, let me make it plain that I'm not a practicing
23 geologist although I have a geology degree, so you won't get
24 the kind of detailed testimony that you might out of a
25 geologist who has been practicing at that profession.

1 Nevertheless, it is my understanding that the reef
2 was a coralin-type barrier reef. It has certain similar
3 characteristics with the reefs, as I understand it, that are
4 possibly being deposited in the Bahamas, although, of course,
5 there are lots of differences but it was deposited under that
6 sort of conditions, as I understand it, that is deposited in
7 a shallow sea, coralin material, primarily limestones at that
8 time, of course. I mean it developed into limestone as
9 geologic time went on and, of course, these are really animals
10 that build this reef and it is their shells that form the
11 framework of the reef. And with the geologic time there was
12 a subsidence. Of course, prior to subsidence you had wave
13 action from the sea, the south side of the reef faced the
14 open sea apparently, the back or the north side of the reef
15 was a lagoonal area and again, this is probably somewhat
16 similar to some of the reefs that are developing, perhaps
17 in the Bahamas and perhaps the Great Barrier Reef of
18 Australia at the present time, but a shallow, reasonably
19 shallow warm sea but with wave action working on the front
20 side of the reef, wearing away some of the rock which
21 naturally drifted down the slope of the reef and was being
22 reworked frequently. At any rate, after this period of time,
23 there was a time of subsidence and burial by younger sediments.
24 Apparently then you began to have sluing and fracturing
25 throughout the reef core, and as it was buried deeper, of course,

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1 there would be more fracturing taking place and then a little
2 later on in the --

3 Q What would that be due to?

4 A Due to probably local movement. There was subsidence
5 going on, earth movements which could cause fracturing.

6 MR. BUELL: Excuse me, Mr. Christianson. May it
7 please the Commission, this is all very interesting, Mr.
8 Christianson's opinion of the origin of the Empire-Abo Pool
9 but based on the record that is before this Commission in this
10 de novo case, there is no way in the world this can be adverse
11 in any position that Mr. Cox, the Applicant, has taken because
12 he hasn't taken a position on it.

13 MR. LUCERO: Excuse me, Mr. Day, may I ask you
14 some questions.

15 MR. DAY: Yes, sir.

16 MR. LUCERO: Have you talked to this witness before?

17 MR. DAY: Yes, sir.

18 MR. LUCERO: And have you seen any of his exhibits?

19 MR. DAY: Yes, sir.

20 MR. LUCERO: Well, what do you intend to prove by
21 showing that he is an adverse witness?

22 MR. DAY: Well, now that I can't go into specifics,
23 sir, he is just a witness, I suppose.

24 MR. HINKLE: If the Commission please, I think it
25 is entirely out of order.

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1 MR. LUCERO: You made him your witness by calling him,
2 sir.

3 MR. DAY: It is important for the Commission, I
4 believe, to know how the reef was formed and I'll tie it --

5 MR. BUELL: And again I tell the Commission, that is
6 not our burden. I think Mr. Day should proceed with his
7 witnesses. In all probability Mr. Christianson will agree
8 completely with you on the origin and birth of the Empire-Abo
9 Pool and will not be adverse in this position. We are looking
10 at this completely reversed.

11 MR. DAY: It's my witness, sir.

12 MR. LUCERO: Excuse me, sir, do you feel in your mind,
13 after having talked to him, if you have seen any of his
14 exhibits or if you haven't, that you can bring all of what
15 you need to bring out as far as your case is concerned through
16 cross examination. You have free latitude.

17 MR. DAY: Mr. Lucero, I feel that I'm on direct now
18 and all I'm doing is going into the origin of the field, how
19 it was formed, and then I'll tie it into matters farther down.

20 MR. LUCERO: Yes, sir, but up to this point you haven't
21 shown that he is an adverse witness to your case, other than
22 the fact that he is employed by one of the other parties.

23 MR. DAY: Well, sir, I'm calling him my witness. He
24 has been subpoenaed, or was at one time.

25 MR. HINKLE: I don't remember who they subpoenaed and

1 who they didn't but I remember that we discussed who would
2 appear here at the last hearing. As far as I know I don't
3 believe any of them have been subpoenaed for this hearing.

4 MR. BUELL: All of the witnesses have been subpoenaed
5 that have been subpoenaed for the de novo Case 5171 and this
6 is a continuation of that, so they are still under your
7 subpoena. According to my records Mr. Christianson has never
8 been subpoenaed.

9 MR. DAY: As requested just a moment ago, I will stay
10 with the general questions of the witness.

11 MR. LUCERO: Mr. Day, you are stating that you are
12 not calling him as an adverse witness but you are calling him
13 as a witness involving your case?

14 MR. DAY: For general questions, yes, sir.

15 MR. LUCERO: You don't have the opportunity to cross
16 examine him there. In other words, you withdraw your statement
17 that he is an adverse witness?

18 MR. DAY: Yes, sir.

19 MR. RAMEY: You may proceed.

20 MR. DAY: Thank you, sir.

21 Q (Mr. Day continuing.) We were talking about the
22 formation of the reef and it was being buried?

23 A That is correct.

24 Q And you referred to the lagoon area in the front
25 reef. Would this be then a lagoon area or, do you call it the

1 back reef, would that be proper? And then your main reef
2 section and then where the ocean has hit, the wave action hit
3 the front of the reef, that would be the front of the reef?

4 A That is correct.

5 Q Mr. Christianson, would this all be on a straight
6 horizontal plane or would it vary?

7 A Well, the reef's building organisms began, I'm sure,
8 on a base that was sloping toward a sea bottom, in a shallow
9 sea situation, sloping from the land to the north into the
10 basin to the south.

11 Q Which would be the fore of your reef?

12 A Right, from the back reef to the fore reef and then
13 the reef organisms built up from a base that was undoubtedly
14 gently sloping from north to south, a typical sea bottom.

15 Q So that it would come like this, a peak here and
16 then slope down into the basin?

17 A Yes, you are speaking of the top of the reef, I'm
18 sure.

19 Q The top of the reef and then coming down to --

20 A The general characteristics are a flatter dip on
21 the top of the reef from the crest to the north and a more
22 steep dip from the crest to the south or southerly direction.

23 Q And then that is where it toes out?

24 A That's right.

25 Q Now, on what part of that formation is the Cox Well?

1 A Well, he's on the down dip fore reef or the south
2 edge of the reef development.

3 Q I see. The unit was formed, you said, in October 1,
4 1973?

5 A Right.

6 Q And what kind of a unit maintenance is being done
7 on this field?

8 A Excuse me?

9 Q Okay, your unit maintenance or your recoverment
10 today, sir?

11 A Well, we are attempting to take as much advantage
12 as possible of the natural gravity drainage which is in effect
13 in the reservoir and that is by injecting some, well all of
14 the available produced gas, after having been moved through
15 the gas plants, which averages roughly sixty-five percent of
16 the produced gases, reinjected into the secondary gas cap,
17 which has developed at the top of the reef that you were
18 describing a moment ago and it is moving downward with the
19 oil moving ahead of the expanding secondary gas cap, taking
20 advantage of the excellent vertical and horizontal and lateral
21 communication that has been evidenced from all types of field
22 production history.

23 Q Mr. Christianon, do you know of the ownership of
24 the field, do you know how much Amoco and Arco own of this
25 field?

1 A Roughly, yes.

2 Q What percentage is that?

3 A Oh, at the present time Arco has got thirty-four
4 point one four percent and Amoco, I believe, is about thirty-
5 four point oh, seven percent of the total unit participation.

6 Q That is a little over sixty-eight percent?

7 A Correct.

8 Q Are you familiar with the drilling companies?

9 A Yes, sir, I am.

10 MR. DAY: No other questions.

11 MR. RAMEY: Mr. Hinkle?

12 MR. HINKLE: No, I think we will bring all of this
13 out again in our direct examination.

14 MR. RAMEY: The witness may be excused.

15 (THEREUPON, the witness was excused.)

16 MR. DAY: If it please the Commission, we will call
17 Mr. Glenn Noell, that is N-o-e-l-l.

18

19 W. GLENN NOELL

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

22

23 DIRECT EXAMINATION

24 BY MR. DAY:

25 Q Would you state for the record your name, please, sir?

1 A My name is, the initial W., Glenn, G-l-e-n-n,
2 N-o-e-l-l.

3 Q And where do you live, Mr. Noell?

4 A Dallas, Texas.

5 Q How long have you lived there?

6 A Approximately twenty years.

7 Q All right, sir, would you please tell the Commission
8 your educational background and your business background?

9 A I have a Bachelor of Science from the University of
10 Oklahoma in geological engineering, graduating in 1950.

11 Q From what school, sir?

12 A The University of Oklahoma.

13 Q What is your business and professional occupation?

14 A I spent about six years working for a natural gas
15 company and in 1957 I moved to Dallas, Texas, still working
16 for the same company and I joined H. J. Gruy and Associates
17 in 1961 and have been self-employed with them ever since.

18 Q Sir, in what capacity?

19 A I am a vice president in charge of reservoir and
20 evaluation studies.

21 MR. DAY: May the qualifications of the witness
22 be accepted by the Commission?

23 MR. RAMEY: Yes.

24 Q (Mr. Day continuing.) Mr. Noell, where does the
25 Gruy company have offices and what is their primary function,

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1 business and occupation?

2 A We have offices in Dallas, Texas, Houston. Gruy
3 Management, which manages oil and gas producing properties, has
4 offices in Corpus Christi and we have an office of sorts in
5 New York City and one in Washington, D.C.

6 Q And does your company do any work outside of the
7 State of Texas?

8 A Yes, sir.

9 Q Would you tell the Commission what areas?

10 MR. BUELL: May it please the Commission, you all
11 accepted this witness's qualifications as a petroleum engineer.
12 Now the work that the other people in the Gruy firm do in
13 Texas or New Mexico or Arabia I don't think has any bearing
14 on his qualifications which have been accepted, so I move
15 that we get on with it.

16 MR. DAY: Thank you, I'll withdraw the question.

17 Q (Mr. Day continuing.) I will ask you if the
18 Gruy Company has had any opportunities to do any studies on the
19 Empire-Abo Field in Eddy County, New Mexico.

20 A We represented Yates Petroleum Corporation during
21 the unitization procedures, mainly on an advisory capacity.

22 Q And have those records and studies of your company
23 been available to you?

24 A Yes, sir.

25 Q And have you studied them?

1 A Yes, sir.

2 Q And have you made other studies of the Empire-Abo
3 Field?

4 A Yes, sir.

5 Q All right, sir, have you made any studies as to
6 the oil-water contact levels points in the field?

7 A We have pretty well accepted what the Unitization
8 Committee has come up with as established the oil-water
9 contact.

10 Q Do you have any exhibits on this with you?

11 A No, sir.

12 Q You don't have any plats in which you have made any
13 water studies?

14 A We have some as far as water production.

15 Q I stand corrected, you said water production.

16 A Yes.

17 Q May we see those exhibits?

18 MR. BUELL: May it please the Commission, may I
19 inquire if he has a couple of these exhibits that he posted
20 on the board for us so that we won't have to go over there
21 and get between him and his witness to be looking at them?

22 MR. DAY: I appreciate that, Mr. Buell. Apparently
23 what they have done is taken an Amoco prior exhibit and blown
24 it up and made their own contours on it. You don't have any
25 extras?

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1 THE WITNESS: I don't have any extras.

2 MR. DAY: I apologize. Maybe during the recess I
3 can get them reproduced at one of the blue print companies.

4 (THEREUPON, a discussion was held off
5 the record.)

6 MR. RAMEY: Mr. Hunker, how did you mark those
7 exhibits?

8 MR. HUNKER: I marked them DN-Four and DN-Five
9 of Mr. Cox's.

10 MR. RAMEY: Thank you.

11 Q (Mr. Day continuing.) Mr. Noell, would you look
12 at what has been marked as Mr. Cox's DN-Four and is that a
13 set of your studies of the water production in September of
14 1973?

15 A That is correct, on water production as well as oil
16 rates.

17 Q All right, sir, and the next exhibit which has been
18 marked as Cox's DN-Five, is that a similar study but as of
19 October 1975?

20 A That is correct.

21 Q All right, sir, would you show to the Commission
22 the water production level or points on the first exhibit and
23 what has occurred in the ensuing two years?

24 A Two things have occurred.

25 Q Excuse me, Mr. Noell, feel free to point.

1 A Two things have occurred, obviously, from September
2 of '73 to October of '75, the oil rate on the unit, on a per
3 well basis, has increased by three times on a per well basis.
4 It has had the effect of bringing more water in due to the
5 high rate, plus a partial water drive, I assume, and so that
6 in essence what is happening is that it is true that the gas
7 cap is coming down but by the same token, the water production
8 on the lower wells is increasing and moving northward.

9 Q All right, sir, and what do you find in your
10 comparison between 1973 with the amount of water produced in
11 1975, the amount of water produced?

12 A Well, on certain wells it was not too significant,
13 depending on how high structurally you were. The way we have
14 contoured it, the over all zero water producing -- in other
15 words, one that is producing water free has increased from
16 here to here, represented by this blue.

17 Q All right, sir, you have heard the testimony of
18 the recycling of gas, approximately sixty-five percent of the
19 gas taken out and from your own studies of the field, would
20 you please state to the Commission, in your opinion, what will
21 happen to the production in the Cox well?

22 A Well, the gas injection is only partially effective
23 because they are only injecting sixty-four or sixty-five
24 percent of the gas, so this is going to allow, in the two
25 years that demonstrated this, that the water production on the

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1 Cox well will continue to increase until finally it will become
2 uneconomical to produce it.

3 Q All right, sir, will any oil be left behind in the
4 Cox lease if the water comes through?

5 A Yes, sir.

6 Q All right, sir, then you have gas here and water
7 here but you state, in your opinion, the water will overtake
8 the Cox well?

9 A That is correct.

10 MR. DAY: We pass the witness at this time, may
11 it please the Commission.

12 MR. RAMEY: Any questions of this witness? Mr. Buell?

13 MR. BUELL: May it please the Commission, could
14 I inquire, Mr. Day passed the witness, may I inquire, does he
15 intend to have more direct from this witness.

16 MR. DAY: I may have some rebuttal.

17 MR. BUELL: But as far as your direct is concerned
18 you are through with him, except for rebuttal? The reason I
19 asked, Mr. Day, I was going to recommend that you go ahead and
20 finish all of your direct with this witness and then we could
21 cross examine him in one big swoop.

22 MR. DAY: I think at this time that is all of the
23 questions I have, Mr. Buell.

24

25

CROSS EXAMINATION

BY MR. BUELL:

Q Mr. Noell, my name is Guy Buell, I represent Amoco Production Company and I'm a lawyer, not an engineer or a geologist, I hope you will be patient with me as I stumble and fall along.

I understand you to say that your company had represented Yates during the unit negotiations?

A Yes, that is correct.

Q Then I understand you to say that you had looked at the record, the file that your company had built up during the representation of Mr. Yates?

A That is correct.

Q I would take it by that then that you were not the Gruy Company employee that was assigned to represent Mr. Yates during that unitization endeavor?

A We operate mainly as a team and so in saying that only one person was involved is a misnomer. I have looked at the Empire-Abo at the current time that Mr. Garb was representing him. I did not take an active part in it at that time.

Q You were not a member of the Gruy Company team that represented Mr. Yates?

A That's right.

Q All right, sir, you said that you had made other studies, would you mind detailing them for the record so that

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1 the Commission will have a complete overview of your
2 qualifications in this particular area?

3 A We have looked at, and when I say "we" I'm talking
4 about Gruy and Associates.

5 Q I would rather hear what you have done, Mr. Noell,
6 if you don't mind, I think that is what the Commissioners will
7 be interested in. What have you done by way of reservoir
8 engineering studies in the Empire-Abo Pool.

9 A We have looked at it in respect to Mr. Cox's request.

10 Q In other words, this is you, your, you as a person,
11 your first exposure to the Empire-Abo Pool?

12 A The Empire-Abo, yes.

13 Q All right, sir, based on your testimony with regard
14 to Exhibits Number Four and Five, you didn't say, but I would
15 have to infer from what you imply that you feel that the Cox
16 deviated well is completed in the Empire-Abo Pool.

17 A I think it's in the reef, yes, sir.

18 Q You realize that in a prior Examiner Hearing Mr. Cox
19 has testified that it was separate and apart and not in
20 communication with the Empire-Abo Pool reservoir, are you
21 aware of that?

22 A I'm aware that is what he testified. Our contention
23 is that it is in a different stringer but still within the
24 reef complex.

25 Q Well, does your cursory study of the Empire-Abo Pool

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1 reveal to you that the Empire-Abo reservoir itself originally
2 is composed of different stringers?

3 MR. DAY: If the Commission please, we do object to
4 the adjective "cursory". I don't know that it has been
5 established that they made a cursory examination of the records.

6 MR. BUELL: Mr. Day is right. I'm in error there
7 and I would like to retract the word "cursory" and I'm going
8 to ask Mr. Noell to detail the depth of his engineering
9 analysis and study of the Empire-Abo reservoir.

10 A We established from the available logs around Mr.
11 Cox's well that correlation between porosity zones is almost
12 impossible.

13 Q (Mr. Buell continuing.) You limited your study to
14 the area of Mr. Cox's lease?

15 A In general to that area that your map here indicates,
16 yes.

17 Q Now, this is only a small portion of the Empire-Abo
18 reservoir?

19 A I realize that.

20 Q You have not made a study of the Empire-Abo reservoir?

21 A Only going through the records that the unit was
22 formed on.

23 Q You wouldn't call that a study, would you, Mr. Noell,
24 a detailed engineering study, reviewing the records that some
25 other man prepared?

1 A Well, in our work you have to sometimes. I just
2 got through coming back from Great Britain where I evaluated
3 a billion barrel reservoir on somebody else's work, so I
4 have to take and put common sense and logic to what I see and
5 go from there because we work from data that is not self-
6 derived, it has come from public records, come from our own
7 records, XYZ company and we try to assimilate them and put them
8 all together to make a complete picture.

9 Q You feel that your review of material that was
10 accumulated by someone else with your firm, your review of
11 that material was an engineering study in depth performed by
12 you?

13 A Under the time that I was given to do it, yes, sir.

14 Q When did you start?

15 A Oh, two-and-a-half weeks ago.

16 Q When, I'm sorry.

17 A About two-and-a-half weeks ago.

18 Q So, you think that within the time frame that you
19 had to work in that you have made a detailed engineering
20 study?

21 A I have done a two-and-a-half week detailed study,
22 yes, sir.

23 Q Let me ask you this: What is the significance of
24 your Exhibit Four and Five with respect to the subject matter
25 of this hearing?

1 A It shows me but based on, I have read the testimony
2 presented by other people here and it shows me that it was
3 inferred that the gas cap was going to drive oil down onto
4 Mr. Cox's lease and I'm attempting to demonstrate that that
5 is not going to occur, that actually water production is going
6 to flood his well out before that gas has any material effect
7 on oil recovery.

8 Q Let me ask you this: Have you made a detailed study
9 in the area of the Empire-Abo Pool reservoir in which the Cox
10 lease is located as to the extent of the aquifer in that area?

11 A I'm going on record as saying it is probably pretty
12 limited.

13 Q Let me ask you this: Your study revealed to you
14 that it is very limited, is that correct?

15 A That is correct. This is based on some of the other
16 Abo reefs mainly that I have studied.

17 Q So, even though, based on your own study and
18 determination and your comparison of the Empire-Abo reef with
19 other reefs with which you are familiar, that this aquifer
20 is of a very limited extent, you feel that Mr. Cox's completion
21 is going to be watered out?

22 A Yes, sir.

23 Q And in view of that, now you are aware where he is
24 completed, aren't you, with respect to the geographical
25 confines of his lease?

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1 A Yes, sir.

2 Q Roughly, I may be off a little, Mr. Noell, but
3 roughly sixty feet from the north line and nine feet from
4 his west line?

5 A Yes, sir, I'm aware of that.

6 Q And when do you think that well is going to be
7 watered out?

8 A Well, it hasn't been allowed to produce long enough
9 to say for sure but as of October '75 it was making eleven
10 hundred and ninety-five barrels of oil and thirty-two
11 hundred and forty-four barrels of water in a short time. In
12 other words, that well is going to have a short life, let's
13 put it that way, if it is allowed to produce.

14 Q Mr. Noell, I'm very poor at math, what percent water
15 cut is that?

16 A Approximately twenty percent.

17 Q Thirty-two hundred and forty-four barrels of water
18 and not quite twelve hundred barrels of oil is ten or twenty
19 percent water cut?

20 A No, about eighty percent, I'm sorry, I did this
21 backwards.

22 Q Would that not reveal to you, Mr. Noell, as a very
23 experienced reservoir engineer, that the Cox zone or reservoir,
24 I'll call it, the zone in which Mr. Cox has completed, is of an
25 extremely limited areal extent in the northwest portion of

1 his lease?

2 A The unit assigned fourteen acres to the lease.

3 Q But I'm interested in your opinion, Mr. Noell, you
4 are the expert.

5 A It is completed low structurally for one thing and
6 so this is going to enhance the water production.

7 Q I realize that, in fact, he has only apparently four
8 feet of effective porosity, is that correct?

9 A I would give it a little more than that.

10 Q Roughly four or maybe a little more in your view?

11 He has completed as high as he can complete it in that stringer?

12 A He attempted to complete in the same zone as the
13 west offset and was not able to make a well in those particular
14 correlative zones, obviously it is showing that there was
15 not communication between the M-16 and his well.

16 Q Mr. Noell, again we are looking at a well that is
17 sixty feet from the north line, nine feet from the west line,
18 tucked right up there in the northwest corner of the lease,
19 making eighty percent water, I'm going to ask you again, in
20 your opinion, does that not indicate to you, as a reservoir
21 engineer, that this four-foot zone that Mr. Cox has completed
22 in, is of extremely limited areal extent under the Cox lease?

23 A That is correct.

24 Q And has your study been detailed enough that you
25 can tell me how many acres you think are productive in this

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1 Cox zone, under the Cox lease, has your study been that
2 detailed?

3 A We have taken what the Commission has said as being
4 productive of fourteen acres.

5 Q That is not the Commission, you are going back to
6 the Unit Committee. Let's forget about that, I'm asking you.

7 A I would suggest that there is at least that much,
8 although we really don't have a control to establish that.

9 Q You've got a well completed in a four-foot zone of
10 porosity, give or take a little, cutting eighty percent water
11 after a very short period of production and you say you as a
12 reservoir engineer do not have enough data to determine the
13 areal extent of that reservoir?

14 A That's right.

15 Q Under the Cox lease?

16 A That's correct.

17 Q Was your study detailed enough that you could
18 estimate in your opinion, based on your observance of the
19 performance of this well, knowing that it is tucked into the
20 northwest corner, just about as close as it can get, cutting
21 eighty percent salt water, couldn't you estimate that it has
22 productive acres of maybe two-and-a-half or three?

23 A Well, we are lacking the information on the dry
24 hole to the south.

25 Q I was coming to that. I'm glad you brought it up.

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1 What information are you lacking on the Amoco Diamond Federal
2 Well?

3 A All we have was a log. We did not have any well
4 tests if there were any performed. We do see remnants of the
5 reef down there.

6 Q Mr. Noell, you are aware, are you not, that at the
7 time Amoco drilled this Diamond Federal Well that Mr. Cox
8 owned the Empire-Abo rights under that well?

9 A That's right.

10 Q So I'll guarantee you that we didn't touch the Abo.
11 But you think you see a remnant in the Amoco Diamond Federal
12 No. 1 of the four foot of porosity in the Cox well?

13 A I can't say it's the same porosity zone, no.

14 Q You are also aware of the fact, are you not, that
15 we furnished Mr. Cox, under subpoena the samples on the
16 Diamond Federal through the Empire-Abo reef, are you aware
17 of that?

18 A We didn't see it.

19 Q All right, sir, do you feel your data is a little
20 lacking on the Amoco Diamond Federal well, let's go back
21 up here to your client's lease. Were you titled on any
22 data on the randomly drilled No. 1 and the randomly drilled
23 Well No. 2?

24 A We had access to that information.

25 Q Based on your study of these data, did you find

1 that the Cox four-foot porosity stringer was present either
2 in the old No. 1 or the No. 2?

3 A I don't remember right now that test, I don't recall
4 it. I don't think it went deep enough to catch that other
5 stringer.

6 Q Would you like to check with him now or is your
7 other colleague going to be a witness, am I invading your
8 field here?

9 A You are getting in his field.

10 MR. BUELL: So I can avoid that, Mr. Day, could you
11 kind of tell me what he might cover so I won't --

12 MR. DAY: Probably he will go into that and you can
13 cross examine him on those portions or those questions that
14 you just submitted to this witness.

15 MR. BUELL: Well, I'm trying not to take Mr. Noell
16 out of his direct and he talked about the fact that oil
17 withdrawals are increasing you all's water production and it
18 will water your well out, so I think I can go into that, I
19 think that is a fair cross examination and what I'm trying to
20 arrive at is the extent of this reservoir in the Cox zone, in
21 the deviated completion, that after just a few months of
22 production is cutting eighty percent salt water.

23 A That's correct.

24 Q (Mr. Buell continuing.) Now, did you look, since
25 you made this study, this is your evidence, this is your

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1 testimony, did you look at the data furnished you on the
2 randomly drilled Well No. 1 and randomly drilled Well No. 2
3 to try to determine whether or not the Cox zone extended that
4 far? If you didn't, just say, "No, I didn't even look at those
5 wells."

6 A I'm trying to recall. To my knowledge, neither one
7 of those wells went deep enough to test the zone that he is
8 completed in in the deviated hole.

9 Q So, if I tell you that both of these wells went
10 deep enough to go through the vertical interval in which the
11 Cox deviated well is completed, would that indicate to you
12 that your study has been somewhat less than complete?

13 A That would indicate to me that that reservoir
14 extends that far down to the Cox No. 1 and 2 undeviated wells.

15 Q But you have not made a study of those two wells?

16 A Yes, sir.

17 Q You have made a study?

18 A Yes.

19 Q But you don't know if the wells are drilled deeply
20 enough to cover it. I'm trying not to be argumentive but I
21 will have to admit --

22 THE WITNESS: Off the record and just ask him. Did
23 those two wells go deep enough to test that zone. To my
24 knowledge it didn't.

25 MR. LUCERO: You are having a slight conversation

1 over here. If you want to call any witnesses, call them,
2 swear them in.

3 A I'm going to say it right now and I stand corrected,
4 if when he gets on the stand, to my knowledge the Cox 1 and
5 2 undeviated wells did not go deep enough to see the zone he
6 is completed in in the deviated hole.

7 Q And if his testimony is that they do, or other
8 testimony is that they do, and that is proven up, then your
9 study was somewhat incomplete with respect to those wells?

10 MR. DAY: May it please the Commission, that is a
11 hypothetical question at this point. He is testifying of his
12 own knowledge. There has been nothing in the record at this
13 point to show, other than Mr. Buell's statement that the
14 other wells went deep enough to test those same correlative
15 zones.

16 MR. RAMEY: That is correct, Mr. Buell.

17 MR. BUELL: All right, sir.

18 Q (Mr. Buell continuing.) Assume for the purpose of this
19 question that not only your witness but other witnesses will
20 testify, that randomly drilled No. 1 and No. 2 did go deep
21 enough to penetrate the correlative interval in which the Cox
22 deviated well is completed and that, as you are aware, both
23 of these wells have been plugged and abandoned, or are you aware
24 of that?

25 A Yes, sir.

1 Q All right, sir, assuming for the purpose of this
2 question, that they do go deep enough to encounter that
3 correlative interval, would that not indicate to you that
4 the entire Cox reservoir under the Cox lease has to be found
5 between the bottom-hole location of randomly drilled No. 2
6 and the deviated Cox Well?

7 MR. DAY: I submit to the Commission that in the
8 same question, he is just rephrasing it in different language.

9 MR. BUELL: I had asked him to assume.

10 A Okay, I'm going to assume one thing, it could go
11 at least that far. The reservoir can extend at least to the
12 Cox 1 and 2.

13 Q (Mr. Buell continuing.) Let me ask you this,
14 Mr. Noell, in your detailed study of the Empire-Abo Pool and
15 the area that is shown on your Exhibit Four and Five, have you
16 gone back and investigated and found where edge wells would
17 have a rather large percentage water cut and then with
18 production that water cut would decrease?

19 A In a few instances, yes.

20 Q But that doesn't affect your judgment in saying
21 that the Cox well is going to water out?

22 A Not with only four to six feet perforated. The
23 reason that the water production would drop on an edge well
24 is that it would be perforated in more than one stringer and
25 possibly if it is completed, the water that was in one stringer

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1 that was making the water.

2 Q I think I asked you earlier, I don't recall the
3 answer, let me ask you again. Based on your study which is
4 reflected by Exhibits Four and Five, how long a life do you
5 give the deviated Cox well?

6 A I can't answer that because I don't know what the
7 allowable will be.

8 Q Assuming that the current conditions continue,
9 the conditions under which this well has produced since it
10 was completed, because that is the amount of production your
11 data is based on.

12 A Is that assuming a fifty barrel a day allowable?

13 Q My memory tells me that the Cox well has been
14 producing thirty-five since completion. I could be wrong.
15 You don't know what it has been producing?

16 A It was thirty-five and then they raised it to
17 fifty, was my understanding.

18 Q I'm not intimately familiar with the producing
19 rate of the Cox well and I assume you are.

20 A It is too short really.

21 Q You can't make a prediction?

22 A That's right.

23 MR. DUELL: May it please the Commission, that's
24 all I have. Thank you, Mr. Noell.

25

CROSS EXAMINATION

BY MR. RAMEY:

Q Mr. Noell, do you have any production history on this well?

A Yes, sir. It's just a few months is all it is.

Q Would you mind giving that to the Commission, please? I believe the well started producing in August?

MR. COX: September 7th, sir.

Q (Mr. Ramey continuing.) It started producing September 7th? This exhibit indicates that the well has been producing roughly forty barrels a day since. Has the water production increased appreciably during that time except for a shut-in period here? Do you wish to refer to the exhibit, Mr. Noell?

A Yes, please.

Q It appears to me that when the well is shut down the water production increases?

A That is correct. This is the production that has been produced on the deviated well. The cum. production on the No. 1 undeviated well was approximately, I'm going to say five thousand barrels before they plugged and abandoned it.

Q But there is no indication from this chart that you have here that the well is watering out, so to speak. It looks like the operator has been able to maintain a fairly level production rate of oil.

1 Q Until you shut it in and then the water increases
2 and hopefully, we don't have enough data, it will come back
3 down to this original curve, at least we hope for awhile
4 there.

5 MR. RAMEY: Thank you. Would you mark that as
6 Exhibit Number DN-Six and submit it, please.

7 Mr. Hinkle, do you have a question?

8 MR. HINKLE: Yes, I have two or three.

9
10 CROSS EXAMINATION

11 BY MR. HINKLE:

12 Q Mr. Noell, are you familiar with the water production
13 from the well which offset the Cox lease and are within the
14 Empire-Abo Unit?

15 A Yes, sir.

16 Q And you analyzed these in connection with your
17 study?

18 A Yes, sir.

19 Q Did you find that the water production in those
20 wells was formerly more than it is at the present time?

21 A It is more, comparing it to September of '73 than
22 it is to October of '75.

23 Q Are you saying that it was more then than it is
24 now?

25 A No, it is more now in October of '75 than it was

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1 in September of '73.

2 Q Are you sure of that fact?

3 A On basically all wells, yes, sir.

4 Q Isn't it a fact that the water rate in the past has
5 been higher in these wells than it is at the present time?

6 MR. DAY: "By these wells," could you be a little
7 more specific, Mr. Hinkle, "these wells" being which wells?

8 MR. HINKLE: The offset wells of the Cox lease
9 which are within the Empire-Abo Unit.

10 MR. DAY: Do you wish to go into specific wells?

11 MR. HINKLE: No, all of the offset wells.

12 A Well, water production from the M-16 as of September
13 '73 was approximately eight hundred and ninety-six barrels.
14 As of October 1975 it was twenty-one, ninety-eight barrels
15 of water.

16 Q (Mr. Hinkle continuing.) What about before 1973?
17 Is it a fact that some of those wells were making more water
18 before '73 than they are at the present time?

19 MR. DAY: That would be before the unit, Mr. Hinkle?

20 MR. HINKLE: Yes, it would.

21 A I can't answer that.

22 Q (Mr. Hinkle continuing.) Now, your testimony, I
23 believe, was to the effect that Mr. Cox's well is going to be
24 watered out eventually from the migration of water up structure
25 from the reef to his well, is that right?

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1 A That is correct.

2 Q Well, now, are you saying in effect that the oil
3 which Mr. Cox is now producing is also coming along from the
4 upper part of the reef and the unit to his wells?

5 A Would you repeat that?

6 Q Are you saying in effect that the oil which is being
7 produced from Mr. Cox's well is also coming from the Empire-Abo
8 reef which is within the Empire-Abo unit? You said the water
9 is coming from there, now, is the oil coming from there?

10 A At least the stringer that he perforated in, yes,
11 sir.

12 Q So you admit that there is migration of oil from
13 the Empire-Abo Unit area to Mr. Cox's well?

14 A No, sir, I didn't say that. I said the water
15 was coming from the south, moving to the north. As I say,
16 it is kind of hard to tell for sure but I would assume that
17 most of the oil that Mr. Cox is producing in the short time
18 he has produced it is coming from his lease and if the water
19 continues to move northward, definitely he will not get any
20 of the oil that is under the Empire-Abo Unit.

21 Q How much area of Mr. Cox's lease are you talking
22 about that it could come from?

23 A We are back to Mr. Buell's question. I don't
24 think we have enough control to really say.

25 Q Two-and-a-half or three acres?

1 A Well, all I can say, the Unit agreed it was
2 fourteen.

3 Q Well, if it were fourteen, has the oil in place
4 already been produced on Mr. Cox's lease?

5 A Not to my knowledge.

6 Q In your opinion, would Mr. Cox's well, which is
7 eight feet from the Unit line, drain any oil from the Empire-
8 Abo Unit area?

9 A We will have cross sections that have been prepared
10 that is going to show that there is poor communication from
11 well to well. You cannot correlate from well to well and
12 it's on testimony already, so it is our opinion that the
13 Cox well is not perforated in the same porosity streak as
14 the M-16, say is.

15 Q In your study have you found that there is good
16 vertical and horizontal communications throughout the reef
17 area?

18 A In some places, yes, sir.

19 Q I'm talking about --

20 A I don't think you can make a statement that it is
21 a homogeneous reef and it is all inter-connected. I think
22 we have several things we are going to demonstrate which will
23 prove that they aren't.

24 Q Generally speaking there is good communication
25 horizontally and vertically throughout the reef area, is that

1 right? Wasn't that found to be a fact by the Engineering
2 Committee who made a study preparatory to unitization. You
3 said you represented the Yates in connection with that.

4 A Well, it is strictly my opinion, I do not think
5 there is that good of communication?

6 MR. HINKLE: That's all.

7 MR. RAMEY: Any other questions? Mr. Stamets?
8

9 CROSS EXAMINATION

10 BY MR. STAMETS:

11 Q Mr. Noel, is the Cox well in communication with the
12 Empire-Abo Unit reservoir?

13 A I'm unable to answer that for sure.

14 Q Well, now, to an earlier question you indicated
15 that the production from the Empire-Abo Pool Unit would cause
16 water to influx into the area of the Cox well and if the Cox
17 well is not in communication with the Empire-Abo Unit, why
18 would production from the Empire-Abo Unit affect the Cox well?

19 A There again, like I say, there are places where
20 there is good communication and there are places where
21 there aren't.

22 Q I would like for you to answer the question. In your
23 opinion, is the Cox well connected with the Empire-Abo Unit
24 or is it not?

25 A I'm going to go on record as saying it is not.

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1 Q It is not?

2 A Right.

3 Q What about your earlier response that production
4 from the unit would affect the Cox well, was that in error?

5 A No, sir.

6 Q No, sir? Well, then can you explain the two
7 diametrically opposed pieces of testimony?

8 A It may be connected in a well three mile away so
9 that you are getting the effect by the higher rate of oil
10 production coming out of the Unit is affecting the water
11 production coming from the base of the reef.

12 Q Well, if it is in communication three miles away,
13 then it is in communication?

14 A That's correct.

15 Q So your testimony now is that the Cox well is in
16 communication with the Empire-Abo Unit reservoir?

17 A I would probably have to admit that in some places
18 it is, yes.

19 Q Thank you.

20 A I do not think it is around the wells that are
21 offsetting him, so consequently without --

22 Q That's all I needed. Thank you very much.

23

24

RECROSS EXAMINATION

25

BY MR. RAMEY:

1 Q Mr. Noell, let's go back to the Cox well. Are you
2 familiar with how this well is producing?

3 A It's on a pump.

4 Q It's on a pump? Is it pumping at capacity?

5 A No, sir.

6 Q Could a larger pump be put in and perhaps more oil
7 and more water be produced?

8 A It is my understanding, yes.

9 Q Do you have any idea what the capacity of this
10 well would be with a larger pump?

11 A We haven't made well tests on it but as I understand
12 it, it has the capacity to produce approximately a hundred
13 and thirty barrels of oil a day.

14 MR. RAMEY: Thank you.

15 MR. DAY: I have a few questions.

16 MR. RAMEY: Mr. Day.

17

18

REDIRECT EXAMINATION

19 BY MR. DAY:

20 Q Mr. Noell, you have made other Abo reef studies?

21 A Yes, sir.

22 Q Is the Gruy Company on the mailing list of the
23 Unit, the Empire-Abo Field Unit?

24 A I believe so.

25 Q All right, and in your study you have also referred

1 to some of the Oil Conservation Commission's own records in
2 their own office?

3 A Yes, sir.

4 Q All right, sir, did you state earlier that in your
5 opinion some of the reef is in the Amoco Diamond Federal well?

6 A It is our opinion that there is a remnant there, yes.

7 Q All right.

8 MR. DAY: Before I forget it, may I submit these
9 two exhibits and the one that the Commission asked to be
10 introduced? We submit those exhibits to the record.

11 MR. RAMEY: Yes, they will be admitted.

12 (THEREUPON, Applicants Exhibits DN-Four,
13 DN-Five and DN-Six were admitted into
14 evidence.)

15 Q (Mr. Day continuing.) You were talking about
16 allowables with the Commission in response to some questions
17 asked by Mr. Buell, do you have any suggestions of what would
18 be a fair allowable to be granted to this well?

19 A Yes, sir, I performed several parameters which may
20 or may not have validity to them, but I think they do. It is
21 obvious that the participation factor if he went into the
22 unit would make the well non-commercial.

23 Q What are your suggested allowables?

24 A We have come up with two cases, one based strictly
25 on acreage and taking into account what the offset wells are

1 producing.

2 Q All right, sir, what acreage have you taken into
3 account?

4 A We have given the L-16 forty acres, L-17 forty
5 acres, the M-16 twenty-four acres.

6 Q Excuse me, the M-16 is the west offset, the L-16
7 is the northwest offset and the L-17 is the north offset?

8 A I believe that is correct. And then they have
9 assigned fourteen acres to the Cox tract.

10 Q Where did you secure these figures of acres?

11 A These have come from the Empire-Abo unit agreement.

12 Q From the unit itself. Continue please.

13 A If you do it strictly on acreage then, if you go
14 back to the October '75 monthly production which is the latest
15 month I had, the production from the total of the three offset
16 wells is thirty thousand, four hundred and forty-two barrels.

17 Q All right, sir.

18 A So just by mathematical calculations, fourteen
19 divided by a hundred and eighteen, which is the total acreage
20 under the four tracts in question, times the thirty thousand,
21 four hundred and forty-two barrels, you come up with an
22 allowable of thirty-six hundred and twelve barrels per month
23 which equates to a hundred and seventeen barrels per day.

24 Q All right, then, in brief you are taking the Cox
25 tract of fourteen acres, which was what the unit assigned to it,

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1 the unit assignment of other acreage to the adjacent wells,
2 the production of the adjacent wells, are you taking the
3 fourteen acres from the total of a hundred and eighteen
4 acres, times the daily production, monthly production and
5 you come up with your fourteen, one hundred and eighteen times
6 that to come up with your one hundred and seventeen barrels
7 a day of oil?

8 A That's correct.

9 Q Do you have any other approaches?

10 A Another way to do it would be to do it on gross
11 acre feet.

12 Q Are these again from the Unit?

13 A These are again taken from the Unit. The L-16 has
14 reported ten thousand six hundred and sixty-five gross
15 acre feet of oil column. The L-17, fifteen thousand, five
16 hundred and sixty-nine. The M-16 has two thousand, nine
17 hundred and eleven. The Cox tract, according to the Unit has
18 two thousand, six hundred and eighty-five gross acre feet of
19 oil column. If you ratio that in the same manner as we did
20 on the first case, you get about --

21 Q That would be the number of acres in the Cox tract,
22 the total?

23 A The number of acre feet in the Cox, gross acre feet
24 in the Cox tract compared to the total of the three offset.
25 You get approximately eight percent of gross pay oil column

1 in the Cox tract.

2 Q And times production, what would that be?

3 A Times current production would give a monthly rate
4 of two thousand, five hundred and sixty-six, or approximately
5 eighty-three barrels a day.

6 Q That would be only eighty-three barrels of oil
7 a day?

8 A That's right.

9 MR. DAY: Thank you. No other questions.

10 MR. RAMEY: Mr. Noell, let me ask you one question.

11

12

RECROSS EXAMINATION

13 BY MR. RAMEY:

14 Q To go back, you stated earlier that approximately
15 sixty-five percent of the gas that is withdrawn from the
16 reservoir is re-injected?

17 A That is correct.

18 Q What would be the effect if more gas were added,
19 say enough gas to realize a zero decline in reservoir pressure
20 what would be the effect of the water movement?

21 A I think it would tend to hinder it, I don't know
22 that it would necessarily stop it. You would have to probably
23 at this stage of the game over-inject much more than the
24 hundred percent of the produced gas in order to affect any
25 stopping of the water flowing to the north.

1 MR. RAMEY: Thank you. Mr. Buell?

2
3 RE CROSS EXAMINATION

4 BY MR. BUELL:

5 Q Mr. Noell, I followed your testimony very closely
6 and I believe that the two recommended allowables that you
7 made for the Cox well were based on the data you took from
8 the unitization studies, is that correct?

9 A That's correct.

10 Q I believe we established earlier in my cross
11 examination of you that you had not made a detailed study of
12 the Cox lease at this time with respect to the completion
13 interval that the deviated hole is open in right now? I'm
14 speaking of productive acreage and acre feet. You told me
15 that you hadn't determined the productive acres.

16 A That is correct.

17 Q And if you don't know the productive acreage you
18 certainly can't determine the acre feet, is that not correct?

19 A I'm relying on your expert engineers on this
20 particular point.

21 Q Well, of necessity, since you haven't studied it,
22 you had to use the unitization study?

23 A That is correct.

24 Q And you are completely familiar with it, you
25 reviewed it, remember?

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1 A Yes, sir.

2 Q And you are to some extent completely familiar
3 with Mr. Cox's activities on his EA lease?

4 A That is correct.

5 Q Let me ask you this, I hope we don't have to go
6 into detail but let me ask you this: At the time that the
7 unitization study came up with the fourteen productive acres
8 and whatever gross acre feet you gave, the Aztec No. 1 Well on
9 this Federal EA lease had been plugged and abandoned?

10 A That is correct.

11 Q And subsequent to that unitization study, Mr. Cox,
12 has he not, has come in and reentered the Aztec randomly
13 drilled No. 1 and attempted to make a completion?

14 A I question what you call randomly.

15 Q I'm saying randomly, it deviated but it wasn't
16 intentionally deviated. You have seen the directional surveys
17 on No. 1 and No. 2, haven't you?

18 A Yeah.

19 Q They are certainly not straight holes but no tools
20 were used to direct them in a predetermined arrangement so
21 I call that randomly drilled, it deviated but it was random,
22 not intentionally.

23 A All right.

24 Q All right, are we agreed that Mr. Cox reentered
25 the Aztec No. 1 and attempted to make an Abo completion?

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1 Q He did not, did he?

2 A No.

3 Q He then moved over and drilled his EA No. 2, didn't
4 he?

5 A That is correct.

6 Q He couldn't make a completion there?

7 A That is correct.

8 Q Then he reentered old randomly drilled No. 1 and
9 intentionally directionally deviated to a spot that we have
10 discussed before, sixty feet from the north line and nine
11 feet from the west line?

12 A That is correct.

13 Q Where he was able to make a completion in four,
14 give or take a little, feet of porosity?

15 A That is correct.

16 Q I'm going to ask you this question: Has not all
17 of the data that has been obtained on this lease, subsequent
18 to the unitization study, proven to you as a reservoir
19 engineer that that unitization committee was extremely
20 liberal in productive acreage they assigned to the Cox tract
21 and grossly liberal on the acre feet they assigned to the
22 Cox tract?

23 A By virtue of the fact that the Aztec well did make
24 something in the neighborhood of five thousand barrels of
25 oil, I think it is logical to assume that at least up dip,

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1 there is probably still oil under this lease. Down dip we
2 can't tell how far down it is, obviously it doesn't go very
3 far.

4 Q You have confidence in Mr. Cox's competency as a
5 geologist, do you not?

6 A I have known him for fifteen years.

7 Q Based on your study of all of the data of his
8 efforts on randomly drilled No. 1 and randomly drilled No. 2,
9 his well, he did everything that any competent geologist would
10 do to attempt to make an Abo completion, didn't he?

11 A I assume that is so.

12 Q And he couldn't, could he?

13 A That is correct.

14 Q And when he directionally deviated this well up in
15 the northwesterly-most corner, all he could find was four
16 feet of porosity, is not that correct?

17 A That is as deep as he drilled, I don't know if there
18 would be anymore below that or not.

19 Q Well, based on all of the data obtained from the
20 directionally drilled well, all he could find was four effective
21 feet of porosity?

22 A Yes, sir.

23 Q I'll ask you once more, has not all subsequently
24 acquired data on the Federal EA lease since the unitization
25 study showed that they were extremely liberal in their

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1 productive acre assignment and their acre feet assignment?

2 A It is a matter of opinion.

3 Q Well, what is yours?

4 A Well, when it equates out and he goes into the
5 unit, he goes in at five barrels of oil per month.

6 Q Mr. Noell, I'm not asking you about that. That is
7 something out of your sphere and expertise as a reservoir
8 engineer. I'm asking you and I will ask you once more, has
9 not all subsequently acquired data that you have seen gathered
10 from Mr. Cox's Federal EA lease shown that the unitization
11 committee was extremely liberal in the number of productive
12 acres they assigned to that tract and the acre feet they
13 assigned to that tract?

14 A I do not agree with that, no.

15 Q What data have you seen on the work that Mr. Cox
16 did in the randomly drilled Aztec No. 1 that has confirmed
17 the productive acres assignment or the acre feet assignment
18 that the unitization committee gave to this tract, what data
19 from Mr. Cox's activities on that well?

20 A That fact that he does now have a well.

21 Q He has a well up in the northwest corner. I'm
22 talking about his reentry of the randomly drilled old Aztec
23 No. 1. What data did he obtain to show you as a reservoir
24 engineer that the unitization committee was right in their
25 assignment?

1 A Well, I think we will have later testimony on
2 this that is going to bring out a similar situation.

3 Q I'm asking you, your opinion, you are on the
4 stand now, Mr. Noell, as an expert on the Empire-Abc pool,
5 what data was revealed to you in Mr. Cox's attempt to
6 make a completion on randomly drilled No. 1 that backed
7 up the assignment of the unitization committee to that
8 tract?

9 A Except that that Aztec No. 1 produced five
10 thousand barrels of oil, so there is oil, or has been oil
11 under that particular lease.

12 Q And it was abandoned?

13 A That is correct.

14 Q And none of Mr. Cox's activity in attempting to
15 recomplete that well showed you anything except zero, is that
16 not correct?

17 A Well, that is a matter of opinion.

18 Q Could he make the well, that's the test?

19 A Well, bear in mind that he was reentering an old
20 well. The odds of him making a well even if --

21 A All right, let's go to the new well. You know that
22 he drilled No. 2 from the surface to total depth?

23 A That is correct.

24 Q What results from the drilling, the testing, the
25 attempting to complete that well backs up your opinion that

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1 the unitization committee was right in their assignment of
2 fourteen productive acres and whatever acre feet they assigned
3 to that tract?

4 A The No. 2 did not prove anything.

5 Q It certainly didn't prove anything to back up the
6 work of the unitization committee, it did just the opposite,
7 didn't it?

8 A That is correct.

9 Q What data was revealed to you from your study of
10 the directionally deviated well up in the northwest corner,
11 eight feet from one line that lends credence to the productive
12 acreage the unitization committee assigned and the acre feet
13 they assigned?

14 A Well, just like I repeated, it proved to me that
15 there is oil in some stringer from the Cox 1 and 2 up to the
16 deviated well.

17 Q What was the highest amount of acre feet that the
18 unitization committee contoured on the Cox Federal EA lease,
19 do you know? Was it sixty feet?

20 A Well, the gross acre feet is two thousand, six
21 hundred and eighty-five.

22 Q And I think the largest contour, the thickest
23 contour was sixty feet, is that not correct?

24 A I cannot recall.

25 Q Will you tell me how in this ever-loving blue-eyed

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1 world this directionally drilled well that can only find four
2 effective feet of porosity to complete in, confirms that liberal
3 assignment of productive acreage that the unitization committee
4 made?

5 MR. DAY: If it please the Commission, I don't know
6 that it has been determined. There have been several asking
7 questions but now he assumes it.

8 MR. BUELL: Mr. Reporter, will you strike the word
9 "liberal", I'm sorry.

10 Q (Mr. Buell continuing.) With the word "liberal"
11 stricken out of that, will you explain to this Commission
12 how the fact that all Mr. Cox could find was four effective
13 feet of porosity confirms the acre feet assignment the
14 unitization committee made to this tract?

15 A Well, the four, whatever feet, is simply the well
16 is completely bottomed at TD and that doesn't imply that there
17 might be some productive stringers below that.

18 Q What data did the unitization committee have before
19 them at that time to show that on the Cox lease there was
20 deeper acre feet than you had encountered in the deviated
21 well?

22 A None.

23 Q None? In fact, according to your testimony and
24 your memory and belief, the Cox well is vertically deeper than
25 either the randomly drilled No. 1 and No. 2?

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1 A That is correct.

2 Q All right, I'll ask you once more now that we've
3 got that out of the way. How could the directionally drilled
4 hole, tucked up in the northwest corner, showing only four feet
5 of effective porosity confirm the acre-foot assignment the
6 unitization committee made to that tract?

7 A I will answer you again, I don't think it probably
8 did and leave it at that. I don't know how many acres there
9 is there as evidence.

10 Q All right, sir, I would like to have this clear
11 to the record, I think you testified to it, but recalling
12 that the bottom hole is some nine feet from the west line
13 of the Cox lease, do you feel that the four-foot stringer
14 that that deviated well is completed in extends on up into the
15 unit area?

16 A These zones are not correlative so I cannot answer
17 yes or no.

18 Q Well, a moment ago you answered in a question of
19 Mr. Stamets that you felt that it was in communication and
20 that is the reason that the oil producing rate from the
21 Empire-Abo Unit was adversely affecting your client's water
22 production rate?

23 A In some fashion or other, I'm sure that it is.

24 Q Well, this well is nine feet from the west line
25 of the tract that the Unit M-16 well is located on. Do you

1 feel that this four-foot stringer goes on to the west under
2 the forty-acre unit that the M-16 well is located on?

3 A We do not have the data to say one way or the other.

4 Q All right, sir, I directed your attention to the
5 west and you said you don't know, I'll direct your attention
6 to the northwest, on your Exhibit Five is labeled the
7 Gulf B tract, do you feel that that four-foot interval extends
8 onto the forty acre unit designated Gulf B on your exhibit?

9 MR. DAY: That's the L-16, Mr. Buell, the unit
10 designation?

11 MR. BUELL: I couldn't make it out. It could be
12 L-16, it is kind of blurred there. That is why I identified
13 it as the Gulf B tract on this exhibit.

14 A I don't have the information to answer your question,
15 I don't know.

16 Q (Mr. Buell continuing.) Would your answer be the
17 same if I asked you to the north?

18 A Yes, sir.

19 Q Then how can you testify that the oil producing
20 rate is adversely affecting the producing characteristics
21 of Mr. Cox's well?

22 A By the encroachment of water, for one reason, which
23 we hadn't seen before.

24 Q Mr. Noell, I'm trying not to get confused but I'm
25 getting confused. You testified a moment ago that you don't

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1 know that the Cox zone extends off the Cox lease?

2 A That is correct.

3 Q If it doesn't extend off the Cox lease there is no
4 way in the world that production from any of the unit wells
5 can affect its producing characteristics one iota, is there?

6 A If there is total non-communication that is true.

7 Q Well, now, as an expert I'm going to insist that
8 you take and stand fast on an opinion one way or the other.
9 Is it your opinion that the Cox zone extends outside of the
10 Cox lease into the Empire-Abo Unit or is it your opinion that
11 it does not?

12 A I think there is a good possibility it does but I
13 do not see that any of the Empire-Abo wells are in that same
14 zone at this particular time.

15 Q Well, now, I'm not asking you whether or not in your
16 opinion the M-16 is completed in the same zone of porosity
17 as the Cox well, that is not my question. My question to
18 you was, whether or not in your opinion, the Cox completion
19 stringer extends under the M-16's forty-acre proration unit?
20 Now, put that way can you answer it?

21 A I would assume that it probably does.

22 Q Do you think it extends under the forty-acre proration
23 unit assigned to the L-16 or identified on this exhibit as
24 the Gulf B forty-acre tract?

25 A I assume that it does.

1 Q And I will ask you the same question with respect
2 to the offsetting tracts to the north?

3 A I assume it.

4 Q All right, sir, let me ask you this as a reservoir
5 engineer and with the mechanics of drainage, radius, things of
6 that nature with which you are so intimately familiar with.
7 Looking at this well only nine feet from the west line and
8 sixty feet from the north line, is it your opinion, as I
9 believe I heard you express a little earlier, that none of the
10 oil that is being produced from the Cox well is coming from
11 the Empire-Abo Unit.

12 A Obviously part of it is coming from the Cox lease
13 itself. Now, how much more would be coming from the Unit, at
14 this time it is impossible to tell.

15 Q Have you made a study to try to determine that,
16 Mr. Noell?

17 A No, sir, I haven't.

18 Q Would not just your common sense and extensive
19 experience as a reservoir engineer, with your intimate
20 knowledge with the mechanics of drainage, tell you that a well
21 completed only nine feet from a line that some of its
22 production must of necessity come from the tract that is
23 across that west line?

24 A That is correct.

25 Q And if I ask you the same thing with regard to the

1 north line only sixty feet away would your answer be the
2 same?

3 A That is correct.

4 MR. BUELL: That's all I have, thank you. Thank
5 you, Mr. Noell.

6 MR. RAMEY: Mr. Hinkle?

7 MR. HINKLE: One question.

8
9 RECROSS EXAMINATION

10 BY MR. HINKLE:

11 Q Mr. Noell, referring to your testimony in response
12 to Mr. Day's question in regard to the production and the
13 allowable from the Cox well and the offset wells, did you
14 take into consideration or ignore the unit replacement of
15 voidage; did you take into consideration or did you ignore
16 the relative voidage; did you take into consideration the
17 oil-in-place volume in arriving at your production figures?

18 A Only to a certain extent as far as just common
19 knowledge. I have given the parameters that I have set out
20 here.

21 Q What do you mean by "a certain extent as far as
22 common knowledge"?

23 A Well, as a for instance, the M-16 lease according
24 to the Unit parameters has been giving on its percentage
25 basis over six times the original oil in place. The Cox well

1 in the Unit parameter was giving something like fourteen
2 percent.

3 Q But you didn't actually take into consideration
4 those elements that I have referred to?

5 A No, sir.

6 MR. HINKLE: Okay, that's all.

7
8 REDIRECT EXAMINATION

9 BY MR. DAY:

10 Q Mr. Noell, the Aztec Well and the Cox No. 2 Well,
11 EA No. 2, they watered out, did they not?

12 A That is my understanding, yes.

13 Q And the figures on any of the assigned allowables
14 to this well were based on Unit parameters from the Unit
15 study, is that correct?

16 A That is correct.

17 Q You didn't do a restudy of the Unit you took the
18 Unit figures as the paramenters?

19 A Yes, sir.

20 Q And as to the life of this well I believe you stated
21 there was not enough history of production, how long it would
22 be but it would be a short life before it watered out?

23 A I believe so.

24 Q And as far as oil, there is oil under the Cox lease?

25 A Yes, sir.

1 Q Is it possible to determine how much oil is coming
2 from adjoining leases or the Cox lease?

3 A No, sir.

4 MR. DAY: No other questions.

5 MR. RAMEY: Any other questions of the witness? He
6 may be excused.

7 (THEREUPON, the witness was excused.

8 MR. RAMEY: We will take a fifteen minute recess.

9 (THEREUPON, the hearing was in recess.)

10
11 MR. RAMEY: The hearing will come to order.

12 Mr. Day, will you proceed with your next witness,
13 please?

14 MR. DAY: Yes, thank you, Mr. Ramey. We would call
15 Dr. Rehkemper. That's R-e-h-k-e-m-p-e-r.

16
17 L. JAMES REHKEMPER

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

20
21 DIRECT EXAMINATION

22 BY MR. DAY:

23 Q Would you state for the record your name, please?

24 A L. James Rehkemper, R-e-h-k-e-m-p-e-r, all one word.

25 Q Where do you live, Dr. Rehkemper?

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1 A I live in Dallas, Texas.

2 Q How long have you lived there?

3 A I have lived there the past eight years. I was
4 born there but I moved from there for about twenty years and
5 returned in 1968.

6 Q Would you give the Commission your educational
7 background, please, sir?

8 A I received a Bachelor of Science degree in geology
9 from the University of Texas in 1955, a Master of Arts degree
10 at the University of Texas in 1956, and a Ph.D from Rice
11 University in 1969.

12 Q That was in geology?

13 A All in geology.

14 Q All right, sir, and what is your business background?

15 A From 1956 to 1963 I was employed with Mobil Oil
16 Company. I worked North Texas, the Anadarko Basin and my
17 last year-and-a-half with Mobil was in North Africa where I
18 worked for them in Tripoli. I left Mobil and returned to
19 school for my doctorate degree. Upon graduation I was employed
20 at the Sun Production Research Laboratory in Richardson, Texas.
21 I was involved in clastic petrology research for approximately
22 three years, after which time I was sent to the Division Office
23 where I was on the Division Geologist staff.

24 Following that experience, I was still with Sun, I
25 was put into a new technology group where I was involved in

1 seismic interpretation of bright spots on land.

2 Q All right.

3 A In October, that would have been October '74, I
4 started working for H. J. Gruy and Associates and I'm
5 currently senior geologist with H. J. Gruy and Associates
6 in Dallas.

7 Q Are you a member of any associations or societies?

8 A I am a member of the American Association of
9 Petroleum Geologists, the Society of Economic Paleontologists
10 and Mineralogists, a member of Sigma Chi and the Dallas
11 Geological Society.

12 MR. DAY: We submit the qualifications of the witness.

13 MR. RAMEY: I think he is a qualified geologist,
14 Mr. Day.

15 MR. DAY: Thank you.

16 Q (Mr. Day continuing.) Dr. Rehkemper, I will direct
17 your attention to the Empire-Abo reef field and I will ask
18 you some general questions and then follow with more specific
19 questions.

20 Have you had an opportunity to make some studies
21 of this field?

22 A Yes, sir, I have.

23 Q You heard earlier testimony of the formation of
24 this reef by Mr. Christianson?

25 A Yes, sir.

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1 Q Do you agree in general?

2 A I think he has it, yes. This reef is a little
3 different from many reefs in that it is a transgressive reef.
4 Most reefs by the nature of their development are regressive,
5 they tend to build out over the shelf but Hugh describes this
6 particular reef as transgressive and it built landward. I
7 agree with his interpretation that it is a reef that could be
8 comparable to the Great Barrier Reef.

9 Q All right, sir, and basically the reef is in three
10 portions, the back reef, the main reef and the fore reef?

11 A Yes, sir.

12 Q Generally speaking is the fore reef tighter or as
13 porous or as permeable as the rest of the main reef?

14 A Your fore reef facies would most likely be tighter.
15 It is deposited in deeper water where you have less wave
16 agitation, therefore, you would have less porosity development
17 unless it is secondary porosity.

18 Q So a well in the fore reef would be in a tighter
19 formation generally speaking, than the wells in the back reef
20 or main reef?

21 A Very definitely.

22 Q All right, sir, have you made any studies as to
23 the local communication. I'm not talking generally through
24 the Abo reef field of communication in general terms, I'm
25 talking about local communication?

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1 A Yes, I have.

2 Q Have you made any studies of local communications
3 in connection with the Cox Federal EA Well?

4 A Yes, I have.

5 Q All right, sir, will you please tell the Commission
6 if you have made any log studies of the adjacent wells to the
7 subject Cox well?

8 A By log you mean log analysis?

9 Q Yes, sir.

10 A I have not performed any log analysis as far as
11 coming up with the particular water saturations and porosities
12 no. I have looked at it in a qualitative sense.

13 Q And have you made any correlations with these logs?

14 A Yes, I have attempted a correlation.

15 Q Can you correlate by porosity?

16 A No. Porosity is quite varied within any particular
17 correlative zone. A zone can be correlative but you will
18 not necessarily have porosity developed within that zone in
19 all wells.

20 Q All right. I ask you if you made a correlative
21 zone study of the logs between the Cox well and the M-16 well?

22 A Yes, I have.

23 Q And what did you find and do you have an exhibit
24 on that?

25 A Yes, sir, I do.

1 Q Which one is it?

2 A The exhibit that I have is actually taken from an
3 earlier exhibit made by Arco and I believe it was an exhibit
4 in the November 1975 hearing.

5 Q That is what you are pointing at now?

6 A This is a portion of their east-west cross section.
7 It is a structural cross section hung on a sea level datum.
8 Here is their top of the reef as they picked it. Also
9 indicated on the original exhibit were the perforations of
10 these three wells, the M-16, the Cox and the L-17. Now, I
11 have added to this cross section, the additional perforations
12 by Cox, one of which was apparently above the main reef, the
13 other was in the upper part of the main reef. Now, this
14 cross section illustrates that the correlative zone which is
15 producing in the M-16 Well, was tested in the Cox well. Below
16 the Cox well is a report of the test which was performed in
17 that zone, which was from sixty-one, sixty-two to sixty-one,
18 seventy. It was perforated with twenty shots, it was acidized
19 with five hundred gallons, swabbed dry, acidized with seven
20 hundred and fifty gallons, swabbed dry, with a slight show of
21 oil and gas. Acidized with ten thousand gallons of fifteen
22 percent, swabbed dry, no fluid entering and they left three
23 hundred and thirteen barrels of load on recovery.

24 Now, this indicates to me that the porosity developed
25 in this zone in the Amoco Well.

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1 Q Is that the M-16?

2 A The M-16. It was not present in the Cox Well. In
3 other words, you did not have porosity and permeability
4 continuity between these two wells. Had you had porosity and
5 permeability continuity, this well would have been productive
6 in this zone. Instead, this well has produced in a lower zone
7 which was not perforated in the M-16 Well.

8 Now, if we go to the north, we have --

9 Q Your conclusions from that is that the producing
10 zone of the Cox Well is related or communicative with the M-16
11 or not?

12 A It is not.

13 Q It is below that zone of the M-16?

14 A The M-16 is producing from up here.

15 Q All right, sir. Do you find that the Cox zone is
16 present in the well to the north?

17 A Yes, I would say by my correlations the zone which
18 is perforated and producing in the Cox Well is present and
19 productive in the L-17. Now, I cannot say that there is
20 communication, that there is porosity and permeability
21 continuity within this zone between these two wells.

22 Q All right, sir, have you found any evidence in the
23 immediate area of local lack of communication?

24 A Yes, and I refer to my Exhibit Number Two which
25 is a short west to east cross section, labeled AA Prime, which

1 runs between the Exxon No. 5, which is a producer, to the
2 No. 3, which is a dry hole, to the L-20, which is the No. 4.

3 MR. BUELL: Pardon me, Mr. Day, he called that
4 Exhibit Number Two, it couldn't be. Could we go off the
5 record and correct that?

6 (THEREUPON, a discussion was held off
7 the record.)

8 A Okay, my discussion of the second exhibit which I
9 have to show, which is DN-Seven, the line of cross section for
10 DN-Seven is illustrated on Exhibit DN-Eight and is labeled
11 AA Prime.

12 This is not a structural cross section, it is a
13 stratigraphic cross section. It is hung on a shale datum
14 within the Bone Springs.

15 The Humble No. 3 Empire Federal was the first hole
16 drilled. It was a dry hole, they ran three drill stem tests,
17 the upper one they recovered three feet of gas cut mud, the
18 second test overlapped a portion of the first, they recovered
19 thirty feet of salt water cut mud. The third test recovered
20 eleven hundred and seventy feet of salt water.

21 The top of the reef, which I indicate on this cross
22 section, was agreed upon by the unitization committee. I had
23 no sample control so I had to take them at their word that
24 this is the top of the reef.

25 In the Humble No. 5 Well, the zone which is producing

1 was tested in the No. 3 Well and it was found to be
2 tight. These two wells are approximately two hundred and
3 twenty feet apart.

4 Sixteen hundred and fifty feet further to the east
5 is the Humble No. 4 or the unitization designation, L-20. Here
6 again it shows that the upper zone, which is producing in the
7 No. 5 Well and was tight in the No. 3 Well, is again productive
8 here, indicating that you do have permeability barriers within
9 this reef through the same correlative zone.

10 Q All right, sir. In these studies that you have
11 made to show that there is communication, local communication
12 can vary and in some instances is very poor, such as there is
13 no communication between the M-16 and the subject Cox well?

14 A Right.

15 Q How did you find the porosity within the reef
16 reservoir, is it distributed regularly or irregularly?

17 A It would be very irregular, yes, sir.

18 MR. DAY: We pass the witness at this point, Mr.
19 Ramey.

20 MR. RAMEY: Any questions of the witness? Mr. Buell?

21 MR. BUELL: Thank you, Mr. Ramey.

22

23

CROSS EXAMINATION

24

BY MR. BUELL:

25

Q Doctor, you are aware of the purpose of this hearing

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1 here today, are you not?

2 A Right.

3 Q From the standpoint of the purpose in our being
4 here today, what is the significance of your exhibits and
5 testimony in that regard?

6 A My purpose here is to show that the zone which is
7 productive in the Cox well is not productive in the M-16 Well,
8 and, therefore, you cannot assume permeability and porosity
9 continuity between any two wells.

10 Q Now, in your direct, Doctor, with regard to the
11 M-16, I understood you to testify that the Cox zone was
12 present in the M-16 but it wasn't tested nor a correlation
13 attempt made?

14 A Right, right. Now, you have to differentiate between
15 zone and pay zone. A correlative zone is a zone which is
16 correlative time-wise. In other words, this was deposited
17 at the same time this was deposited so they are correlative
18 zones. What I'm saying is, that although this zone is present
19 here, it was not productive.

20 Q In view of the fact that it wasn't tested, how do
21 you make your determination that it was not productive?

22 A Okay, well, the only evidence we have is -- well,
23 if it was productive it should have been perforated I would
24 suspect. The only log suite I had on this was a gamma ray
25 neutron which is a poor log at best. I say it could have been

1 present here but I cannot say whether it is productive or
2 not.

3 Q Well, a moment ago you said that it wasn't productive
4 and I wanted to clear the record.

5 A Okay. Well, all I can say is that this particular
6 zone is present but I cannot say it was productive or not
7 productive. I believe I was spending most of my time on this
8 upper zone here which I think we know was not productive here
9 or not productive there.

10 MR. DAY: Dr. Rehkemper, you are pointing to Exhibit
11 Number Nine?

12 A Yes.

13 MR. BUELL: And incidentally, that was never
14 identified for the record on his direct and the first cross
15 section that the Doctor testified to as he referred to as
16 an Arco exhibit in the previous hearing has now been identified
17 as Cox's DN Exhibit Number Nine.

18 Q (Mr. Buell continuing.) All right, sir, I did
19 understand correctly when you testified that you had not made
20 a quantitative analysis of any of these logs?

21 A That is correct, sir.

22 Q So, that is the reason that you cannot form a
23 judgment as to whether or not the Cox zone is productive or
24 not productive in the M-16?

25 A Right.

1 Q All right, sir, while we are on that, you heard
2 the discussion of the location of the bottom hole of the Cox
3 Well?

4 A Right.

5 Q And it is only nine feet from the west line and the
6 M-16 is to the west. As a geologist, would you be tremendously
7 surprised if the Cox zone didn't extend as a productive zone
8 of porosity over into the forty-acre proration unit assigned
9 to the M-16?

10 A That is a possibility.

11 Q If I ask you that same question with regard to the
12 Cox zone in the other directions, sixty feet from the northwest
13 and sixty feet to the north, would your answer be the same?

14 A You say sixty feet from the Cox well it would be
15 productive?

16 Q The Cox Well is sixty feet from the north line,
17 would you not be surprised if the Cox zone didn't extend
18 past the north line of his lease in a northwesterly direction,
19 as well as in a north?

20 A I would say it is possible. Based on a lack of
21 continuity in this zone, the shallow zone, it may or may not
22 be, you may or may not have porosity or permeability
23 continuity. We know it doesn't happen here. We cannot say
24 with any certainty that the zone carries into the Amoco M-16.

25 Q Now, you have already said with certainty that it

1 does, now let's try to keep the record straight.

2 A Well, now, okay.

3 Q For your sake as well as ours.

4 A Okay, the zone carries but I don't know if it is
5 productive or not.

6 Q I'll accept that. That is consistent with your
7 prior testimony.

8 A Okay.

9 Q Have you formed an opinion or a judgment, Doctor, as
10 to whether or not the four feet of porosity that the Cox
11 deviated well is completed in is completely under the Cox
12 Federal EA lease?

13 A Completely under the lease? I cannot say that because
14 in the two wells, the Aztec Well and the No. 2, that particular
15 zone was not penetrated in those two wells. Now, we go south
16 to the Amoco Well, the Amoco Well, I have not seen the samples.
17 I have not seen a sample description of the Abo reef. I was
18 told that it was described as a biomicrudite. This is a
19 classification of carbonate rocks used by Dr. Morrell Fulker,
20 of the University of Texas. It indicates that you have fossil
21 fragments, it indicates that they are coarse grained, coarse
22 grained fossil fragments in this well. Now, this is character-
23 istic of reef facies. So based on that, like I say I have not
24 seen it, I have been told that this is how it was described.
25 There is reason to believe that the reef facies extends as far

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1 down as the Amoco Well.

2 Now, I have not performed log analysis on the
3 Amoco Well. I have an analysis which was performed on that
4 well by Walter Eichmeyer who was former manager --

5 Q Excuse me, is he in the room today?

6 A He is not in the room, I have a report of his.

7 Q Well, if he is not here for cross examination, I'm
8 going to ask the Commission to instruct you not to go into
9 that if we can't test his accuracy in the judgment that he
10 made. I'm asking you for your opinion. You are the expert
11 on the stand and my question was: Have you formed a judgment
12 that the stringer reservoir in which the Cox deviated well is
13 completed, that four feet of porosity, is confined entirely
14 to the Cox lease?

15 A I cannot testify definitely that it is.

16 Q And a moment ago you couldn't testify definitely
17 as to whether or not it extended past his lease line?

18 A That is correct.

19 Q So we are kind of at a hiatus as far as your expert
20 testimony is concerned?

21 A That is correct. Well, we will go through it again.
22 I feel like that zone carries to the north but I cannot testify
23 that you have porosity and permeability continuity.

24 Q A moment ago you said that you couldn't testify
25 that we had porosity and permeability continuity to the west,

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1 the northwest or the north, is that correct?

2 A That's right. All we know is that the same zone
3 is porous in the north offset but I cannot say that they are
4 connected because in Exhibit DN-Seven we find that the same
5 zone is productive and it contains porosity and permeability
6 in the No. 5 Humble Well and the No. 4 Humble Well. We can
7 make an assumption that if you have porosity and permeability
8 continuity in between these two wells, you are wrong, because
9 they have a well between the two that disproves that. This
10 is the same situation as we have here. We have the productive
11 zone, I'm referring to Exhibit Nine. We have a productive
12 zone in the EA Cox No. 1, I feel that that same zone is
13 productive in the No. L-17, but I cannot say that you have
14 porosity and permeability continuity between those two wells
15 and I show this as evidence that you can have permeability
16 barriers within the reef.

17 Q Doctor, you see my confusion as earlier Mr. Cox
18 contended, based on his geological investigation, that this
19 was a separate stringer that had never been produced by any
20 other well in the area, it was a separate and complete
21 accumulation of oil of what is known as a common source of
22 supply and I was wondering what you in your expert judgment
23 could tell this Commission that would help them in deciding
24 whether or not the deviated Cox well is in a separate and
25 distinct accumulation of oil not heretofore produced by any

1 other well, or whether it is simply another zone of porosity
2 that is productive and in communication with the Empire-Abo
3 field?

4 A I cannot say that it is. You have porosity and
5 permeability continuity. I will say this zone is productive
6 elsewhere in the field but I cannot say that the two zones
7 are connected.

8 Q All right, sir, so if we have no connection between
9 the Cox zone and the Empire-Abo Pool, there is nothing from
10 the standpoint of production from the Empire-Abo Unit wells
11 that could adversely affect the producing characteristics of the
12 Cox Well, is that correct?

13 A If you assume no porosity or permeability communica-
14 tions I would say, yes.

15 Q All right, sir, have you made a study to try to
16 determine the extent of the Cox zone porosity under the Cox
17 lease, areal extent I'm speaking of?

18 A Areal extent, well, like I say, the only control
19 we have is the Amoco Diamond Federal to the south and based
20 on sample descriptions it looks like you are in a reef facies.
21 Here again we have reef facies in a producing zone in the
22 Cox well. You have reef facies in the Amoco Diamond Federal,
23 whether you have permeability and porosity continuity, I
24 cannot say. I would say that there is a possibility that
25 you do.

1 Q Doctor, I don't want to take you out of your
2 sphere of expertise but would you not suspect -- let me ask
3 you this: Are you familiar with the structure of the Abo
4 reef at all in the area of the field?

5 A By structure what do you mean?

6 Q By structure, as a lawyer that's all I've ever
7 heard you guys talk about, the structural contour.

8 A The configuration?

9 Q Yes.

10 A By structure you can also mean internal structure
11 of the reef.

12 Q Yes, you know, you draw all of these little wavy
13 lines of equal height.

14 A Okay. Yes, I'm familiar with it.

15 Q Generally speaking, and I'll direct your attention
16 to your DN Exhibit Eight. In the area of the Cox Federal
17 EA lease, how do we find the structure, are we going down
18 structure across this lease or are we going up structure or
19 just what?

20 A You are going -- you go down and then you go up
21 again, I believe. Well, it is indicated right here on
22 Exhibit Nine. This is a structural cross section, this is
23 the top of the reef. Okay, now, one thing that should be
24 brought out is that this is a deviated hole, as you well
25 know, and there is a vertical correction of thirty feet.

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1 Q I know there is a vertical correction to get the
2 true vertical depth, I don't know what it is.

3 A Okay, well, there is a thirty-foot correction. In
4 order to make this Exhibit Nine correct, this log would be
5 shifted thirty degrees.

6 Q Downward?

7 A Upward.

8 Q Are you sure that this log of the Cox deviated
9 well is not hung on true vertical?

10 A Well, let me check here just to make sure.

11 Q What does TVD mean?

12 A That means true vertical depth.

13 Q So we don't have to do any shifting, do we?

14 A Well, I don't know whether this log has been shifted,
15 let me check. It's hung on a twenty-five hundred foot datum
16 at this point. Okay, twenty-five hundred plus thirty-six
17 twenty is sixty-one, twenty and, no, this has not be adjusted
18 because it is at sixty-one, ten, twenty, forty, fifty. Okay,
19 I'll take it back, it has been adjusted. I'm sorry. This
20 has been adjusted for deviation.

21 Q All right, sir, so we are coming down structurally
22 even on the deviated well which is in the upper northwest
23 corner of the Cox lease?

24 A Yes, moving down dip.

25 Q Coming down dip. Do you know whether or not the

1 structure would continue downward into Amoco's Diamond
2 Federal No. 1?

3 A Yes, it does.

4 Q I don't want to get you out of your sphere of
5 expertise, but would you not expect that when you have an up-
6 structure completion, producing according to Mr. Noell's
7 testimony, eighty percent water, that if the reef, in fact,
8 was present in the further down structure Amoco Diamond
9 Federal Well, it would be completely watered?

10 A Well, I may open up a barrel of worms here, but if
11 we are in a transition zone here, I don't know if we are or
12 not. There has been testimony in the past to the effect that
13 we are. I don't know how thick this transition zone could
14 be.

15 Q I'm asking your opinion, Doctor.

16 A Yeah. Okay, I would say, I cannot tell you with
17 any degree of certainty that this well would be wet in the
18 Amoco Diamond Federal even though it is down dip.

19 Q Do you think it would be hydrocarbon bearing?

20 A I would say there is a possibility.

21 Q Then in this common zone of porosity which you have
22 alluded to, we would have oil, going down structure we would
23 have water and then going further down structure we would
24 have oil, is that a physical possibility, Doctor?

25 A Well, not if you have porosity permeability

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1 continuity, no.

2 Q Well, a moment ago you said that there was a good
3 chance that you do have?

4 A I would say it is a possibility.

5 Q That you saw this remnant over a vertical distance
6 of -- how many feet is it from the bottom-hole location of
7 the Cox deviated well to the Diamond Federal Well?

8 A The distance?

9 Q Just roughly.

10 A I would say two thousand feet.

11 Q How far?

12 A Two thousand feet.

13 Q Okay, you see the possibility of porosity and
14 permeability communication over fifteen hundred feet, based on
15 the fact that somebody told you that they saw in a sample log
16 that there might be a little reef there but yet between the
17 deviated Cox well and the M-16, although that is a much shorter
18 distance, wouldn't you say that it is about five hundred feet?

19 A That's probably six, sixty.

20 Q Six, sixty, I'll give you a thousand if you want it,
21 a much shorter distance, although you see the zone on the
22 log you yourself can examine, you say that you doubt that
23 we have continuous porosity and permeability communication,
24 aren't you being a little inconsistent?

25 A No, I think you have a wide variability. I'm sure

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1 you can probably point to a cross section where you have
2 a well. Now, referring to Exhibit Seven where you have wells
3 more widely separated as would show communication, but I think
4 in a reef it is highly variable.

5 Q Is it kind of like beauty, it is just in the eyes
6 of the beholder, and I'm not being facetious?

7 A Well, I think you are trying to, but just because
8 you don't have continuity between these two, you don't have
9 it between these two.

10 Q No, that's not what I'm saying. I'm wondering how
11 you as an expert, Doctor, and I'll admit for the record that
12 you are an expert, how you can look at two completions over
13 fifteen hundred feet apart and on the down structure one,
14 someone told you that they looked at a sample log and there
15 might be a reef there and you can form a judgment that you
16 have porosity and permeability connection based on these data
17 when over a distance of only six hundred feet where you can
18 look at the data yourself you say, I'm convinced there
19 isn't?

20 A In that particular zone, sure, I think this is just
21 logical.

22 Q That's all I can expect of you is your opinion.

23 A Now, you don't want me to bring this up, the log
24 analysis indicates that they have a show.

25 Q Have you looked at the logs that we furnished Mr. Cox

1 on the Diamond Federal No. 1?

2 A No, I haven't.

3 Q Well, then where do you get your opinion that the
4 logs said that you had a show?

5 A I have a lot of respect for the professional ability
6 of Walter Eichmeyer.

7 Q Well, we are back to this?

8 A Right, this is the man.

9 Q The guy who is not here?

10 A The one that is not here, right.

11 MR. BUELL: Mr. Cox, do you have with you a log
12 of the Amoco Diamond Federal No. 1?

13 MR. COX: No, I do not.

14 Q (Mr. Buell continuing.) Then you never looked at
15 it?

16 A I've looked at the gamma ray neutron, in fact, it
17 was probably on one of Arco's sections, we can see.

18 Here's Amoco. I'm referring to an exhibit by Arco
19 which I presume was presented in evidence in the November 19th
20 hearing, whereby they show, indeed, that the reef in the Cox
21 well is also present in the Amoco Diamond Federal No. 1. Now,
22 this log is a compensated neutron, compensated formation
23 density. Okay. They do not show their porosity scale. These
24 curves are displayed as porosity. The top of the reef indicates
25 porosity on the formation, compensated formation density log.

1 On the gamma ray which accompanies this log you have a fairly
2 clean gamma ray, so I think there is evidence that you may
3 well have continuity between these two. Structurally you are
4 still above the original oil-water contact of twenty-six,
5 sixty-five, so there is a possibility, and I would state that
6 there is a possibility that you have pay in the Amoco Diamond
7 Federal No. 1.

8 Q In your opinion is the original oil-water contact
9 at minus twenty-six, sixty-five currently still there today?

10 A I have no idea.

11 MR. LUCERO: Excuse me, Mr. Buell, is that exhibit
12 that he keeps pointing to here and there and this well and
13 that well, has it been identified for the record? Because we
14 could have people who are not here today reading this record
15 some day.

16 MR. BUELL: They are going to be confused.

17 MR. LUCERO: I'm talking about the one he is just
18 referring to. Now, what is the number of that exhibit?

19 MR. BUELL: I can't find it anywhere.

20 MR. DAY: That has not been stamped.

21 MR. LUCERO: Well, didn't you say that that had been
22 used at the prior hearing.

23 THE WITNESS: It was used at the November 19th, 1975
24 hearing.

25 MR. LUCERO: Well, let's identify it for the record,

1 so far it is just a printed piece of paper there.

2 THE WITNESS: In pencil it is marked as Exhibit
3 Number Four. Is there someone here with Arco that could
4 identify it?

5 MR. RAMEY: Why don't you label that as Cox's Ten.

6 MR. BUELL: Would it be Ten?

7 MR. RAMEY: D-N Ten.

8 (THEREUPON, Cox's Exhibit Number DN-Ten
9 was marked for identification.)

10 Q (Mr. Buell continuing.) All right, sir, since you
11 have now looked at Amoco Diamond Federal No. 1 log on Cox's
12 Exhibit DN-Ten, do you feel that the Cox zone is any better
13 developed in this well from a log standpoint than it is in the
14 M-16, which is reflected on your Exhibit Number Nine?

15 A Well, I am comparing a gamma ray neutron log, the
16 compensated formation density neutron log. The compensated
17 formation density neutron is a much better quantitative tool
18 than the gamma ray neutron, so in the absence of a comparable
19 log in the J-1, I cannot say how the two zones compare.

20 Q All right, sir.

21 MR. DAY: Mr. Buell, excuse me, for the record could
22 the witness identify which log is on which exhibit, I don't
23 believe he did.

24 MR. BUELL: It couldn't hurt the record, I'll assure
25 you of that. Why don't you, Doctor, starting with the M-16

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1 on your Exhibit DN-Nine?

2 A Okay. On Exhibit DN-Nine, the three wells, M-16,
 3 the Cox Well and the L-17.

4 Q (Mr. Buell continuing.) Actually that's going to
 5 create confusion because that is a much larger cross section,
 6 you have only exposed three wells but in the record each and
 7 everyone of those logs are going in, so couldn't we identify
 8 that as a multi-well log?

9 A Okay, it is a multi-well log cross section.

10 Q Three logs of which you have concentrated your
 11 testimony on?

12 A Right.

13 Q And they are?

14 A They are the M-16, the Cox Well and the L-17.

15 Q Let me direct your attention now to Cox's Exhibit
 16 DN-Ten, is that the exhibit upon which we find the log on the
 17 Amoco Diamond Federal No. 1 which you have been discussing?

18 A Right.

19 Q And again it is a multi-well cross section?

20 A This is correct.

21 Q And your testimony was limited to an evaluation?

22 A An evaluation of the Cox Well and the Amoco Diamond
 23 Federal No. 1.

24 MR. BUELL: I think that should help the record a
 25 lot, Mr. Commissioners.

1 MR. RAMEY: Thank you, Mr. Buell.

2 Q (Mr. Buell continuing.) Doctor, have you made a
3 study of the randomly drilled No. 1 Well on the Cox lease and
4 the randomly drilled No. 2 Well on the Cox lease from a
5 standpoint of determining whether or not the Cox zone extends
6 to those wells?

7 A I do not believe that Cox zone was encountered in
8 these two wells. I believe it was not penetrated in these
9 two wells.

10 Q How did you form your judgment?

11 A By correlation of the logs. I had no samples, so I
12 could not identify the facies, but strictly on electric log
13 correlation.

14 Q Doctor, let me ask you this: Couldn't that mean
15 that they just weren't present in those two wells, although
16 the correlative vertical interval was penetrated?

17 A No, I said that the correlative vertical interval
18 was not penetrated.

19 Q Was not penetrated?

20 A Right. And that zone would have occurred below
21 the total depth of those two wells.

22 Q And how did you arrive at that judgment?

23 A By electric log correlation, which is comparing
24 the geometry of the gamma ray neutron curves on one log to
25 the geometry of the gamma ray neutron curves on the other log.

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1 This is what is known as electric log correlation.

2 Q Well, a moment ago you testified that it was
3 extremely difficult to correlate zones of porosity from one
4 well to the other?

5 A Zones of porosity, yes, but I think if you study
6 a log very carefully, you will see very subtle characteristics
7 which can be carried over fairly great distances and you are
8 saying that this is a correlative zone, but you are not
9 saying that the porosity within these two zones is continuous.
10 I think you can carry a zone within a reef for fairly great
11 distances.

12 Q All right, let me ask you this: According to your
13 Exhibit DN-Nine, and I'm referring to the log of the Cox Well
14 on that exhibit, you have only a very short interval that
15 was logged from the top of the reef to the bottom of the log,
16 is that not correct?

17 A That is correct.

18 Q Now, which characteristics on this short interval
19 of log in the deviated well, did you compare with the
20 randomly drilled No. 1 and deepened No. 1 and the randomly
21 drilled No. 2 to satisfy yourself that the Cox zone was below
22 the total depth of those two wells?

23 A Like I said before, based on the --

24 Q Which characteristics that we are looking at?

25 A Well, both. You have to look at this in detail, you

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1 have to slip and slide your logs. It's not something that
2 you look at and say, "Well, this is it, there it is." It is
3 very tedious slipping and sliding and you come up with an
4 interpretation. Now, I will come up with an interpretation
5 and I say, "I feel to the best of my knowledge that this
6 zone was not penetrated."

7 Q Do you have a log of the randomly drilled No. 2
8 Well and the randomly drilled No. 1 that you could show this
9 Commission this tedious procedure that you went through?

10 A Well --

11 Q And while you are looking for your papers, could
12 I ask you a question without disturbing your search? Do you
13 ever use a tool like this to a layman while scientifically it
14 it may not be a valid tool, but particularly in an area such
15 as the Empire-Abo where all the witnesses testify that
16 correlation from well to well is extremely difficult, do you
17 ever use as a yardstick, or a tool, the vertical depth from
18 the top of the reef to the zone that you are interested in?

19 A Depending upon the distance between the wells. The
20 top of the reef is time transgressive. The top of the reef,
21 in one well it may not be, it may not represent the same time
22 of development as the time of the reef in another.

23 Q Even over distances as short as we are discussing
24 here, between the No. 1 and the No. 2?

25 A I believe it may even be on this cross section here.

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1 Q And the cross section here you are referring to is
2 DN-Nine?

3 A DN-Nine.

4 Q Why don't you just go ahead there. I'm sorry I
5 interrupted your search.

6 A No, what I'm saying is, this top of the reef can
7 vary widely between wells.

8 Q Well, in your opinion did it vary widely between
9 the randomly drilled No. 1 and randomly drilled No. 2 and
10 the directionally drilled well?

11 A No.

12 Q So that is not critical to us here? If the top of
13 the reef didn't vary widely among these three wells, why
14 would not A to B to see how far from the top of the reef
15 your zone of interest is and then compare it and if your
16 other wells went that deep through the reef?

17 A You can try that.

18 Q Would you do me a favor, would you go ahead and try
19 to find your --

20 A I will attempt to do that, yes. I'm not sure
21 that I have them on the same scale.

22 MR. RAMEY: Are you at a breaking point, Mr. Buell?

23 MR. BUELL: May it please the Commission, since he
24 does need to look for his logs and see if he has them on the
25 same scale, I suggest that maybe we should recess for lunch.

1 MR. RAMEY: Yes, I think that would be proper to
2 suggest that and I'll take your suggestion.

3 The hearing will be recessed until one-thirty.

4 (THEREUPON, the hearing was in recess.)
5

6 AFTERNOON SESSION

7 MR. RAMEY: We will call the hearing to order, please.

8 Mr. Day, if you would like to offer your exhibits
9 at this time.

10 MR. DAY: Yes, DN-Seven, Eight, Nine and Ten of Cox,
11 we tender those exhibits into evidence.

12 MR. RAMEY: Without objection they will be admitted.

13 (THEREUPON, Cox's Exhibits DN-Seven, DN-Eight,
14 DN-Nine and DN-Ten were admitted into evidence.)

15 MR. RAMEY: Mr. Buell, you may proceed.

16 MR. BUELL: Thank you, Mr. Ramey.

17 Q (Mr. Buell continuing.) Do you have the logs,
18 Doctor?

19 A Yes, I do.

20 Q I think it might be well if we move over here where
21 the Commissioners themselves could see the procedure you are
22 using.

23 A All right.

24 Q And would you state for the record the logs that
25 you are getting ready to compare at my request?

1 MR. RAMEY: Yes, I think that would be proper to
2 suggest that and I'll make your suggestion.

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16 MR. BUELL: Thank you, Mr. Ramey.

17 Q (Mr. Buell continuing.) Do you have the logs,
18 Doctor?

19 A Yes, I do.

20 Q I think it might be well if we move over here where
21 the Commissioners themselves could see the procedure you are
22 using.

23 A All right.

24 Q And would you state for the record the logs that
25 you are getting ready to compare at my request?

1 A I have a log on the Aztec Well. Actually this is
2 a gamma ray neutron run by Cox on this well. The second log
3 is a sidewall neutron gamma ray on the Robert G. Cox Federal
4 No. 2; the third log is a gamma ray neutron on the deviated
5 hole of the Robert G. Cox Federal No. 1.

6 MR. LUCERO: If he is going to testify from them
7 why don't we mark them, at least for identification, so we
8 know what is taking place with respect to these logs.

9 MR. BUELL: All right, for the record, let's
10 identify the log on the Robert G. Cox Federal EA No. 1 and
11 according to Dr. Rehkemper, this is a log that Mr. Cox ran
12 on the randomly drilled Federal EA No. 1. We'll identify that
13 as Amoco's Exhibit DN-Five. Then we will identify the log
14 referred to by Dr. Rehkemper as the log on the Robert G. Cox
15 randomly drilled Federal EA No. 2, as Amoco's Exhibit DN-Six.
16 Then the log that Dr. Rehkemper identified as a log on the
17 Federal EA 1, directionally deviated well, we'll identify that
18 as Amoco's Exhibit DN-Seven.

19 Q (Mr. Buell continuing.) Now, Doctor, would you
20 describe for the record the correlation methods you have used
21 in determining to your own satisfaction that neither the
22 randomly drilled No. 1, nor the randomly drilled No. 2
23 penetrated the vertical section that includes the Cox zone?

24 A Yes, sir.

25 Q First I think it would help if you would give us

1 your pick of the top of the Abo reef for each of the three
2 logs.

3 A Okay. On Exhibit DN-Five the top of the Abo reef
4 is picked at fifty-one, thirty-two, subsea minus twenty-five,
5 twelve.

6 On Amoco Exhibit DN-Six, the top of the Abo reef
7 is picked at sixty-one, fifty-six, subsea minus twenty-five,
8 thirty-six.

9 On Exhibit DN-Seven, the top of the Abo Reef is
10 at sixty-one, twenty. This is measured depth, this is log
11 depth which would give a measured depth subsea which I really
12 should convert to vertical depth of minus twenty-five hundred.

13 Q Does that correspond with the pick of the top of
14 the reef in the directionally deviated well shown on Cox's
15 DN-Nine?

16 A Yes, sir.

17 Q All right, sir.

18 A Okay. Initially to see how much relief the reef
19 surface may have between these three wells, I look at the
20 Bone Springs formation which overlies the reef and I attempt
21 to pick correlative points.

22 Q Excuse me, Doctor, you are now out of the Abo reef,
23 you are up above it?

24 A That is correct, I'm in the Bone Springs but I think
25 this is necessary in order to see if this reef is building up,

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1 transgressing time, building up, between these three wells.
2 If it is, you will find the Bone Springs markers will disappear
3 into re-facies.

4 On the Amoco DN-Five exhibit I have picked two such
5 markers, the upper one at six thousand, thirty-four, plus or
6 minus, the lower one at six thousand, seventy, plus or minus.

7 In Exhibit DN-Six the upper marker is at six
8 thousand, fifty-eight, plus or minus and at six thousand,
9 ninety-three, plus or minus.

10 On DN-Seven exhibit the upper marker is picked at
11 six thousand, twenty-six, plus or minus, this is a measured
12 depth, six thousand, seventy-two, plus or minus.

13 Now, I feel that these markers in the Bone Springs
14 are correlative and they indicated that they have, except for
15 possibly in the deviated well, which is DN-Seven, which due
16 to deviation you may be getting a little longer log section,
17 but you have little relief from the log surface at this time.
18 Therefore, as we heard in earlier testimony, if you have little
19 relief from the log surface, you can assume that by measuring
20 a thickness on the top of the reef to a lower correlative
21 point within the reef, that these points are correlative.

22 I have picked three, what I consider correlative
23 points within the reef. It may be a little hard to describe
24 but I will give you the approximate depths and you can check
25 on them.

1 In DN-Five the uppermost correlative point within
2 the reef is at sixty-one, forty-four to forty-nine. It is
3 a kind of a zone, a shaley zone.

4 On DN-Six it is picked at sixty-one, sixty-four to
5 seventy.

6 On DN-Seven it is picked at sixty-one, twenty-eight
7 to thirty-three.

8 Now, let's look at the neutron which we have on the
9 DN-Five and the DN-Seven and the sidewall neutron on the
10 DN-Six. I find what I consider a correlative marker there.
11 On the DN-Five it is located from sixty-one, eighty to ninety,
12 approximately. On the DN-Six, sixty-one, ninety-six to sixty-
13 two, oh, eight. In DN-Seven it is located from sixty-one,
14 sixty-four to seventy-two.

15 Okay, in establishing these I mentioned that there
16 were three. The other is on the gamma ray neutron and
17 coincides with the neutron correlation point that I picked
18 earlier, so I'll not go over that. From this correlation I
19 find that in Amoco DN-Five exhibit, the zone which is
20 perforated in the Robert G. Cox No. 1 would have been
21 encountered at a depth of approximately sixty-two, thirty.
22 The bottom hole of that log is at sixty-two, nineteen. So it
23 is my interpretation that the DN-Five did not penetrate the
24 producing zone as encountered in the Robert G. Cox No. 1.

25 Q Would it bother your testimony now if I asked you a

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1 question now about Amoco's Exhibit DN-Five?

2 A No, sir.

3 Q You were very careful to talk about the bottom of
4 the log then. As a matter of fact, did Mr. Cox deepen this
5 well and did not log the deepened portion?

6 A Not to my knowledge, not in the Cox, not in the
7 Cox No. 1.

8 Q That is the randomly drilled No. 1 Well and it is
9 your testimony that you don't know what the total depth on
10 the well is?

11 A I know what is reported as the total depth. The
12 total depth, driller was sixty-two, thirty, logger was sixty-
13 two, twenty-one. This is from the heading on DN-Five.

14 Q Doctor, I don't believe you are aware of the fact,
15 obviously, that Mr. Cox deepened this well and did not log
16 the deepened portion, are you or are you not aware of that?

17 A I am not aware of that, no.

18 Q And you said that the Cox zone in the randomly
19 drilled No. 1 Well as reflected on our Exhibit DN-Five would
20 have to be, what did you say, sixty-two, thirty?

21 A Sixty-two, thirty, yes, sir, approximately.

22 Q So, if this well is in truth and in fact deepened
23 to sixty-two, fifty, it would include the Cox zone, would it
24 not?

25 A Yes, sir.

1 Q Are you aware whether or not Mr. Cox made ~~any~~
2 tests over the intervals that according to your interpretation
3 would include the Cox zone in this deviated well?

4 A No, he did not test it, to my knowledge.

5 Q How would you know whether or not he tested it if
6 you didn't even know he deepened it?

7 A Well, I say I do not know. The only test in that,
8 to my knowledge, he made was in the DN-Five from sixty-one,
9 sixty to seventy sixty-one, eighty to eighty-four.

10 Q All right, sir, I believe you stated earlier that
11 you had confidence in Mr. Cox's competence as a geologist?

12 A I never made that statement.

13 Q Then I'll ask you.

14 A Yes, well, I think he is a competent geologist and
15 this is an opinion but I feel he is.

16 Q Everything you have testified to is an opinion, you
17 haven't testified to a fact yet, except your name and your
18 various degrees.

19 A That is correct.

20 Q All right, sir, let me ask you this: If that
21 zone was in the well, in the deepened interval, it was
22 certainly not productive, was it?

23 A I cannot say that. I do not know.

24 Q Well, you know this well after Mr. Cox reentered it
25 and deepened it, it was abandoned as a dry hole, are you

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1 aware of that?

2 A Yes, sir.

3 Q All right, sir, now I believe you finished your
4 dissertation on our Exhibit DN-Five. Would you go now to
5 DN-Six and if you have any other comments on it?

6 A No, I have no more comments on DN-Five. On DN-Six,
7 based on my correlations, the zone which is producing in the
8 Robert G. Cox No. 1 EA would be encountered at approximately
9 sixty-two, sixty or thereabouts. I do not have a log depth
10 scale below the depth of the log, which means that this well
11 did not penetrate the correlative zone producing in the
12 Robert G. Cox No. 1 EA.

13 Q Doctor, would the fact that both the randomly
14 drilled No. 1 Well, our Exhibit Number Five and the No. 2 Well
15 randomly drilled, both had some deviation, would that have
16 any effect on the correlation that you have just gone through?

17 A No, sir.

18 Q All right, sir, does that conclude your comments?

19 A Yes, sir.

20 Q Dr. Rehkemper, and I don't want to argue with you,
21 I realize you have given your opinion and your sincere
22 opinion, but would you agree with me with regard to the
23 characteristics that you have picked down in the Abo and have
24 correlated from Exhibit Five, randomly drilled No. 1, Exhibit
25 Six, randomly drilled No. 2, to the intentionally deviated well

1 that reasonable minds could differ with the interval that
2 you have picked as the continuing correlative interval that
3 you have been discussing?

4 A I would say it's possible, I'm not about to say
5 that I can control another geologist's log picks.

6 Q Well, Doctor, the reason I asked that broad
7 general question, I can look at some of the characteristics
8 that you picked on DN-Five, random drilled No. 1, and it is
9 obvious that you wanted to start from there and as I go from
10 your pick on that to the next two exhibits, I know there is
11 quite a distinct difference in the characteristic that you
12 picked in the next two wells.

13 A Well, log picking is an art.

14 Q Not a science?

15 A No, it is an art. You are a lawyer, I can pick
16 someone off the street and it takes experience and repetitious
17 log correlating to become a good correlator. It is not
18 something that you, as a lawyer, can come in and say, "This
19 is the way it is," unless you have log experience and
20 geologic maps. I think it takes an experienced geologist
21 to correctly correlate logs.

22 Q All right, sir, would you be patient enough to
23 run through with me a tool, as I as a lawyer off the street
24 can understand, and that is the vertical distance between
25 the top of the reef and the vertical interval that includes

1 the Cox zone, would you make that comparison just
2 although you don't feel that it has any scientific validity?

3 A You want to compare the depth or the distance
4 between the top of the reef and the top of the pay?

5 Q The top of the Cox zone, yes, sir.

6 A I could do that if I had my directional survey
7 to correct the two depths here because this is expanded
8 somewhat.

9 Q By this you are referring to the deviated hole
10 that is our Exhibit DN-Seven?

11 A Right.

12 Q And without that, of course, it will give you a
13 mis-reading?

14 A Right. However, I feel that my correlations of the
15 geometry of the logs supports my stated effects.

16 Q Do you have any other comments you would like to
17 make on the correlations that we have just been discussing?

18 A No, sir.

19 MR. BUELL: That's all I have of Dr. Rehkemper.
20 Thank you.

21 MR. RAMEY: Mr. Hinkle?

22 MR. HINKLE: I have a few questions here.

23

24

CROSS EXAMINATION

25

BY MR. HINKLE:

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1 Q Doctor, am I correct in analyzing your testimony
2 this morning that you would like for the Commission to
3 conclude that there is no communication between the wells in
4 the Abo reef, unless the porosity zones can be analyzed
5 together, and perforated together, is that right?

6 A I believe even at that time, even though you have
7 a porosity in two wells which is correlative, I think we have
8 shown that there is still a doubt that there is communication
9 between these zones in the two wells.

10 Q Have you made a study of all of the wells in the
11 reef?

12 A No, not all of the wells in the reef.

13 Q Have you tried to correlate the wells in the reef
14 for porosity zones?

15 A I have correlated zones, that would be both east-
16 west and north-south, and I have marked on there perforations
17 but I have not done a log analysis on each log to see whether
18 a particular zone looks tight or porous, no, sir.

19 Q But isn't it a fact that it is impossible to
20 correlate all of the porosity zones that are perforated in
21 the reef?

22 A Yeah, I would say that it is impossible to
23 correlate all of them, yes.

24 Q Possible or impossible?

25 A It would be impossible to correlate every one.

1 Q Now, aren't there other ways to determine whether
2 there is communication? Would you say that if the pressure
3 in the Empire-Abo Unit has in all of the wells taken the
4 same pattern and they have dropped the same scale and so forth
5 as production has continued, doesn't that show that there is
6 communication between them?

7 A I feel that this is an engineering problem and
8 this is out of my expertise to say whether this can exist or
9 not, sir.

10 Q You know, as a matter of fact, though, that that
11 is the best evidence?

12 A Well, if this is the best evidence, then you may
13 be right.

14 Q Referring to your DN Number Seven, you have shown
15 the No. 3 Humble Well to be between the 4 and 5, is that
16 correct?

17 A Would you repeat that? I have found the Humble.

18 Q On the DN-Seven, you show the No. 3 to be between
19 the 4 and 5?

20 A Yes, sir, that is correct.

21 Q Now, the No. 3 is a dry hole, is it not?

22 A Right.

23 Q And that is off of the Abo reef?

24 A It is not off the reef, no, sir.

25 Q Well, it's in an area where you wouldn't expect

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1 porosity, is that right?

2 A Oh, you can expect porosity there but it just
3 didn't develop. I mean, it's within the reef. This just
4 shows that the reef is not porous in all places.

5 Q But actually this well is not between these two
6 wells, it's off to one side, is it not?

7 A Oh, possibly by fifty feet, if that much.

8 Q Now, isn't it a fact that Humble, after completing
9 this dry hole, went some three hundred and fifty feet northwest
10 and got a good well in the reef?

11 A Are you speaking of the Humble No. 5?

12 Q I guess it is.

13 A No, that would be south. It would be southwest,
14 rather than northeast. I think it would be southwest of it.

15 MR. HINKLE: I believe that's all I have.

16 MR. RAMEY: Any further questions of the witness?

17 Mr. Day?

18

19

REDIRECT EXAMINATION

20 BY MR. DAY:

21 Q Dr. Rehkemper?

22 A Yes, sir.

23 Q The problem or difficulty here is that we are not
24 able to establish communications in the local areas, in this
25 Abo reef field, this Empire-Abo reef field?

1 A That is correct.

2 Q And you testified that in your opinion the M-16
3 is producing from a zone that is different from the zone the
4 Cox well is producing from?

5 A That is correct.

6 Q And based upon that, is it your opinion that there
7 would be an economic waste of oil if the Cox well is not
8 allowed to produce some oil?

9 A Yes, I would think there would be.

10 Q Does it make any difference in the study of the
11 correlation of logs, of the depth, can you correlate the
12 zones without referring to the depth, or do you do that?

13 A You do not use the depth necessarily. You are
14 working with stratigraphic equivalent units. Due to
15 subsequent tilting of the reef, your structural position means
16 little as far as the correlations go.

17 Q As they tilt then, they could be different
18 depths, but you really studied the characteristics?

19 A Right. I work stratigraphically, rather than
20 structurally within the reef.

21 MR. DAY: No other questions.

22 MR. BUELL: I may have one more question, Mr. Ramey,
23 please.

24 MR. STAMETS: While we are waiting I would like
25 to ask a couple.

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CROSS EXAMINATION

BY MR. STAMETS:

Q Dr. Rehkemper, what is the nature of the inter-connections in this reservoir, is it inter-crystalline porosity, is it vugular porosity, or is it a fracture?

A I have never seen a sample from this field. I have seen some sample descriptions whereby, I guess, they described the porosity as vugular, which is, as you know, just a micro-cavern, you might say. It is formed in the same way as Carlsbad Caverns is formed only on a micro scale. You have percolating waters which tend to dissolve part of the matrix, part of the limestone.

Q Would these avenues of inter-communication run directly horizontal between wells or might they be horizontal and vertical and at an angle and inter-connect zones at different levels in the horizon?

A If you are speaking of within a correlative zone.

Q I'm speaking of the reef structure as a whole, that in one well you might, say at a depth of one hundred feet into the reef, you might encounter vugular porosity, might that be inter-connected with the reservoir say two hundred feet into the reef?

A I doubt that you would get this kind of continuity, vertical continuity, within a reef. I would not expect it. Now, you could attain this by vertical fracturing. I have

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1 never seen -- vertical fracturing is very difficult to
2 identify. There is no log that I know of that identifies it.
3 They have what they call a micro-seismogram, which some
4 claim will pick up fractures. I have worked with these
5 frequently and I have little faith. So, the only way you can
6 prove vertical fracturing, possibly cores might show this to
7 you, provided you can tell the difference between fractures
8 caused by the coring operation and those which were there at
9 the time the rock was cored.

10 Q Would drive mechanism in the reef reservoir of
11 gravity segregation be an indication of the vertical
12 communication within a reef?

13 A Yes, it might if you have actual vertical segrega-
14 tion. Now, in a local area, I mean it may not apply, but maybe
15 over the entire reef, I mean who is to say how these fractures
16 or porous zones are going to run, this is hard to say.

17 MR. STAMETS: Thank you.

18 MR. RAMEY: Do you have a question, Mr. Buell?

19
20 RE CROSS EXAMINATION

21 BY MR. BUELL:

22 Q Dr. Rehkemper, I'm going to give you an example
23 of a lawyer being a non-expert in geological matters. When
24 I looked at your Exhibit DN-Seven and with particular reference
25 to the Humble Well No. 3 and the Humble Well No. 5, I just

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1 let my eye follow what you have indicated is the top of the
2 Abo reef and assume that Well No. 5, the log on the extreme
3 left end of the exhibit was lower structurally than the
4 Humble No. 3 Well, the next well to the right?

5 A No, this is not a structural cross section, sir.

6 Q Would you look at this, please, and I believe you
7 can, if you don't already know, make a quick calculation and
8 determine that in truth and in fact, the No. 5 Well is
9 higher structurally than the No. 3 Well?

10 A It could well be, I don't know.

11 Q Would you do that for me? I believe you can do it
12 with data you've got right on this exhibit.

13 A Okay, the subsea top, again I'm referring to the
14 DN-Seven Exhibit, the subsea top of the No. 5 would be, the
15 measured depth is sixty-two, oh, two, the kelly bushing is
16 thirty-six, thirty-seven. I believe in the No. 5 that
17 figures out to be a minus twenty-five, sixty-nine subsea.

18 Q Let the record reflect that in a red felt pen, he
19 put the subsea data by the top of the Abo reef in the Humble
20 Well No. 5 on Cox's Exhibit DN-Seven.

21 A Okay, in the No. 3, Humble No. 3, the subsea is
22 a minus twenty-six, thirteen.

23 Q Let the record reflect that he is writing the datum
24 of minus twenty-six, thirteen opposite the top of the pay in
25 Humble No. 3 on Cox's Exhibit DN-Seven.

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1 A Okay.

2 Q All right, sir, Doctor, I direct your attention
3 now to the Humble Well No. 3 on your Exhibit DN-Seven. The
4 operator, you and everybody agrees that is a dry hole?

5 A Yes, sir.

6 Q I believe everyone is in agreement and the proof
7 itself shows that the Humble Well No. 5 on your Exhibit
8 DN-Seven is a commercial producer?

9 A Yes, sir.

10 Q How far apart are those two wells?

11 A Approximately two hundred and twenty feet. This
12 was measured from the maps that were supplied.

13 Q And the Humble Well No. 5, the productive well, is
14 higher structurally than the Humble Well No. 3?

15 A That is correct.

16 Q And this shows that over a very small horizontal
17 distance, you can move up structure from a dry hole and make
18 a commercial well?

19 A Yes, sir.

20 Q In fact, what Mr. Cox did with his intentionally
21 deviated Cox well that he went up structure several hundred
22 feet and made a productive well, where his No. 2 and No. 1
23 had both been dry holes?

24 A Mr. Cox deviated the hole but it was not due to
25 water. He didn't have a water problem there which he apparently

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1 has here. Okay, I would say this is what he did.

2 Q He directionally deviated up structure away from
3 two dry holes and made a well?

4 A From a tight hole and made a well.

5 Q Just as we see here on your DN-Seven Exhibit?

6 A Except that -- okay, yes, I'll agree to that.

7 MR. BUELL: Thank you, Doctor. That's all I have
8 if it may please the Commission.

9 MR. RAMEY: Any other questions of the witness? He
10 may be excused.

11 (THEREUPON, the witness was excused.)

12 MR. DAY: May it please the Commission, we rest
13 our direct.

14 MR. HINKLE: May the Commission please, we have
15 one witness and we have some big exhibits to put on the wall
16 there, if we could take about a five-minute recess and get
17 them up there and get them marked.

18 (THEREUPON, a short recess was taken.)

19 MR. RAMEY: The hearing will come to order.

20 Mr. Buell?

21 MR. BUELL: May it please the Commission, I would
22 like at this time to offer Amoco's Exhibits DN-Five, DN-Six
23 and DN-Seven.

24 MR. RAMEY: Without objection these will be
25 admitted.

1 (THEREUPON, Amoco's Exhibits DN-Five,
2 DN-Six and DN-Seven were admitted
3 into evidence.)

4 MR. RAMEY: Mr. Hinkle?

6 HUGH CHRISTIANSON

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

10 DIRECT EXAMINATION

11 BY MR. HINKLE:

12 Q State your name, address and by whom you are
13 employed?

14 A Hugh Christianson. That's C-h-r-i-s-t-i-a-n-s-o-n.
15 I'm employed by Atlantic Richfield Company and my address is
16 Midland, Texas.

17 Q What is your position with Atlantic Richfield?

18 A Senior Area Engineer for the Empire-Abo area.

19 Q I believe you qualified this morning as an adverse
20 witness. I don't want any repetition but I would like for
21 you to review with the Commission your connection with the
22 Empire-Abo Unit and the work that you have performed in
23 connection with it and with the engineering and geological
24 committee that existed prior to the formation of the unit and
25 since that time?

1 A I first began my acquaintance with the Empire-Abo
2 reservoir in March of 1967 and began studying the reservoir
3 with, as I mentioned this morning, the viewpoint of eventually
4 hopefully being able to unitize in order to increase recovery.
5 This was, as I say, March 1967. This study continued and
6 then in about, I believe October of '67, Amoco which was
7 then the major interest holder, this was prior to Arco's
8 merger with Sinclair. Amoco had the major interest in the
9 pool. They called a working interest owners meeting and
10 the working interest owners set up an engineering committee
11 and charged it with coming up with parameters that would be
12 the basis for unitization and a recommendation as to whether
13 unitization was feasible or not.

14 This engineering committee began meeting almost
15 right away, I believe in November of '67 and met quite
16 continuously with both work sessions and other types of
17 sessions. All of the participants, potential participants,
18 in the entire Empire-Abo Pool were invited by letter to
19 participate in the engineering committee study. We had a
20 good representation of both majors and independents throughout
21 the entire study and we completed this study in about -- I
22 believe it was a report called the phase-one report was put
23 out in about August of '68. So we were continuously studying
24 the Abo reservoir from the period of early November to the
25 time just before the report came out in August of '68. This

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1 report did set up parameters as a basis for unitization
2 and recommended that the working interest owners proceed with
3 unitization.

4 The study, as I say, which took something like
5 eight or nine months, consisted of a review of both -- there
6 were geologists and engineers on the committee so it included
7 both a geological and engineering study of all of the well
8 logs, sample logs, drilling time, any kind of data we could
9 lay our hands on, production data, of course, with the main
10 purpose being to determine the extent of the Empire-Abo
11 reservoir and to agree on the acreage that should be included
12 in the Empire-Abo Unit and as being in the same reservoir.

13 Q Have you been the principal witness at all of the
14 hearings that involved the Empire-Abo Unit, including the
15 formation of the Unit, the amendments to it and hearings with
16 respect to allowables and so forth?

17 A I think this is true with the exception of the
18 recent improved pressure maintenance hearing which Mr. Ed
19 Sommers who works in my groups was the principal witness
20 there. This is where they were proposing to inject additional
21 non-Abo gas into the secondary gas cap.

22 MR. HINKLE: Are the qualifications of the
23 witness acceptable?

24 MR. RAMEY: Yes.

25 Q (Mr. Hinkle continuing.) Have you prepared or has

1 there been prepared under your supervison, certain exhibits
2 for introduction in this case?

3 A That is correct, exhibits which I have marked
4 three of them in pencil as Arco DN Number One. Number Two
5 will be a table of production data. This is Exhibit Number
6 Three, this cross section, and Arco DN Exhibit Number Four
7 over here on the wall is another cross section.

8 Q Now, refer to Exhibit One and explain what this is
9 and what it shows?

10 A Well, Exhibit One is a map of the entire Empire-Abo
11 Pool with the dashed lines showing the outline of the original
12 proposed unit area which was approved by the USGS and the
13 NMOCC for attempted unitization.

14 A few tracts now comprising approximately less
15 than two-and-a-half percent, in other words, at the present
16 time we have about ninety-seven and a half percent of the total
17 pool unitized. At any rate, a few tracts shown by the
18 dashed lines elected voluntarily to stay out of the unit.
19 They are, as I say, indicated by dashed lines.

20 As far as this hearing is concerned, one of the
21 primary purposes of this exhibit is to show the relationship
22 of Mr. Cox's Federal EA No. 1 Well, which is located at this
23 point up in the northwest-northwest of Section 12, 18 South,
24 27 East. It shows its relationship on down dip flank of
25 the reef to show where our Arco DN No. 3, which is the NW-SE,

1 or northwest-southeast cross section to show where it is
2 located relative to the overall reef, being a dip, slash,
3 cross section, to show where our Arco DN Exhibit Number Four,
4 which is again a cross section along the strike, basically
5 a strike cross section, along the down dip flank of the
6 reservoir in a west to east direction with the actual location.
7 Both of these cross sections, of course, going through Mr.
8 Cox's well and on.

9 Also shown on here which I might point out are the
10 gas injection wells. They are the wells indicated by
11 triangles. Approximately nine of these with the solid
12 triangle outline, scattered across the up dip side of the
13 reservoir. Nine of these are injected gas at the present time.
14 We have a number more shown by the dashed lines at the various
15 locations which are in the process of being converted to
16 injection at the present time, so we will be able to inject
17 more gas into the secondary gas cap.

18 Repeating that this is up dip, we are injecting gas
19 into the up dip into the secondary cap. Oil is draining down
20 dip, basically to the southeast in the direction of the NW-SE
21 cross section.

22 Due to this extremely good vertical permeability
23 and lateral permeability which field production, also field
24 data indicates is going on.

25 Q Did the engineering committee include Mr. Cox's

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1 acreage as being within the Empire-Abo Pool?

2 A Yes, it did. As you can see on Exhibit Arco DN
3 Number One, eighty acres of Mr. Cox's lease were taken in as
4 having some portion of the productive reef.

5 Q Was it for that reason that his lease is included
6 in the boundaries of the agreement?

7 A Yes, that's right.

8 Q Was Mr. Cox invited to submit his acreage to the
9 unit agreement?

10 MR. DAY: May the record reflect, were you the
11 owner of that lease, Mr. Cox? I don't know who the owner was
12 of the lease at that time. He said Mr. Cox was invited, I
13 don't know if --

14 A Presumably Aztec Federal was the owner there
15 originally.

16 Q (Mr. Hinkle continuing.) Whoever the owners were,
17 were invited at that time?

18 A Yes, they were sent copies of invitations to all
19 of the engineering committee meetings and I'm sure got copies
20 of all of the basic data that was developed, such as the
21 phase-one report that I mentioned a moment ago, the unit
22 parameters and were invited to various working interest
23 owners meetings to vote. The effort always is to attempt
24 to get everybody in on the engineering committee work if
25 possible so they can get in their two cents worth, get their

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1 viewpoint before the committee.

2 Q The acreage which is now known as the Cox lease
3 and is not committed to the unit?

4 A At the time of unitization Mr. Cox and his other
5 participants chose not to participate in the Empire-Abo Unit.

6 Q Do you have any further comments with respect to
7 Exhibit Number One?

8 A No, I believe we have pretty well covered it.

9 Q All right, refer to Exhibit Number Two and explain
10 what this is and what it shows?

11 A All right, Exhibit Number Two, I presume the
12 Commission has a copy of this. This would be Arco Exhibit
13 DN Number Two. This is a table which presents comparisons of
14 various producing characteristics of both Mr. Cox's Well and
15 the immediate offsetting wells in the Empire-Abo Unit which
16 I feel are important in determining whether or not the
17 interval which Mr. Cox is producing from in his Federal EA
18 No. 1 deviated well is, in fact, connected to the main Abo
19 reef production or not.

20 And I might just identify on Exhibit One where the
21 unit wells on which we have production data are located in
22 relationship to Mr. Cox's deviated Federal EA No. 1 Well.

23 Here is the location of Cox's Federal EA No. 1 Well.

24 Q You are referring to Exhibit Number One?

25 A Exhibit Number One. Now, what we have plotted on

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1 here is the surface location three, thirty out of the corner,
2 realizing that the bottom hole location is actually
3 approximately fifty-eight feet from the north line of his
4 lease and about eight or nine feet from the west line which
5 would put it on this map way up in the corner about the width
6 of a pencil dot south of the north line of that lease. At
7 any rate, there it is. Now, the wells we will be looking at
8 in the unit, as far as their production is concerned, follow
9 along with me in Unit L. Here is the L row over here and
10 the sixteen vertical column. Unit Well L-16, following
11 the Unit from this point in 16 up, we have the Unit L-16 Well
12 which is the northwest offset to Mr. Cox.

13 We have the L-17 Unit Well, which is the north
14 offset to Mr. Cox and the L-18 Unit Well which is the north-
15 east offset to Mr. Cox's Federal EA No. 1.

16 We also have the M-16 which is the west offset to
17 the Cox Federal EA No. 1.

18 Okay, so we are oriented as to where these wells
19 are and then if we look at the, under Roman one, gas-oil
20 ratio comparisons and these gas-oil ratios are in MCF per
21 barrel of oil, as you can see by the legend at the top and
22 we find, for example, that Well L-16 has a GOR of various
23 values and these are from New Mexico Oil Conservation
24 Commission records, I might say. You can see that from
25 July through December we have a month by month gas-oil ratio

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1 in MCF per barrel of oil produced plotted for the L-16 Well
2 and you can see it has been as high as thirteen, twenty-three
3 and as low as eleven, oh, six cubic feet per barrel and
4 currently the latest data we have the L-16 is producing at
5 a ratio of eleven hundred and thirteen cubic feet per barrel
6 or one point, one, one, three MCF per barrel of oil produced.

7 The L-17 the same sort of information with the
8 December GOR on that well point eight, two, one MCF per
9 barrel of oil.

10 The L-18 with a December GOR of point eight, four,
11 six MCF per barrel of oil produced and M-16 with a December
12 '75 GOR of one point oh, seven, one MCF per barrel.

13 The next line down is a month-by-month average gas-
14 oil ratio for that group of four wells which are direct
15 offsets to the Cox Federal EA No. 1 Well. We see that that
16 average is varying from as much as eleven, fifty-one cubic
17 feet per barrel in August of '75, summertime results in high
18 gas volumes generally due to the temperature, and we see
19 lower volumes coming along until December of 1975, the
20 average GOR is point nine, four, three MCF per barrel for
21 this group of offset wells.

22 And dropping down to the next line which on the
23 left column is identified as R. G. Cox EA Federal No. 1 Well,
24 we pick up his first gas-oil ratio in September of 1975, point
25 eight, five, seven MCF per barrel with the GOR staying in

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1 that same general range of point eight, six, one MCF per
2 barrel, being the gas-oil ratio of December of '75 and I'm
3 asking you to compare the average gas-oil ratio of the four
4 offsets directly offsetting Mr. Cox, point nine, four, three
5 MCF per barrel to the Cox EA Federal No. 1 gas-oil ratio of
6 point eight, six, one, and I'm simply saying that in my
7 opinion a ratio that is this close indicates that these wells
8 are communicative. The original solution gas-oil ratio was
9 in the neighborhood of twelve hundred and fifty cubic feet
10 per barrel in this reservoir. The fact that both of the
11 offsetting wells to Mr. Cox and Mr. Cox's Well itself are now
12 producing at these ratios much lower than the initial solution
13 gas-oil ratio, is very supportive of good vertical communica-
14 tion, good horizontal communication, allowing the gas to
15 move up structure rather than be produced at the wellbore
16 because, as you know, as the pressure drops in a reservoir
17 the amount, the ability of the oil to hold gas in solution
18 drops, and so, in a reservoir of this type this is one of
19 the most significant evidences of good vertical communication,
20 good well-to-well communication, the fact that your down-dip
21 wells have a gas-oil ratio very close now to what the
22 laboratory solution gas-oil ratio is at the current pressure
23 in the reservoir, which is lower than the initial conditions.
24 In fact, although at the present time about roughly one
25 third of the original oil in place has been produced from the

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1 Abo reservoir, these current gas-oil ratios on down dip
2 walls, as you can see, average considerably less at point nine
3 four, three and point eight, six, one MCF per barrel. They
4 average considerably less than the original solution gas-oil
5 ratio of around twelve, fifty cubic feet per barrel.

6 It is my opinion that if the Cox Federal EA No. 1
7 deviated well were in a separate reservoir the probabilities
8 would be that this gas-oil ratio should have been in the
9 neighborhood of twelve, fifty cubic feet per barrel. Instead
10 we find it here at around eight, sixty cubic feet per barrel.

11 Okay, the next column with the double asterisk is
12 average daily oil rate for Mr. Cox. In fact, all of the
13 data below the label, R. G. Cox EA Federal No. 1 on the left
14 has to do with data that we compiled on Mr. Cox's well and
15 the double asterisk number is identified with the legend
16 down at the bottom as a double asterisk, that's the total
17 monthly production, oil production, divided by the number of
18 days in the month, and we can see that it started out in
19 September with twenty-three point three, thirty-eight point
20 five barrels a day in October, thirty-four point seven barrels
21 in November and thirty-four point six on a calendar day basis
22 in December.

23 Then dropping down to the three asterisked line which
24 says, average daily oil rate per actual producing day and
25 this is explained down at the bottom on the three asterisked

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1 line at the base by saying this is the total monthly
2 production divided by the number of actual producing days.
3 This is the oil actually produced, on days produced, as best
4 as we can determine. And we've got in the last column the
5 number of actual producing days and the purpose of showing
6 th's is to at least indicate that Mr. Cox's well is improving
7 it appears in a general way when you move from September
8 through December, it is improving in the barrels of oil it
9 is capable of producing per day produced. For example, he
10 went thirty-seven point one barrels a day per day produced
11 in November of 1975 to forty-one point three barrels per
12 day produced in December of 1975. Even though he did, as
13 indicated by the twenty-eight producing days in November, he
14 had his well shut in for two days in November and in December
15 he had his well shut in five days as indicated by the
16 twenty-six producing day total here in the very last column
17 down at the bottom on the right of Exhibit Number Two.

18 So, it doesn't appear that shutting in the well
19 a couple times has hurt the oil production.

20 Okay, that takes care of page one, which was
21 Roman one of Arco Exhibit DN Number Two. If we move to
22 page two, which is Roman two, we are comparing here API oil
23 gravities and I feel this is another indication of whether or
24 not there is communication between Mr. Cox's Federal EA
25 Number One Well at its deviated location and the offsetting

1 Empire-Abo Unit.

2 Roman two, item A, says, "Empire-Abo Unit nearest
3 batteries to Cox EA Federal No. 1." This production comes
4 in from roughly ten or fifteen wells to each of these two
5 batteries. The battery M-14 is on the M-14 location on
6 this map and it is right at this point relative to Mr. Cox's
7 well at this point, bringing in production from some of the
8 offsetting wells of Mr. Cox, plus some other wells in this
9 area. The other battery, which is battery K-18 is on the
10 K-18 spot as you might suppose, in this general area approxi-
11 mately a half mile northeast of the Cox Federal EA and
12 taking the other offsetting wells to the Cox Federal EA No. 1,
13 plus some other wells in the general area and you can see
14 that battery M-14 had an oil gravity in September of 1975
15 of forty-three point five degrees API.

16 And under Roman two, item B, the Cox Federal EA No.
17 1 reported a gravity of forty-three degrees API on the USGS
18 well completion or re-completion report and log submitted by
19 Mr. Cox with the test date shown on that report as nine,
20 fifteen '75, so, we were comparing September API oil gravity
21 from the Unit nearby to September reported API oil gravity
22 by Mr. Cox. Of course, the correlation is excellent, indicating
23 again that the Cox Federal EA No. 1 Well is in communication
24 with the main Abo reef that is contributing production to
25 the wells offsetting.

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Q Now, refer to Exhibit Three and explain that, that's the one on the wall.

A All right, Exhibit Number Three, Arco's DN Number Three, let me orient you again to where that is located and the identifying keys are on the NW northwest which is the up-dip side and that is located at this point, in other words, at the H-12 location on the Unit grid.

Moving down in a slice dip cross section to the southeast to the far end which is labeled southeast, moving down through the Amoco Diamond Federal No. 1 Well, which we heard a little bit about earlier today and this is a dip cross section relative to the fact that this would be the main stike of the reef, along the long axis, something like twelve-and-a-half miles long. This is the back reef to fore reef. In other words, this area back here would have been the lagoonal type deposition that we were talking about this morning and the area on the fore reef side would have been facing the open sea on the south side with wave action, erosion, the re-deposition and re-working taking place on the fore reef side, a much quieter environment back here, so in general you would get a little bit more in the way of muds which turn into shales later on the back reef side than the fore reef side.

Anyway this is now showing the development of the reef, the top to the bases as picked and not solely by me but

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1 by the engineers and geologists who comprised the Empire-Abo
2 engineering committee during the seven to eight months period
3 when the study, pre-unitization study, was going on. One of
4 the early conclusions of this group, based not only on log
5 correlations but on producing characteristics already in
6 evidence was that reservoir communication was excellent, both
7 vertically and laterally. I'm talking about into and out of
8 this area, as well as down the dip. Of course, this was
9 based on a great deal of information beyond simply geological
10 correlations which, of course, were used, but the conclusion
11 was that there was excellent communication, but it simply was
12 not possible to correlate particular porous intervals from
13 well to well. But this didn't really bother the geologists
14 that were involved because they said, as has been said this
15 morning, that the characteristic of the type of vugular
16 porosity this primarily secondary developed through a combina-
17 tion of fractures and layer percolation of water which
18 reached out at various intervals and then perhaps a little
19 anhydrite coming along behind to infill various of the fracs
20 as well as in some places resulted in a situation where you
21 simply could not correlate a particular porous zone and get
22 through this extremely well developed fracture and vug system.
23 The correlation was obviously there and this was evidenced by
24 such things as the fact that we could already see a secondary
25 gas cap developing. We had excellent drill stem test

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1 information which gave us the position of the original gas-
2 oil contact located in a very localized area in the general
3 area right in here.

4 Q Are you referring to Exhibit One?

5 A Yes, I'm referring back to Exhibit One and just
6 giving you a feel for about where the relatively small initial
7 gas cap which amounted to probably about seven tenths of a
8 percent of the total hydrocarbon pore volume. It was located
9 in the up structure west end of the reservoir pretty much.
10 We started getting evidence through the fact that wells
11 completed relatively high in the reef and this well doesn't
12 happen to have been completed there but there are wells which
13 were completed early in the reservoir life, relatively high
14 at low oil-gas ratios, twelve hundred cubic feet per barrel,
15 in that range, and later on after considerable production
16 began an increase in the gas-oil ratio, they were recompleted
17 lower in the reef and went right back to low GOR's, solution
18 gas-oil ratios from ratios five and ten thousand cubic feet
19 per barrel up in this area to ratios right at within a few
20 percent of whatever solution gas-oil ratio was in the pressure
21 in the reservoir at that particular time.

22 This is the type of information, plus pressure
23 data that the committee analyzed. Of course, pressure data
24 well-to-well indicated there was very little difference in
25 pressure and all of these things, as well as the basic

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1 correlations, the top and the base of the reef which is
2 pretty evident in the log. You can pick the top of the base
3 pretty well, it led the committee to believe excellent vertical
4 communication, in fact, had a classic gravity drainage
5 reservoir here with a secondary gas cap developing and
6 expanding down structure.

7 I want to point out one more thing on this cross
8 section. Moving on down the stairs to the area of Mr. Cox's
9 well, and this is located where his well is sub-surface
10 wise up in the northwest corner of Section 12 and I
11 want to point out that when you look at the dip on the top
12 of the reef and the fact that there has been a problem with
13 production a little bit down the dip from this location,
14 that it would be to an operator's advantage if there were no
15 particular rules governing the situation to complete the well
16 as far up dip because not only would you be moving up dip
17 and getting towards the better wells as you can see by the
18 production data on the offsetting wells, but moving back
19 over here to Arco DN Number One, you can see by the outline
20 of the Unit boundary the general strike of the zero net pay
21 in the Abo reef is in the northeast-southwest direction as
22 I'm outlining here with my pencil. So, in effect, by moving
23 back directly, pretty much directly up this cross section you
24 see, you are, in fact, improving your chances of getting
25 into an area that is on strike with, for instance, this six

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1 hundred foot west offset in the Unit M-16 which had seventy
2 or eighty feet or so of net Abo reef.

3 MR. NUTTER: Mr. Christianson, would you make a
4 pencil line there where you outlined the position of the
5 zero porosity with your pencil?

6 A Yeah, zero porosity right in this general -- through
7 that dry hole which is on one of the other exhibits.

8 I really shouldn't say zero porosity, I should say
9 dipping into water and I'll apologize. Zero oil column is
10 a better way to put it because this is what's happening. You
11 know, you can see by looking on the cross section. You are
12 not losing porosity completely. Moving down this way you
13 are dipping below the original oil-water contact and evidence
14 has indicated that there is probably some type of oil-water
15 transition zone up above the original contact because the
16 oil wells completed above it made water from the beginning
17 and we will see that on Arco DN Number Four Exhibit when you
18 move over there.

19 So, anyway let me correct and say not zero porosity
20 but zero hydrocarbon pour volume or zero productive hydrocarbon
21 pour volume as limited by the reef dipping into water. That
22 is the line I am drawing over here. Not a zero net pay but
23 a zero -- a point where the reef dips below the oil-water
24 contact and this is something like that in the area of the
25 Cox lease, Cox Federal EA No. 1.

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1 Q (Mr. Hinkle continuing.) Mr. Christianson, referring
2 to Arco's DN Three Exhibit, have all of the wells shown on
3 that exhibit been corrected for true vertical depth?

4 A Yes, that's right. All of these wells are corrected
5 to true vertical depth and if you look at the heading on the
6 top of each well, it identifies the well, gives the well's
7 elevation of the rotary kelly bushing and gives the TD of
8 fifty-six, ninety-five, that is measured TD in the hole itself
9 and then using the Totco survey correcting for the calculated
10 deviation, you find that the true vertical depth is indicated
11 by the letters TVD, true vertical depth. The true vertical
12 depth in this particular well, which is the number I-13 is
13 fifty-six, ninety-one compared to a measured depth of
14 fifty-six, ninety-five. The logs were adjusted subsea wise
15 upward four feet to take care of the adjustments, so you can
16 see that in this well that there was an adjustment of all of
17 these required upward adjustments.

18 There was an adjustment from a log measured TD at
19 fifty-six, thirty-eight to fifty-six, thirty-three, that's
20 five feet, An adjustment from fifty-six, ninety-five to
21 fifty-six, ninety-one, that's four feet, an adjustment to
22 true vertical, two feet in this well. These are all Unit
23 wells, of course. An adjustment of nine feet at this point,
24 this is the maximum adjustment required.

25 Here is an adjustment of four feet and moving to

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1 the direct northwest offset to the Cox EA deviated well,
2 an adjustment of six feet to get the true vertical depth and
3 then at the Cox Federal EA No. 1 deviated well, it has the
4 maximum adjustment from sixty-two, twenty to sixty-one,
5 eighty-nine, or about thirty-one feet, to get the true
6 vertical depth from log measured depth, that is because the
7 well, in effect, curved in this fashion.

8 Then on the Amoco Diamond Federal No. 1 a correction
9 of approximately two feet from log measured depth to true
10 vertical depth.

11 Q Now, refer to Exhibit Number DN-Four and explain
12 that?

13 A Okay. Exhibit Number Arco DN Number Four. This
14 is a west-east cross section from W to E along the down
15 dip, what I called the toe of the reef and this is sort of
16 a strike cross section, it goes back to Arco Exhibit DN
17 Number One. We are shown where W and E are and all of the
18 wells inbetween and they are located from west to east, about
19 as far west and again about as far east of the Cox Federal EA
20 No. 1 Well, and generally in a long strike with the zero oil
21 pay line or the point where the reef dips into the water table.
22 It is not exactly parallel but it generally gives you the
23 picture.

24 When you look I want to point out that the top of
25 the reef correlates again as shown in the heavy black line

1 labeled "top of the reef" and all of these wells, just as
2 Arco DN Number Three, have been corrected to true vertical
3 depth with the corrections shown at the top. They are all
4 similar to what the corrections were on the wells over on
5 Exhibit DN Number Three.

6 And so we are hung on a true vertical depth and on
7 a subsea on an interval subsea depth of about twenty-five
8 hundred feet as shown by the heavy dashed lines. So both this
9 Arco Exhibit DN Number Four and DN Number Three give you the
10 true subsea relationship of where the top of the reef is and
11 where the perforated intervals are. The perforated intervals
12 are the red colored intervals with the black circles and the
13 purpose really of Exhibit DN Number Four is to illustrate
14 the correlation well-to-well along strike in the down dip
15 area of the reservoir, and then also to show just by the
16 production data in regard to each well, its initial production
17 data, the recent production data occurs below the log of a
18 particular well, to show by production data that, in my
19 opinion, we are in what appears to be an oil-water transition
20 zone, in that we find wells producing some water even on
21 initial completion. And, in fact, going to volumes of water
22 that are higher and then decreasing again. And this was a
23 point that I wanted to point out in regard to an earlier
24 exhibit. Let me take for example the M-16 Well which happens
25 to be the west offset to the Cox Federal EA No. 1 and here is

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1 the Cox Federal EA No. 1, the familiar log that we saw over
2 here on this Exhibit DN Number Three and the familiar top
3 of the reef and the perforated intervals some fifty or sixty
4 feet in the reef.

5 And here is the M-16 and this is the Unit M-16, if
6 we move down we find that this production data which happens
7 to be for November 1975 shows that the well is producing a
8 hundred and fifty barrels of oil per day and seventy-one
9 barrels of water per day. At one time, a year or two or
10 three past, the well produced as much as a hundred and sixty-
11 three barrels a day. It actually started out at, I think we
12 got the initial water rate on the well of about twenty-three
13 barrels of water a day, it built up as high as a hundred and
14 sixty-three barrels of water a day, now it is back down to
15 about seventy-one barrels of water a day. So, the well has
16 been producing water for a long time and this is not the only
17 one. The west offset to it has a similar history, not as
18 dramatic a difference but the water rate at one time was
19 fifty-six barrels of water per day. It started out at seven
20 barrels of water a day and went up as high as fifty-six
21 barrels of water a day and now it is down to forty-two barrels
22 a day in November of '75.

23 This type of performance, as far as I'm concerned,
24 indicates that you are in a type of transition zone, that the
25 water is probably not moving in quite as severely as Mr. Noell

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1 would have us believe this morning, because while some of
2 the wells may be making more water now than they were a year
3 or two ago, they are making less water than they were making
4 several years ago and they are being pulled at higher total
5 rates than they were several years ago, so you would expect
6 some increase in water just simply because you are producing
7 greater volumes of total fluid from the well.

8 I might just go to the L-19 which is the Exxon
9 Federal No. 5, which is on the cross section that we looked
10 at this morning and this is located, as I'm pointing it out
11 with my pencil on Arco DN Number Four, and we see that the
12 original water production was twenty-six barrels of water
13 a day and it has been as high as forty-two barrels a day. We
14 are showing in November of '75, water production twelve
15 barrels a day on that well. And, of course, Mr. Cox's well
16 is producing about thirty-five oil and in the neighborhood
17 of a hundred and ten water per day from his subsea location
18 at this point. And so you can see that there is some water
19 production and it is not absolutely related to subsea
20 positions.

21 Q Mr. Christianson, are you through with that?

22 A Yeah, let me just check. Well, I just want to
23 point out the fact that the Cox Federal EA No. 1 deviated
24 well is producing oil and substantial water at a subsea depth
25 which we can eyeball as similar to some of the others, in fact

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1 it is slightly lower by twenty or thirty feet than most of
2 these wells and about equal to these two wells. The fact
3 that it is producing oil and water certainly is no indication
4 of reservoir separation, but it is part of this transition
5 zone that I believe exists in this down dip toe of the Abo
6 reef, which is what our cross section here, Arco DN Number
7 Four is running through.

8 I might just point out, there are some GOR's for
9 comparison on the cross section that were not in the data
10 that I submitted with Exhibit Number Two.

11 Keeping in mind that Mr. Cox's well has a GOR of
12 point -- we are showing an August of '75 GOR for him of
13 point eight, eight, two. The data I gave you awhile ago was
14 December, around point eight, six, two MCF per barrel of oil.

15 Moving to the immediate east offset, it currently
16 has a -- well, I read that wrong, his November GOR is point
17 eight, six, three MCF per barrel of oil on the Cox Federal
18 EA No. 1. The immediate offset has a November GOR of point
19 eight, one, four MCF per barrel of oil. Another location
20 east of the well has a GOR of point eight, three, nine MCF
21 per barrel of oil. And these are Unit wells, L-17 and L-18.

22 Another location east of the Unit L-19, the gas-
23 oil ratio is point eight, seven, seven MCF per barrel of oil.
24 One more location east to the L-20, Unit Well, the gas-oil
25 ratio in November of '75 was point eight, seven, nine MCF.

1 Again comparing all of those less than nine
2 hundred to Mr. Cox's Federal EA No. 1 gas-oil ratio in
3 November of point eight, six, three MCF per barrel of oil.

4 Again supporting with some different wells what
5 was brought out in Exhibit Two that the gas-oil ratio would
6 compare very well between Mr. Cox's Federal EA No. 1 and
7 the wells in the unit, Abo Unit, that are located in the
8 general immediate area and this, in my mind, is further
9 evidence that there is connection between the Cox Federal EA
10 No. 1 Well and the Abo reef in the Empire-Abo Unit.

11 Q Mr. Christianson, the Empire-Abo Unit was approved
12 as a pressure-maintenance project, was it not?

13 A That is correct.

14 Q What method is being used to maintain the pressure?

15 A Well, we are going at it in at least two different
16 directions. We are attempting to minimize the producing
17 gas-oil ratio by shutting in high gas-oil ratio wells and
18 what this does, of course, is allow the free gas to migrate
19 up rather than being produced out of the reservoir itself.
20 Lets say a well here, this well has a low GOR but if it
21 happened to have a high one --

22 Q What exhibit are you referring to?

23 A I'm referring to Arco DN Number Three. And this
24 is a pretty good illustration of what we are doing and if
25 the well did begin to increase in gas-oil ratio because we are

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1 unitized and can shift our oil production around the reservoir
2 to the most efficient well, if this well did increase in
3 gas-oil ratio that would be an indication that it was
4 producing probably coning free gas up in the secondary gas
5 cap. We would like to keep this secondary gas cap as whole
6 as we can and so we would either cut that well back in oil
7 production or shut it in entirely and shift its allowable to
8 another low oil-gas ratio well. This means that the free gas
9 that would have been produced out will instead be allowed
10 to migrate both vertically and horizontally, but it has got
11 to move both ways up into the secondary cap where it will act
12 to expand that cap. This helps to maintain the pressure in
13 the reservoir, which in itself helps to increase recovery.
14 In addition there is some effect of the gas injection in
15 moving the oil down structure. I don't think this is as
16 important as the fact that you need to allow the oil to
17 migrate down. In other words, let nature take its course
18 and the oil, because of the difference in gravity between the
19 oil and the gas and because of the excellent communication,
20 the oil will move down, will move not only down vertically
21 but will move down the structure in the direction of the low
22 structure wells, such as the Cox Federal EA No. 1 deviated
23 well there.

24 Q What was the reason for the location of the injection
25 well as shown on DN-One?

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1 A Well, we wanted to be sure that we put the gas in
2 the secondary cap, so we located the well, as you can see,
3 generally speaking, along the back reef, not all the way back
4 in the back reef, moving again to the NW-SE cross section,
5 Arco Exhibit DN Number Three, instead of putting it here we
6 put it here generally. It's in the cap because the cap -- the
7 gas-oil contact is minus two thousand or even a little below
8 that. But it is not all the way back in the back reef. So,
9 in essence, we are using one row in for the most part,
10 depending on the ability to take gas in the individual well,
11 but in effect we don't have an injection well on this cross
12 section. There is one immediately, one location southwest
13 of it, but it would be comparable to a location here and we
14 are putting gas in a part of the reservoir up here in the
15 top part and augmenting that gas in the secondary gas cap.

16 Q Approximately how long has the pressure-maintenance
17 project been in effect now?

18 A Well, it started the day we unitized in October 1st
19 of '73. We immediately shut in a whole bunch of up dip
20 high gas-oil ratio wells. Now, we did not have our gas
21 injection facilities going until about the middle of '74 but
22 we were, in effect, reducing voidage from the reservoir by
23 shutting in many of these wells on the back up dip side that
24 were already high GOR's.

25 Q Has there been a uniform drop in pressure throughout

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1 the whole Unit?

2 A Well, relatively, yes. I mean these things are
 3 always relative when you are talking about a reservoir
 4 engineering situation.

5 Q Does that pressure indicate anything with regard to
 6 communication between the wells?

7 A Oh, yes. Yes, the fact that there is not a whole
 8 lot of variation well-to-well laterally in pressure. Now,
 9 I'm talking about for the most part. There will be some wells
 10 on the back reef side which are of low permeability and don't
 11 build up because of their lower permeability within the
 12 limited amount of shut in time, perhaps, that would show
 13 somewhat lower pressures.

14 Q But the overall operation of the maintenance project
 15 indicates that all of the wells are in communication?

16 A That's right. All of the wells that we defined
 17 as Abo reef wells, yes.

18 Q Now, in connection with your engineering committee
 19 study and all of the experience that you have had, is there
 20 any indication of any barriers or peculiarities in the reef
 21 which might indicate the formation of a separate pool within
 22 the Empire-Abo Unit area?

23 A Well, certainly not within the Unit. I didn't get
 24 into the fact that we are -- back when we were discussing
 25 what we were using as far as methods to help production, we

1 are injecting in the neighborhood of sixty-five percent of
2 the produced gas back into that secondary cap. I don't
3 think I mentioned the percentage.

4 Q I believe the testimony in this case shows that
5 Mr. Cox's well is bottomed within fifty-eight feet of the
6 north line and eight feet of the west line of acreage committed
7 to the Empire-Abo Unit. Have you formed any opinion of
8 whether or not production in Mr. Cox's well is violating
9 correlative rights as far as the acreage that has been committed
10 to the Unit is concerned?

11 A Yes, I have. I believe that at this location, far
12 up in the northwest corner of his lease and only some eight
13 to nine feet from our Unit boundary that is on the west and
14 fifty-eight feet south of the north line or fifty-eight feet
15 from the Unit boundary in that direction, everything I know
16 about the way fluids drain into a well which is usually in all
17 cases I have been concerned with, in a radial manner that
18 there is no question that it would be impossible for him
19 only to pull a distance of eight feet. When he withdraws
20 fluid he withdraws equally -- the pressure drop relative to
21 that fluid withdrawal will be in a radial fashion around
22 the wellbore and it would definitely extend both north into
23 the Unit property and west into the Unit property.

24 Q Have you formed any opinion as to the productive
25 acreage around Mr. Cox's well, the number of acres involved,

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1 productive?

2 A I haven't really gone into that study, however, I
3 will say that the engineering committee's original study, I
4 believe assigned fourteen acres and thirty-nine thousand,
5 eight hundred and ninety barrels of original oil in place
6 to the lease and I feel that -- of course, the committee
7 at that time did not have all of the information, for
8 instance the present Cox Federal EA No. 1 deviated well was
9 not completed at that time and indicating as it does, as
10 little as four feet of net pay up in the bottom hole location
11 point, fifty-eight feet from the north and eight feet from
12 the west line, the committee, as a matter of fact, not
13 having that data, assigned -- when you look at their contour
14 maps you can see they assigned approximately sixty feet of
15 net reef to that spot, fifty-eight feet from the north line
16 and eight feet from the west line and we are beginning to see
17 evidence developing now that perhaps there is only four feet
18 of net reef there. So, my feeling, although I have not made
19 a detailed study, my feeling would be that the result of one
20 would probably be a reduction in that -- and a sizeable
21 reduction in that original oil in place as calculated by
22 the engineering committee.

23 Q Do you have any idea what that reduction should
24 be?

25 A I wouldn't really want to say, but it would certainly

1 be fractional relative to that number of thirty-nine
2 thousand, eight hundred and ninety. And let me point out
3 that there is even a certain chance that the well is
4 bottomed on our property. You know there is an error, there
5 could be a certain radius of error in that bottom-hole
6 location -- when you are eight feet from the line you don't
7 really know within eight feet that that is where the bottom
8 of your hole really is.

9 Q Do you have any recommendation to make to the
10 Commission with respect to the disposition of Mr. Cox's well?

11 A Yes, before I make that, I would like to emphasize
12 that Arco does not object to an allowable for the Cox Federal
13 EA No. 1 Well, if it is bottomed at a location in compliance
14 with Commission Order R-4561, that is within a hundred feet
15 of the surface location. That is what Order R-4561 specified.
16 The present location violates correlative rights and could
17 even force economic waste through drilling of unnecessary
18 wells to prevent drainage and having made that statement, then
19 I will go ahead and say that, representing Arco, I feel
20 that the Applicant should be required to comply with Commission
21 Order R-4561. In other words, bottom his well in the Abo
22 within a hundred feet of the surface location and that no
23 allowable be assigned to this well at this location, fifty-
24 eight feet from the north and nine feet from the west line
25 of the lease.

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1 Q When you say "representing Arco" you mean Arco as
2 the unit operator of the Empire-Abo Unit?

3 A That's right, Unit operator.

4 MR. HINKLE: I would like to offer into evidence
5 Exhibits One through Four.

6 MR. RAMEY: Without objection they will be admitted.
7 (THEREUPON, Arco Exhibits DN-One, DN-Two,
8 DN-Three and DN-Four were admitted into
9 evidence.)

10 MR. HINKLE: That's all I have.

11 MR. RAMEY: Any questions of the witness? Mr. Day?
12 Mr. Day, let's take about a ten minute break right here.

13 (THEREUPON, the hearing was in recess.)
14

15 MR. RAMEY: The hearing will come to order. Mr. Day,
16 I believe you have the floor.

17 MR. DAY: Thank you.
18

19 CROSS EXAMINATION

20 BY MR. DAY:

21 Q Mr. Christianson, the statements that you have made
22 on your opinion are based on your information and studies of
23 the field, is that correct?

24 A That is correct.

25 Q Taking the gas-oil ratios and gravity of the oil

1 alone, without any other supporting data, is it your opinion
2 that you conclude there is communication in those zones?

3 A Yeah, but I don't ever operate that way.

4 Q Yes, sir. Now, have you correlated these logs
5 yourself?

6 A You mean on these cross sections?

7 Q Yes.

8 A Oh, yeah, of course now as I say these are engineer-
9 ing committee picks in every instance except the new wells,
10 the Cox Federal EA No. 1 deviated Well and the Amoco Diamond
11 Federal. I'm in agreement with those picks and I was a
12 participant in those picks and then the other two are my picks
13 that is the Cox EA No. 1 and the Amoco Diamond Federal.

14 Q Incidentally, you have got marked on there, original
15 oil-water contact, what do you mean by "original"?

16 A Well, that is the subsea level, minus twenty-six,
17 sixty-five, which was determined by the engineering committee
18 for the Empire-Abo Unit in pre-unitization work as being the
19 level below which you would get a hundred percent water
20 production.

21 Q Is that changed?

22 A There have been some localized upward movements of
23 water, yes, I would say that.

24 Q Do you find any upward movement of water in these
25 wells here?

1 MR. LUCERO: Excuse me, would you indicate what
2 wells you are talking about for the record again?

3 MR. DAY: On Arco Three, DN-Three.

4 A. No, I don't see any there at all.

5 Q (Mr. Day continuing.) Well, then --

6 A. Let me check one well here. No evidence there, no.

7 Q Well, then, sir, again referring to the same
8 exhibit, is there a good possibility that oil would be
9 found in the Amoco Diamond Federal No. 1 Well, since the reef
10 comes into that well and it is above the oil-water contact?

11 A. It is above the original contact but I think if you
12 recall some of my testimony just completed, the amounts of
13 water production on the wells over here on Arco Number DN-Four
14 indicate that there is probably an oil-water transition zone
15 which is above the minus twenty-six, sixty-five level and in
16 this zone you run the risk of producing water and certainly
17 this well if it had any porosity would and if it is, in fact,
18 connected, which I'm basing this only on the log correlations,
19 at any rate it would be a very risky test.

20 Q All right, the reef is in the Amoco Diamond Federal
21 No. 1 Well as shown on Arco's DN-Three?

22 A. Yes, in my opinion this is the top and base of
23 the reef but there is little if any porosity.

24 Q And as you have shown it, part of that reef is
25 above the oil-water contact?

1 A That's right, the original.

2 Q Going to, is that Arco DN-Four there?

3 A DN-Four, yeah.

4 Q Going to Arco DN-Four, look at the correlative
5 zones that you have shown there and then look at M-16 and
6 the Cox Well and tell us whether you agree or disagree with
7 Dr. Rehkemper's statement that the zones are not correlative?

8 A That what zone is not correlative?

9 Q The production zones of those two wells.

10 A As far as the log, if you relate it merely to
11 distance below the top of the reef, then I would say that it
12 is obvious that the well, the Cox Federal Well here, is
13 perforated roughly fifty feet below the top of the reef, where
14 this well, the M-16, is perforated right at the top of the reef.

15 Q Mr. Christianson --

16 A This doesn't disturb me any.

17 Q You heard Dr. Rehkemper's testimony about the
18 non-correlative zones between the -- the production zone
19 between the M-16 and the Cox Well did you not?

20 A Yes, as best I could follow it.

21 Q My question was: Do you agree or disagree with
22 his opinion?

23 A Well, I disagree if his opinion is, and I think
24 it was, that simply because this well is perforated in the
25 zone fifty feet below the top of the reef, which this one,

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1 the M-16, is perforated in the zone at the top and the
2 Doctor can't correlate this zone with some zone over here.
3 That does not mean in my opinion that there is disconnection
4 within the Abo reef.

5 Q I believe you heard the Doctor's testimony that
6 he went on characteristics of the log in comparison?

7 A Right.

8 Q Based on his testimony of characteristics, which
9 you heard, and I'm not referring to the top of the reef,
10 bottom of the reef, but the characteristics, are you agreeing
11 or disagreeing with him?

12 A I disagree in the sense I don't feel that based on
13 my attempts, the engineering committee and geological members
14 of that committee's attempts to correlate porous zones, I
15 don't think you can correlate a particular porous zone in the
16 Abo reef.

17 Q And I believe you said you didn't correlate
18 porous zones?

19 A And you are in even worse shape here because you've
20 got a cased hole which is really just a perforating correla-
21 tion hole is all this thing is on the Cox Federal EA No. 1,
22 run in a cased hole and you are trying to compare that in
23 great detail with open hole gamma ray neutron logs on either
24 side of it and you see from the kick here at the bottom on
25 the gamma ray side that the operator was searching for a

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1 reasonable point to calibrate and see his log and there is a
2 big swing here and a big swing back and then he got settled
3 down and up he went and, you know, it is just a pretty shakey
4 reed to have to lean on to try to say that one of these
5 zones doesn't correlate with some zone over here. They are
6 both in both the M-16 and the Cox Federal EA No. 1 and in my
7 opinion they are in the Abo reef and they show similar
8 producing characteristics, so they are connected, in my
9 opinion.

10 Q Are you saying the correlated zones of production
11 in each of those two wells correlate one to the other and are
12 not communicating?

13 A Oh, no, I'm not saying that. All I'm saying is that
14 the Abo formation in those two wells is connected in my
15 opinion. I don't think it is necessarily connected right up
16 here to this particular interval or right to some interval
17 in here but there is connection.

18 Q So, are you saying there is or is not communication?

19 A Oh, there definitely is in my opinion, communication
20 between the Empire-Abo Unit M-16 and the Cox Federal EA No. 1
21 deviated well.

22 Q As to the production zones?

23 A Right, as to the Abo reef and they are both
24 producing from the Abo reef.

25 Q I'm not giving the generalization of the Abo reef,

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1 which is maybe several feet thick in that area, I don't know,
2 tops and bottoms you can see on Arco DN-Three here, the top
3 of the reef is way up here and the bottom is way down there
4 and you don't produce all up and down in the whole reef.
5 Now, I'm asking you, are you making the statement or not that
6 there is communication between the production zones of those
7 two wells?

8 A Yeah, obviously, since they are both, in my opinion,
9 producing from the Abo reef, they are communicating.

10 Q Anything in the Abo reef communicates, is that
11 what you base your statement on?

12 A If it has got the same gas-oil ratio and the same
13 oil gravity and the same producing characteristics as the
14 offsetting wells it is communicating, if it is within the
15 Abo reef as my cross sections definitely show.

16 Q Are there any other characteristics upon which you
17 may base your statement, on those general statements?

18 A Well, one further piece of data that a reservoir
19 engineer would like to have is the shut-in bottom hole
20 pressure.

21 Q I'm asking what information you have, sir, upon
22 which you base your statement that they are in communication?
23 You made the general statement that anything in the Abo reef
24 is in communication, I'm simply asking you if you have any
25 other information upon which you base that statement?

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1 A Well, logs, gravity, oil and water production, and
2 what else?

3 Q Well, let's go to --

4 A GOR, those four things all indicate to me that it
5 is connected and, therefore, I don't know --

6 Q All right, would you show us on the log itself, since
7 you mentioned logs? Would you show us the characteristics
8 on the logs upon which you base your opinion that the two
9 zones are in communication?

10 A Characteristics?

11 Q Yes, you said you based it on the logs.

12 A Well, because the producing zone is below what
13 I consider to be the top of the Abo reef. The first decent
14 drilling break occurred right about at this spot, which he
15 tested and wasn't able to make a well in.

16 MR. LUCERO: Excuse me, Mr. Day, can you have him
17 refer to which exhibit?

18 A This is Arco Exhibit DN Number Four and I'm looking
19 at the R. G. Cox Federal EA No. 1 log and I'm saying that the
20 perforated interval is within the Abo reef, below the top of
21 the Abo reef and, therefore, taking into consideration the
22 production characteristics which I have gone through. In my
23 testimony, the two wells are connected in the Abo reef.

24 Q Then we again come back to your statement, that
25 anything in the reef is in communication?

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1 A Anything in the reef is in communication?

2 Q Is that your statement?

3 A If it has got permeability and if you can correlate
4 it within the reef and if its producing characteristics are
5 similar. You can't take one item and hang your hat on it,
6 you look at everything you can lay your hands on.

7 Q If we may for the moment, set aside gas-oil ratio
8 and look strictly at the logs there on Arco's DN-Four, and
9 would you tell me from those logs alone any evidence that you
10 find of communication between the Cox producing zone and the
11 M-16 producing zone?

12 A Only as I mentioned before that the top of the reef
13 is here and the base of the reef is somewhere below the log
14 interval here, therefore, and the perforations are in the
15 reef as I correlate the log. Limiting me to the log, that
16 is the reason.

17 Q Now, that's it?

18 A Right.

19 Q The fact that it is completed in what you consider
20 the reef, based on your log studies, that would show you that
21 was in communication?

22 A I would tend to feel that until I had other data
23 pointing in a different direction.

24 Q All right, then let's go over to the Humble dry hole
25 you heard the testimony on it from Dr. Rehkemper?

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1 A Yes.

2 Q Would you like to see that exhibit because I will
3 refer to it?

4 A Yeah, okay, why don't we put it on the wall.

5 Q Now, you heard Dr. Rehkemper's testimony on,
6 referring now to Cox's DN-Seven Exhibit, of correlation between
7 the Humble dry hole, which is the log in the middle of that
8 exhibit, and the Humble No. 5 which is now the L-19, which is
9 the last one on the left?

10 A Yes.

11 Q Now, then, how do you explain that this was a dry
12 hole in the same -- do you correlate this zone with this zone
13 between the two wells, between the dry hole and the producing
14 hole?

15 A Yes, just looking at it I'm sure they are both
16 on that cross section up there.

17 Q What exhibit are you referring to?

18 A They both are on the Arco DN Number Four. Here
19 they are. Here is the Exxon Federal No. 5, the producing
20 well. Here is the Exxon Federal No. 3, the dry hole and, yeah,
21 it looks like these tops that I've got here are exactly the
22 same and these are engineering committee tops and I think this
23 shows the structural relationship a lot better than that cross
24 section.

25 Q All right, going back to Cox DN-Seven, how do you

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1 explain if the zone is the same that you have a dry hole
2 in the Humble 3 Well and oil production in the Humble 5?

3 A The No. 3 dry hole is down dip out of the productive
4 area of the reef. You always drill a few dry holes when you
5 are trying to find out where to delineate a reservoir and
6 this happens to be one of them.

7 Q You correlated the zone, did you not, sir?

8 A Yes, right.

9 Q They are the same zones that were found in both
10 wells?

11 A Absolutely. The well is actually, see, this is a
12 completely misleading cross section. It should have been
13 laid out like this because this is what the thing really
14 looks like.

15 Q The way it looks here it only communicates --

16 A This is actually higher, it is dipping down, it
17 is in dipping and strike, a non-striking dip direction away
18 from the main reef.

19 Q I want to know what the communication is between
20 those two wells, as you state are the same correlative
21 zone?

22 A Well, one of them, I'm not sure exactly what
23 the tests were, eleven hundred and seventy feet of water,
24 indicating that it did have some permeability, it made water.

25 Q What is the communication between those two zones?

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1 A I think there is probably some communication in the
2 Abo here.

3 Q Upon what do you base that?

4 A Because the correlation appears to be there.

5 Q How do you get the correlation?

6 A The top of the reef correlates reasonably well and
7 then there was some permeability that the well made water
8 and so Exxon proceeded to move up dip, right up this cross
9 section, in fact, this is just one location over and made a
10 good well.

11 Q You are going back again to the fact that it must
12 have communication because it is in the reef, is that correct?

13 A Well --

14 Q Is that what you said?

15 A Generally speaking, I would say if there is some
16 porosity there it is probably communicating.

17 Q Sir, are you aware that the Humble 5 Well drifted
18 two hundred feet to the north according to the OCC files
19 and Mr. Nutter's calculations?

20 A The No. 5?

21 Q The Humble No. 5.

22 A That is probably in the ball park if Mr. Nutter
23 did it.

24 Q Are you also aware that there was no penalty on
25 that allowable since that well was drilled before the Unit

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1 was formed?

2 A No, I'm not specifically aware of that, although I
3 know it was drilled while --

4 Q In 1971?

5 A Right, the Unit was being formed at that time.

6 Q Are you aware that the Pan American well, a direct
7 offset of that was drilled a considerable length of time
8 before that, also deviated. Are you aware that the OCC
9 files --

10 A Do you mean randomly drifted?

11 Q Yes, sir. Are you aware that the deviation survey
12 on it found the deviation and there is no penalty on that
13 according to the OCC records here, Mr. Porter's, I believe,
14 signature is on that.

15 A Which one is that?

16 Q The Pan American Well which offsets the Humble No. 5
17 to the northwest.

18 A Okay, I'm going up here to Arco Exhibit DN Number One,
19 if it, of course, did drift to the northwest, that was in
20 a large base lease which was the Amoco-Malco Federal F and
21 it would not have been infringing on anybody's boundary
22 problems. Now, which well of Exxon's did you say drifted
23 the northwest?

24 Q Humble 5.

25 A The only violation, if you want to call it that,

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1 would be to Exxon itself because the immediate offset north
2 of that locations is part of the same lease, the Empire-Abo
3 Federal lease and under primary operation that is all one
4 lease, a hundred and sixty acres.

5 Q What lease is on the west of the Humble lease?

6 A That is, again, a part of the Amoco-Malco Federal
7 lease.

8 Q And how far is this surface location from that
9 line?

10 A The No. 5 surface location I'm reasonably sure it
11 shows here as being six, sixty from the Amoco-Malco Federal F
12 lease line, six, sixty east of it, so if it drifted two
13 hundred feet even due west it would still be four hundred and
14 sixty-six away from the Amoco-Malco Federal lease.

15 Q Coming back to the dry holes here, your correlation,
16 your statement on the communication is that it is in the
17 reef and, therefore, communicates?

18 A Well, but it is a lousy communication, let me make
19 that clear, because after all, it was such a poor quality
20 reef that they couldn't do anything with it, that's the
21 evidence on the drill stem test.

22 Q So you state that there is poor communication, at
23 best, between those two wells?

24 A Between that dry hole, yes, most dry holes are
25 poorly communicated to the nearby reservoir.

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1 Q All right, sir, would you state where the Cox
2 Well is located in general direction with reference to the
3 Empire-Abo field?

4 A Well, it's on --

5 Q It's on the south side of the field?

6 A Yeah, right.

7 Q And to the west?

8 A It's on the south edge of the reef.

9 Q And to the west of the field, the western part of
10 the field?

11 A West? Slightly west of central, yes, about a mile-
12 and-a-half or so west of central.

13 Q Now, when you quoted the quality of communication,
14 when you referred to your Exhibits Three and Four, you
15 quoted the Unit, those are the Unit statements and not your
16 own?

17 A Would you repeat that, please, sir?

18 Q You referred to the quality of the communication
19 in the reef?

20 A Within the reef?

21 Q And you kept referring to Unit studies, are those
22 Unit studies and not your studies?

23 A No, they are mine and Unit studies, at least the
24 conclusions, and I participated in the studies, of course.
25 The conclusions I agree with a hundred percent as to excellent

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1 communication within the reservoir.

2 Q Well, you are quoting the Unit only to support your
3 position, is that what you are doing, the Unit study?

4 A Well, yes, I'm simply saying that I wasn't by myself
5 in arriving at this conclusion there was a wide variety of
6 experienced engineers and geologists involved in the study
7 who reached essentially the same conclusion that I did.

8 Q That you did?

9 A As to vertical and horizontal communication.

10 Q You are saying that in support of your study?

11 A Beg pardon?

12 Q I'm just trying to get clear, you keep quoting
13 the Unit study, but you are doing that in support of what
14 you say?

15 A Oh, yes.

16 Q Now, on the gas cap that you referred to up
17 there, how did that affect the overall production in the reef?

18 A How does the gas cap affect --

19 Q Yes.

20 A Well, the fact that we are attempting to exercise
21 good stewardship over it is going to increase the recovery.

22 Q You mean in time?

23 A Yes, it is having that effect right now.

24 Q Over the entire reef?

25 A Yes, I would say so.

1 Q What effect is it having on the wells that are in
2 the southwestern part of the field?

3 A Southwestern? Well, probably just in other parts
4 of the field, the oil is moving down structure.

5 Q Is it affecting those wells now?

6 A Beg pardon?

7 Q Is it affecting those wells now?

8 A How far southwest do you want me to go to talk
9 about it?

10 Q To the edge of the field.

11 A Yes.

12 Q And is it your statement -- you are pointing to
13 Arco Number One?

14 A Beg pardon?

15 Q You are referring to Arco Number One?

16 A I'm referring to Arco DN Number One, right.

17 Q Is is your statement that the recycling of the gas
18 is affecting the production of each and every well in that
19 field at the present time?

20 A Yes. Oh, yes, it is helping to hold up the reservoir
21 pressure which is helping the productivity of all of the wells.

22 Q To what degree?

23 A To what degree?

24 Q Yes, sir. To what extent is it helping production
25 in each and every well?

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1 A Well, any time you act to maintain reservoir
2 pressure you enable a well to produce at a better rate than
3 if the pressure was declining.

4 Q Mr. Christianson, you are making a general statement
5 can you make a specific statement that the gas recycling
6 which is only sixty-five percent, I believe, by your own
7 testimony, how specifically is it affecting a well that is
8 on the southwestern edge of the field?

9 A You are referring to this as a recycling project,
10 this really isn't, we are beefing up the secondary gas cap.
11 Our gas is being produced out of wells down structure, it's
12 solution oil-gas ratio and then we are taking sixty-five
13 percent of that gas which was in solution in the oil in the
14 reservoir and we are putting that back up in the gas cap. We
15 are not recycling gas in the gas cap, that is something that
16 goes on a lot of places but we are not doing that.

17 Q All right. How does that specifically affect the
18 production in the southwestern-most wells of that field?

19 A It helps to hold the pressure up in this area and
20 helps the migration of oil down dip and it should maintain a
21 lower GOR for a longer period of time on the wells in the
22 southwestern portion of the field.

23 Q Again we are going to general statements, are we
24 not, you don't have any specific data to show that, say that
25 southwestern-most well is being helped by your efforts in the

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1 gas cap?

2 A Well, only, of course, we ran numeric model studies
3 where we modeled every well in the reservoir.

4 Q Do you have anything specific, Mr. Christianson?

5 A For the most part these wells were helped by the
6 gas-injection project.

7 Q But you don't have anything specific?

8 A I don't see what point it would serve. I don't
9 happen to have all of that kind of data along with me, no.

10 Q Incidentally, can you refer to, or do you know of
11 your own recollection, what is the difference in distance
12 between the Cox Well and the L-17?

13 A Distance?

14 Q Yes, sir.

15 A L-17, I'm back on Exhibit Arco DN Number One. L-17,
16 I would say that that is roughly nine hundred and fifty to
17 a thousand feet horizontally.

18 Q Would this Amoco DN-One Exhibit introduced on
19 January 21st help you to give me those estimates of distance?

20 A Are you talking about the distance from the location
21 in the bottom hole in the Abo reef of the deviated well and
22 the L-17, are you talking about surface locations, or what?

23 Q Well, on Amoco DN-One, I'm asking you the difference
24 between the bottom of No. 1, if you know its bottom, with
25 No. 3 or the best estimate.

1 A The bottoms of the two wells. Well, I would say
2 it's in the neighborhood, and this is an estimate, probably
3 a thousand feet, that is the L-17 bottom-hole location is
4 probably a thousand feet north-northeast of the bottom-hole
5 location of the Cox Federal EA No. 1.

6 Q And the M-16?

7 A The what?

8 Q The M-16.

9 A The M-16 bottom-hole location would probably be less
10 than six hundred feet. In other words, to the two bottom-
11 hole locations.

12 Q All right, thank you.

13 Was the M-16 plugged back?

14 A Plugged back?

15 Q Yes, sir.

16 A When?

17 Q At any time.

18 A My data that I have doesn't indicate that it was.

19 Q All right.

20 A However, it may have been.

21 Q Do you have any knowledge that it was?

22 A I don't really have any knowledge that it was, no.

23 Q On the cross sections that you have shown on the

24 Arco's Exhibit DN-Three and Four, do you know whether any
25 of those wells were plugged back?

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1 A I can't tell you if they were or if they weren't,
2 no, sir.

3 Q All right, sir, you don't have any independent
4 knowledge of that?

5 A No, I haven't brought that kind of data along with
6 me, I'm sorry.

7 Q All right. Going to the water production, have
8 some of the wells that did not produce water before are now
9 producing them, producing water, that is?

10 A You mean in the area of the Cox Federal EA Number
11 One?

12 Q No, sir, just in any of the sections surrounding
13 the Cox Well, or any of the wells that were not producing
14 water before are now producing water?

15 A Yes, I know of at least one that is producing
16 some water now that did not produce it in the past.

17 Q Are some of the wells that have produced water in
18 the past, and again I'm referring to the same section, now
19 have increased their water production?

20 A Some of them have increased as I think the data
21 on an earlier exhibit by Mr. Noell showed, have increased
22 their water rates over what they were immediately prior to
23 the formation of the Unit.

24 Q Is the water then being coned in by the production?

25 A There is certainly some possibility that there may

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1 be some coning or there may be some upward movement of the
2 water-oil contact also.

3 Q I believe I have asked you this before in times
4 past but I don't recall if we have it in the present record.
5 Is there oil underneath the Cox lease?

6 A Well, if you take the location of the Cox Federal --

7 Q Would you answer yes, or no?

8 A Yes, I would say there is.

9 Q All right, now, refer to Arco DN-Three, please, sir.

10 A Arco DN-Three, okay.

11 Q And from looking at those logs, the cross sections,
12 would you say that there are shaley and tight zones present?

13 A You mean within the Abo reef?

14 Q Yes, sir.

15 A I would say that you can't really tell from the
16 logs.

17 Q You cannot tell?

18 A That's right, you have to have more information.

19 Q All right, if it is determined or if there is, let's
20 say this is hypothetical, you made the statement that you
21 don't find it but if there are shaley and tight zones present
22 in those logs of the wells, would they affect the horizontal
23 and vertical permeability?

24 A If they were present, and I'm taking your postulation
25 and I'm not agreeing to it.

1 Q Yes, sir, I understand that.

2 A If they were present and if they could be
3 correlated over wide areas of the reservoir, they might
4 certainly have some effect.

5 Q Mr. Christianson, are the wells in the field which
6 have produced water structurally higher than the oil?

7 A Wells in the field, yes, I think there are
8 probably some wells that have produced minor volumes of
9 water.

10 Q Would that indicate to you a permeable barrier
11 or poor communication?

12 A Possibly in that localized area.

13 Q So, you are saying that in some local areas there
14 is poor communication?

15 A That's right.

16 Q Mr. Christianson, going back to Arco DN-Three,
17 referring to the oil-water contact of a minus twenty-six,
18 sixty-five, is that correct?

19 A Yes, sir.

20 Q How much oil could you have from the bottom, between
21 that and the bottom of the Cox Well?

22 A Well, the engineering committee said thirty-nine
23 thousand, eight hundred and ninety barrels.

24 Q Well, what do you say?

25 A I would say based on the data they had before them

1 at that time that was a reasonable estimate.

2 Q And this is below, this is the amount of oil that
3 is below the Cox Well?

4 A Below it, no.

5 Q That was my question.

6 A I don't know, some percentage of that. It would
7 be, say, two-thirds.

8 Q So, you are saying that there is oil below the
9 Cox Well, where it is bottomed now?

10 A No, I'm saying, well, if you go with the original
11 engineering committee estimate, there is a reasonable
12 possibility that there is some oil down there, yes.

13 Q That L-151 on Arco DN-Three, that is a new well
14 is it not?

15 A Yes, sir.

16 Q And is the Unit drilling several wells inside the
17 field?

18 A That is correct.

19 Q As a matter of fact, I think there were fifteen
20 drilled this year?

21 A Fifteen, actually seventeen completed in 1975.

22 Q Seventeen?

23 A In-field wells.

24 Q And that is to help recover more oil, is that
25 right?

1 A That is correct.

2 MR. DAY: All right, we'll pass the witness.

3 Thank you.

4 MR. RAMEY: Mr. Stamets?

5
6 CROSS EXAMINATION

7 BY MR. STAMETS:

8 Q Mr. Christianson, if I understand your testimony
9 to this point, what you have said is that the Cox Well
10 through the reservoir porosity, vugular porosity, inter-
11 crystalline porosity, fractures both vertical and horizontal,
12 the Cox well is essentially in communication with every other
13 well?

14 A That is correct, that is what I have tried to say.

15 Q Thank you. Now, at the first day's testimony in
16 the current case, in response to some questions I asked
17 Mr. Currens, he indicated that it was his opinion that if
18 the Commission permitted wells to be drilled at locations
19 such as the bottom-hole location of the Cox Well, that an
20 offsetting operator, in order to protect himself from
21 drainage, that he would have to drill a well on his lease
22 that close to his lease line, that this would not result in
23 an appreciably greater recovery from the reservoir and
24 would result in economic waste. Now, do you concur with
25 his testimony in response to my question?

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1 A. Yes, I do.

2 Q Further, in response to the second part of this
3 question, I asked Mr. Currens if wells were drilled, many
4 wells were drilled, under this type of spacing pattern and
5 produced at rates commensurable with what is being produced
6 in the Empire-Abo Pool, would waste occur because of
7 inefficient production from these wells and I believe his
8 answer was, yes. Do you concur with that response?

9 A Yes, I think that qualifying only that the non-unit
10 well, of course, not returning any of the produced gas, that
11 would be Mr. Cox's Well, would be, of course, involved in
12 the greater portion of the waste.

13 Q I believe the record would show that we were
14 speaking of a hypothetical situation and we were not referring
15 to a unit operation.

16 A Okay.

17 MR. STAMETS: Thank you.

18 MR. HINKLE: I have one more on redirect.

19 MR. RAMEY: Okay, Mr. Hinkle.

20 MR. BUELL: I have one or two on cross, would you
21 prefer that I get mine out of the way?

22 MR. RAMEY: Yes, Mr. Buell.

23

24

CROSS EXAMINATION

25

BY MR. BUELL:

1 Q Mr. Christianson, is Arco as unit operator, monitoring
2 the unitized pressure maintenance program?

3 A Yes, sir, it is.

4 Q And I believe you just testified that during the
5 year 1975 seventeen in-field wells were drilled?

6 A Correct.

7 Q Let me ask you whether or not in your monitoring
8 program of the unitized pressure maintenance program in the
9 drilling of these seventeen in-field wells, did you encounter
10 any evidence or data whatsoever, impediments to communication
11 within the Empire-Abo reef?

12 A No.

13 Q All right, sir, do you happen to recall the average
14 porosity that was used in the unitization study?

15 A Six point four percent, I believe, was the weighted
16 average.

17 Q Do you happen to recall the average water saturation
18 used?

19 A Nine percent.

20 Q What?

21 A Nine percent.

22 Q And do you recall the reservoir volume factor
23 that was used?

24 A One point six, oh, six reservoir barrels per stock
25 tank barrels.

1 Q All right, thank you, Mr. Christianson. Let me
2 ask you this: I believe when you were testifying with
3 relation to Arco's Exhibit DN-Two, you mentioned that the
4 Cox deviated well was producing below a solution gas-oil
5 ratio?

6 A No, it is essentially at solution GOR at the
7 current reservoir pressure.

8 Q And it was about eight, sixty-three, as I recall?

9 A That's right.

10 Q The original solution gas-oil ratio was twelve,
11 fifty?

12 A Correct.

13 Q And I believe you further testified that the reason
14 that it was producing at such a low gas-oil ratio is that
15 the gas that was coming out of solution was migrating up
16 structure and joining forces with the secondary gas cap?

17 A This is the process that is going on in the
18 reservoir, yes.

19 Q All right, sir, I'm not going to refer you to an
20 exhibit but picture in your mind's eye, if you will, the Cox
21 deviated well eight or nine feet from the west line and
22 fifty-eight or sixty feet from the north line of their lease,
23 in the bottom-hole location of that well, let me ask you this:
24 Is it generally speaking up structure to the northwest?

25 A Yes, that is correct.

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1 Q So, let's say that this gas would only have to
 2 migrate ten, twelve, fifteen feet to get off the Cox lease
 3 and work its way on up to join the secondary gas cap?

4 A That's right.

5 Q In your opinion, if the Cox zone reservoir was
 6 limited to the Cox lease and did not extend across his lease
 7 line into the Empire-Abo Unit, would the Cox Well be producing
 8 today with a gas-oil ratio of eight hundred and sixty-three
 9 to one?

10 A I doubt it very seriously.

11 Q If that reservoir was limited to the boundaries of
 12 his lease, it could only migrate about ten or twelve feet
 13 away from the wellbore at the most?

14 A Yes, sir.

15 Q So, if it was limited to his lease, we would see
 16 a higher gas-oil ratio on the Cox Well?

17 A It would be, in my opinion, yes.

18 MR. BUELL: That's all I have. Thank you, Mr.
 19 Christianson.

20 MR. RAMEY: Mr. Hinkle?

21

22 REDIRECT EXAMINATION

23 BY MR. HINKLE:

24 Q Mr. Christianson, on cross examination of Mr. Day
 25 there, you referred to Cox's Exhibit DN-Seven and said that

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1 it was misleading and it was not correct. For the purpose
2 of the record, I wish you would point out just why it is
3 misleading and why it is not correct?

4 A Well, the first obvious point which Mr. Buell brought
5 out in cross examination of Dr. Rehkemper was that the cross
6 section is not hung on a true subsea depth so you don't see
7 the true subsea relationship and this well appears to be
8 lower, that is by this well I mean the Humble EA Federal No. 5
9 appears to be lower on top of the Abo reef subsea-wise than
10 the offsetting well which is the Humble EA Federal No. 3 dry
11 hole, when in actuality as the well is calculated, the EA
12 Federal No. 5 is actually higher subsea. This is the vertical
13 problem that you have in looking at the thing and then the
14 horizontal problem is that it appears in looking at this that
15 the Humble EA Federal No. 3 lies on a line in between the
16 Humble EA Federal No. 5 and the Humble EA Federal No. 4, when
17 in fact it doesn't. As a matter of fact, you can look on
18 the Arco DN Number One and you will have to look at the one
19 right in front of you but you can see from the location there
20 that the Humble or Exxon Empire-Abo Federal No. 3 Well is
21 almost exactly due south of the Humble Empire-Abo Federal
22 No. 5, and then you turn at a ninety-degree angle and go east
23 to the Humble Empire-Abo Federal No. 4. So, really these
24 two wells are a part of the dip cross section, whereas this
25 well and this well are part of the strike cross section.

Q Now, you are referring to cross sections?

A Okay, the Humble EA Federal No. 5 and the Humble EA Federal No. 3 are the part of a dip cross section to the cross section shown on Arco Exhibit DN Number Three and whereas we admittedly shift in going from the Humble EA Federal No. 3 to the EA Federal No. 4 into a long strike cross section, so we are going this way and then we are going this way, which is not really shown in the way this thing is set up. So, in effect, what you've got really in these two wells are the tag end of a cross section that would be very similar to this one right here, which is the Arco DN Number Three, and the dry hole would compare very closely to a location somewhere slightly to the right here of the Cox EA Federal No. 1, down dip from it, and then this one, the EA Federal No. 3 and then the Humble EA Federal No. 5 would correspond more to a location similar to the Cox Federal EA No. 1 deviated well. You would have those two wells of a dip cross section here.

MR. RAMEY: Are these depicted on your other cross section, Mr. Christianson? Aren't these wells on your other cross section?

A Yeah, they happen to be part of this strike cross section.

Q (Mr. Hinkel continuing.) You are referring to what cross section?

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1 A I'm referring to cross section Arco DN Number Four
2 Exhibit and those two wells happen to be the Exxon Federal
3 No. 5, Unit L-19, and the Humble L-19 dry hole which is the
4 old Humble Federal No. 3. And so these two wells show the
5 same relationship that is shown going from this well to this
6 well. This well to this well, except this is along a strike
7 cross section and these are on a dip cross section.

8 MR. LUCERO: Mr. Christianson, could you refer, when
9 you say, this well and this well?

10 A Well, I did all of this before so it is in the
11 record, do I have to do it again?

12 MR. LUCERO: I don't know, maybe we are just
13 repeating ourselves.

14 A Well, I went through it and identified them the
15 first time through and I'm really saying it over again what
16 I said before.

17 MR. LUCERO: That's what I figured. Thank you.

18 MR. RAMEY: Any other questions of the witness?

19 MR. BUELL: May it please the Commission, may I
20 make a statement in deference to Dr. Rehkemper? Dr. Rehkemper
21 used a copy of our orientation map, Amoco's Exhibit DN-One,
22 and on that map, unfortunately, we had the surface location
23 of the Humble Well No. 3, the center well on the cross section
24 offered as Cox's Exhibit DN-Seven. We got our data from
25 Humble and Humble themselves had it misplotted on their maps,

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1 and we have learned since we furnished this exhibit to the
 2 Commission that that surface location had been resurveyed and
 3 the surface location is as shown on Arco's Exhibit DN Number
 4 One, but in support of Dr. Rehkemper, he was simply using
 5 the surface location as shown on our Exhibit DN-One and we
 6 did have it misplotted. Actually as far as our purposes were
 7 concerned, now that Mr. Christianson has corrected the surface
 8 location of the relationship between the No. 3 Well, the
 9 Humble No. 3 Well on Cox's DN-Seven and the well on the extreme
 10 right I don't think it is too critical to Dr. Rehkemper's
 11 position that he was taking or to the position that Mr.
 12 Christianson was taking.

13 MR. RAMEY: Any other questions of the witness?

14 MR. DAY: Yes, if Mr. Hinkle is through.

15 MR. RAMEY: Mr. Day?

16
 17 RE CROSS EXAMINATION

18 BY MR. DAY:

19 Q Mr. Christianson, do you know the difference between
 20 correlating a log structurally and stratigraphically?

21 A Correlating a log structurally?

22 Q Yes.

23 A Oh, yeah, I hope I do a little bit anyway.

24 Q Well, which is better?

25 A Which is better?

1 Q Yes.

2 A I would say that it depends on the case that you've
3 got that you are trying to correlate and what you know about
4 the reservoir as a whole.

5 Q Let's go directly to Cox's DN-Seven, are you
6 correlating those structurally or stratigraphically?

7 A Well, Dr. Rehkemper, I presume, is correlating them
8 stratigraphically.

9 Q And you?

10 A Well, I prefer to correlate them the way they are
11 actually sitting there in the reservoir.

12 Q So you are saying structurally?

13 A Structurally, right.

14 Q So there is a difference between you and Dr. Rehkemper
15 then on that approach?

16 A Only in the sense that I will correlate strati-
17 graphically, if you want to call it that, by laying two
18 logs side by side and comparing kicks and I guess that's
19 stratigraphic correlation.

20 MR. DAY: That's all.

21 MR. RAMEY: Any other questions of the witness? He
22 may be excused.

23
24 (THEREUPON, the witness was excused.)
25

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1 MR. BUELL: May it please the Commission, we have
2 one witness for a very short direct testimony.

3 MR. RAMEY: All right.

4 MR. BUELL: We would like to call Mr. Currens and we
5 will need from the Commission files, your copy of Amoco's
6 Exhibit DN-Two that was presented January 21, 1976.

7 (THEREUPON, a discussion was held off
8 the record.)

9
10 DAN CURRENS

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

13
14 DIRECT EXAMINATION

15 BY MR. BUELL:

16 Q Mr. Currens, Exhibit Number Two has been explained
17 in the record of the January 21 portion of this hearing, but
18 would you briefly, in order to orient all of us to this
19 exhibit, briefly state what it shows?

20 A Amoco Exhibit DN-Two is a depiction of the forty-
21 acre drilling unit on which the Cox EA Federal Deviated Hole
22 No. 1 was drilled and according to the directional survey,
23 completed. It shows the surface location of the EA Federal
24 No. 1. It is shown by a line to the, a blue line coming out
25 generally to the west and then forking. On the south fork of

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1 the line it showed the bottom-hole location of the original
2 EA No. 1 that was drilled by Aztec.

3 Q That would be the randomly drilled No. 1?

4 A Yes, the old hole, the randomly drilled one and by the
5 north fork of the blue line the bottom-hole location of the
6 Deviated Cox Federal EA No. 1, based on the Eastman survey
7 that is in the record of this hearing.

8 Q I think the record is replete with testimony and
9 exhibits and, in fact, just to your left and to our right,
10 on Arco's Exhibit DN Number Three, the log of the Deviated
11 Cox Well shows that it is completed in the approximately four
12 feet of porosity in that well, is that correct?

13 A Yes, sir, the lower porosity shown on that log.

14 Q All right, sir, in view of that have you made a
15 study to determine what the reservoir limits of what I'm going
16 to call the Cox zone for simplicity purposes, the reservoir
17 limits of the Cox zone on the Cox Federal EA lease?

18 A I've made a study and arrived at a maximum that it
19 could be.

20 Q All right, sir. let me ask you this: In making
21 that study did you look at data obtained both by Aztec drilling
22 the originally randomly deviated No. 1 and also their drilling
23 it deeper, as well as Mr. Cox's activities in the wellbore of
24 randomly drilled No. 1?

25 A Yes, sir.

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1 Q What did that study reveal to you with whether or
2 not in randomly drilled No. 1, the Cox zone was present or
3 not?

4 A In the randomly drilled No. 1, as has been discussed
5 earlier today by Dr. Rehkemper, the logs that were run in the
6 well did not go to the absolute total depth of the well.
7 Initially, you will recall, the well was completed by Aztec
8 at a time that it had a total depth of sixty-two, ten, it
9 was completed in perforations from sixty-one, twenty-eight to
10 sixty-one fifty and that was in 1959. Subsequent to that
11 time, in 1961, Aztec squeezed those perforations and deepened
12 the well to a depth of sixty-two, fifty-three and they tested
13 a hundred percent water with a small volume of gas, according
14 to the reports, from that open-hole section.

15 Q But the well was never logged, as far as you know,
16 or as far as any log you have seen, to a total depth of
17 sixty-two, fifty-three?

18 A No, sir, not that I have seen.

19 Q All right, sir, would you now discuss Mr. Cox's
20 activities in the randomly drilled Federal EA No. 1?

21 A As I understand, the work that he did, he reentered
22 the well and made a completion attempt at an interval sixty-
23 one, sixty-two to eighty and then made other completion attempts
24 in the interval sixty-one, twenty-eight to fifty, sixty-one,
25 sixty-two to eighty and subsequently drilled out to a total

1 depth of sixty-two, fifty, just about the same, three feet
2 short of what Aztec had drilled out to and that actually never
3 made a well in any of this additional work in his reentry
4 of No. 1.

5 Q And to your knowledge, Mr. Cox never logged to
6 the complete total depth of the well over sixty-two, fifty
7 feet?

8 A Not that I know of, no, sir.

9 Q What may give some people a problem, Mr. Currens,
10 I believe on Amoco's Exhibit DN-Two, which you are referring
11 to now, the last shot point of the directional survey on
12 randomly drilled Federal EA Number 1 is shown as sixty, fifty,
13 is that observation correct?

14 A Yes.

15 Q So actually the directional survey run by Mr. Cox did
16 not go all the way to the total depth of sixty-two, fifty or
17 sixty-two, fifty-three?

18 A No, it didn't. The well had been plugged back by
19 that time, I believe it was in a temporarily abandoned status
20 and there was a plug in the well.

21 Q Actually that point isn't too critical, is it,
22 Mr. Currens?

23 A No.

24 Q I bring it up so that if someone looking at DN-Two
25 saw the sixty, fifty as the last shot point on Mr. Cox's

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1 directional survey, they might get confused over the fact
2 that the total depth of the well was really sixty-two, fifty-
3 three.

4 A That apparently was just as far as he could get with
5 the directional survey and the plugs at the time.

6 Q Let me ask you this: Looking at that portion of
7 the directional survey down to sixty, fifty, could you assume
8 for the additional two hundred feet that it would generally
9 have deviated in the same direction the past shot points
10 in the exhibit is?

11 A Very likely it would have gone off in the same
12 general direction as the last several shot points indicated.

13 Q All right, sir, you heard Dr. Rehkemper's testimony
14 with regard to his correlations?

15 A Yes, sir.

16 Q And where he anticipated the Cox zone will fall?

17 A Yes, sir.

18 Q And the randomly drilled Federal EA No. 1, let me
19 ask you whether or not this well penetrated that zone as
20 identified by Dr. Rehkemper?

21 A Yes, sir, it did.

22 Q What did the test in the interval, in and around
23 total depth or in and around the interval that Dr. Rehkemper
24 revealed from the standpoint of productivity?

25 A One hundred percent water was the report by Aztec in

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1 1961 when they deepened to include that interval that he would
2 have correlated to.

3 Q Was Mr. Cox able to make a completion at any
4 interval?

5 A No, sir.

6 Q In the randomly deviated Federal EA No. 1?

7 A No, not that I'm aware of.

8 Q All right, sir, does that give you a clue as to
9 the possible southern limits of the Cox zone under the
10 Cox Federal EA lease?

11 A Yes, sir.

12 Q Let me ask you this: You can't tell from the
13 Exhibit Two, but relying on your knowledge and the orientation
14 of the well, is the bottom hole of the randomly deviated
15 Federal EA No. 1 about on a line between the deviated bottom-
16 hole location and the Amoco Diamond Federal Well that we have
17 mentioned and is shown on Arco's DN-Three to your left?

18 A Yes, roughly.

19 Q All right, sir, based on your study and maybe it
20 will help us get in perspective, in the upper northwest
21 corner of our Exhibit DN-Two, what amount of surface acreage
22 are we looking at? I know within the red boundary we are
23 looking at forty acres, but what are we looking at up there
24 in that northwest corner?

25 A Well, in the northwest corner a square to the, with

1 the surface location of the No. 1 as the corner of it, that
2 three hundred and thirty-one from the north line and three
3 hundred and thirty feet from the west line location, this
4 area in the extreme northwest corner, that would be a square
5 of those dimensions would be approximately two-and-a-half acres.

6 Q All right, sir, let me ask you this: Based on your
7 study of the completion attempts and the randomly deviated
8 well over the interval that should contain the Cox zone, based
9 on your evaluation of the performance and the production
10 data from the deviated completion and that four feet of
11 porosity, what, in your opinion, could be the maximum extent
12 of the Cox zone under the Cox Federal EA lease?

13 A I don't believe it could be more than two-and-a-half
14 acres.

15 Q In your opinion, is a well that is producing with a
16 water cut of eighty percent, would you normally expect that
17 to be fairly close to the oil-water contact, the current
18 oil-water contact?

19 A Yes, sir, I would.

20 Q And we know that the zone was not productive at the
21 bottom-hole location of the random deviated Federal EA Well
22 No. 1?

23 A That is correct.

24 Q And using these data you come up with your maximum
25 reservoir extent under the Cox lease of the Cox zone of two-

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1 and-a-half acres?

2 A Yes, sir, I don't believe it could be any more than
3 two-and-a-half acres.

4 Q Have you made a study to determine the amount of
5 hydrocarbons that would be contained originally, originally
6 in place, in this two-and-a-half acre Cox zone reservoir?

7 A Yes, sir.

8 Q Would you state for the record what that is, please,
9 and how you made that calculation?

10 A Okay. Utilizing four feet of pay, six point four
11 percent porosity, nine percent water saturation, without
12 respect to the reservoir volume factor at all.

13 Q What is the importance of the reservoir volume
14 factor in a determination of original oil in place, for some
15 of us laymen, would you tell us?

16 A Well, the oil in a reservoir normally contains
17 dissolved gas and this does because, you know, it is producing
18 with a ratio of eight or nine hundred cubic feet per barrel.
19 Normally it contains the dissolved gas and as the well is
20 produced, the oil is brought to the surface and put in a stock
21 tank and the gas is separated from the oil and the stock tank
22 oil, the amount of oil that gets in the stock tank is a smaller
23 volume than the volume that it occupied in the reservoir
24 under normal circumstances. You get fat oil in the reservoir
25 and you get skinny oil on the surface.

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1 Q It would be fair then to say it shrinks?

2 A It shrinks, yeah.

3 Q All right, sir, and you completely eliminated that
4 factor in making the determination of the original oil in
5 place?

6 A Yes, sir.

7 Q All right, sir, using the porosity figure that you
8 used and if memory serves me correctly, that is the average
9 porosity used in the unitization study?

10 A Yes, sir.

11 Q The water saturation, I believe, is identical to
12 the average water saturation that was used?

13 A Yes, sir.

14 Q What do you come up with?

15 A I come up with one thousand eight hundred and eight
16 barrels per acre and on a two-and-a-half acre basis, that
17 would be forty-five hundred and twenty some odd barrels.

18 Q All right, sir, do you have any knowledge of the
19 cumulative production that Mr. Cox has obtained from his
20 Cox zone in the deviated well completion?

21 A I have the production figures supplied to the
22 Commission to January 1st, 1976.

23 Q And what was his total cumulative production?

24 A Four thousand and eight barrels.

25 Q Compared with what originally in place, not including

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1 the reservoir volume factor?

2 A I didn't write it down, let me do it again.

3 Forty-five, twenty, all right.

4 Q All right. Now, we are almost through the month
5 of February and Mr. Cox has been producing at an average
6 rate of, say, thirty-five barrels or more a day, twenty-nine
7 days in February, at the end of February he should have added
8 another thousand to that cumulative, what would his cumulative
9 be then?

10 A Actually, two thousand is that cumulative because
11 that cumulative was to January 1, so there is January
12 production plus February production.

13 Q I misunderstood you.

14 A So it would be about twenty-one hundred barrels
15 more and if he produced thirty-five barrels a day for those
16 sixty days, the cumulative production at the end of February
17 would be six thousand, one hundred and eight barrels.

18 Q Far in excess of the original oil in place under
19 the Cox zone reservoir, under the Cox Federal EA lease?

20 A Yes, sir.

21 Q If he has depleted all of the original oil in
22 place, and no well ever recovers that much, under his lease,
23 but let's assume that he has, where is the oil coming from
24 that he is producing from this completion?

25 A From other properties in the area, from the unit.

1 Q Which would be the Empire-Abo unit?

2 A Yes, sir.

3 Q Do you have anything else you care to add at this
4 time, Mr. Currens?

5 A No, sir.

6 MR. BUELL: May it please the Commission, that's
7 all we have by way of direct of Mr. Currens.

8 MR. RAMEY: Any questions of the witness?

9 MR. DAY: Yes, sir.

10 MR. RAMEY: Mr. Day.

11 CROSS EXAMINATION

12
13 BY MR. DAY:

14 Q Mr. Currens, are you saying that under the Cox lease
15 there are only two-and-a-half producing acres?

16 A I said that I could not see that he could have any
17 more than two-and-a-half acres productive from the completion
18 that he has made in this well.

19 Q All right, are there only two-and-a-half producing
20 acres in the Cox lease?

21 A I doubt that there are any more than that.

22 Q You disagree with the unit engineering that Mr.

23 Christianson relies on of fourteen producing acres? He relies
24 on the unit study, do you disagree with that?

25 A We are talking of two different points in time.

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1 Q I realize that.

2 A And, yes, I disagree with there being fourteen
3 productive acres right now.

4 Q And do you disagree with Arco's DN-Three, that
5 the oil-water contact where it is, that the reef comes all of
6 the way through the Amoco Well?

7 A The original water-oil contact is what is depicted
8 on that exhibit. I have not made a study of the original
9 water-oil contact.

10 Q You don't agree or disagree with Arco's DN-Three,
11 is that your answer?

12 A That is correct.

13 Q Do you agree or disagree that the reef is present
14 in the Amoco well? By that I'm talking about the Amoco
15 Diamond Federal No. 1 Well.

16 A The Diamond Federal No. 1 Well appeared to have a
17 reef section in it, yes, sir.

18 Q And the fact that it is -- it is a fact, isn't it,
19 that the Aztec well produced five thousand barrels of oil?

20 A That's my understanding, yes, sir.

21 Q From the Cox lease?

22 A Yes.

23 MR. DAY: I pass the witness.

24 MR. RAMEY: Any other questions of the witness? He

25 may be excused.

(THEREUPON, the witness was excused.)

MR. RAMEY: Mr. Hinkle, did you offer your exhibits?

MR. HINKLE: Yes, I believe I did.

MR. RAMEY: Do you have any statements?

MR. BUELL: That's all we have, Mr. Examiner.

MR. DAY: If it please the Commission, if we may have a brief recess, I think I may have a brief rebuttal.

MR. RAMEY: We will take a five minute recess.

(THEREUPON, the hearing was in recess.)

MR. RAMEY: The hearing will come to order. Mr. Day?

MR. DAY: Sir, we call Glenn Noell back to the stand, please.

DIRECT EXAMINATION OF GLENN NOELL

BY MR. DAY:

Q Mr. Noell, will you tell the Commission, what significance does it have to compare gas-oil ratios and gravities to communication within a field?

A It really has no significance whatsoever. It can or cannot be a factor in determining communication. I can show you any number of fields that are many miles away from the Empire-Abo that approximately have the same solution gas-oil ratio as this field does.

Q So does it alone confirm communication?

1 A No, sir.

2 Q Does it have anything to do with it? You have
3 heard testimony that there is extensive in-field drilling
4 in this field, and you know that I think from your own studies
5 what does this tell you about their development of the field?

6 A Well, it has, maybe I'm the wrong person to ask, but
7 I assume they are doing this, one, to keep the unit allowable
8 up and, number two is, and here again I'm surmising, they feel
9 like if they would get additional oil recovery and they are
10 saying that a forty-acre drainage per well is not necessarily
11 the most optimum spacing.

12 MR. DAY: All right, sir. No other questions.

13 MR. RAMEY: Any questions of the witness? Mr. Buell?

14
15 CROSS EXAMINATION

16 BY MR. BUELL:

17 Q Mr. Noell, the hour is late and we are all anxious
18 to get through and I may put this question a little more
19 bluntly than I intend to and I hope you will understand that
20 it is entirely due to the lateness of the hour, but would you
21 please state for the record your position on whether or not
22 you think the Cox zone in the Cox deviated well is separate
23 or in communication with the Empire-Abo Pool?

24 A I don't believe I can conclusively say one way or
25 the other.

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1 Q Did not your two exhibits that you introduced,
2 Cox's LN-Four and Five, I believe, were not those two exhibit,
3 was not the thrust of those two exhibits to the effect that
4 the Cox zone completion in the Cox deviated well was in
5 communication with the Empire-Abo Pool?

6 MR. DAY: Do you recall those exhibits?

7 A I do not recall which exhibits you are --

8 Q (Mr. Buell continuing.) They were the only two
9 exhibits you had, Mr. Noell, surely you haven't forgotten
10 them in a couple of hours.

11 A Oh, I thought you were referring to this one here.

12 Q No, sir, I'm referring to your two water-oil ratio
13 maps or whatever you want to call them. One was for the
14 period September 1972, that was your Exhibit Four, the other
15 was October of '75, your Exhibit Number Five.

16 Was not the thrust of those two exhibits, the only
17 two you presented, to the effect that the Cox zone in the
18 Cox deviated well was in communication with the Empire-Abo
19 Pool?

20 A To a certain extent, yes.

21 Q To what extent were they not thrust in that
22 direction?

23 A I do not know. I do not think that information is
24 available to really establish that. We can see the water
25 moving up and you can infer that makes it in partial

1 communication but by the same token you can demonstrate in
2 certain localities that there is definitely not communication.

3 Q I'm going to summarize what I think your judgment
4 is and I want to be fair and if you disagree you can certainly
5 correct me but as I get your judgment and your opinion and
6 that is that you are telling this Commission that based on
7 the reservoir study that you have performed, you cannot reach
8 an opinion, you cannot make a judgment as to whether or not
9 the Cox zone in the Cox deviated well is in communication
10 with the Empire-Abo Pool or is separate from the Empire-Abo
11 Pool?

12 A Based on the available data, you are correct.

13 MR. BUELL: That's all I have. Thank you, Mr. Noell,
14 thank you, gentlemen.

15
16 REDIRECT EXAMINATION

17 BY MR. DAY:

18 Q Mr. Noell, the oil and water have different
19 characteristics, do they not?

20 A Yes, sir.

21 Q And they flow differently through formations?

22 A Yes, sir.

23 Q In a different way?

24 MR. DAY: No other questions.

25 MR. RAMEY: Any other questions of the witness? He

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1 may be excused.

2 (THEREUPON, the witness was excused.)

3 MR. DAY: I would like to recall Dr. Rehkemper,
4 please.

5
6 DIRECT EXAMINATION OF L. JAMES REHKEMPER

7 BY MR. DAY:

8 Q Dr. Rehkemper, would you tell the Commission in
9 your study of local communications, if the fact that the dry
10 hole Humble well shown on Cox's DN-Seven is located to the
11 south of the Humble 5 Well or to the east of it makes a
12 difference in your log comparisons?

13 A No, it doesn't. This is a stratigraphic section,
14 it is not a structural section as I mentioned in my earlier
15 testimony. All this is showing is that the same zone, the
16 correlative zone is tight between two producing wells.
17 Therefore, I am saying that you cannot prove communication
18 between the Humble No. 3 and the Humble No. 5 Well because
19 they are separated by a well which is tight.

20 Q Looking to Arco DN-Three, if those logs indicate
21 any shaley or tight zones, would that affect the vertical
22 communications?

23 A Yes, I would say that it would.

24 Q Would you please approach that exhibit and inform
25 us whether or not there is any indication of shaley and tight

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1 zones?

2 A I would say that there are indications of shaley
3 and tight zones. Admittedly we are looking at a gamma ray
4 neutron log which is affected, especially the neutron, by
5 hole size, however, characteristically on the gamma ray neutron
6 log, the gamma ray shows an increase in radiation and the
7 neutron an increase in porosity. This is normally interpreted
8 as being shale or shaley. There are numerous zones in J-14
9 up near the top where this condition exists. Now, in
10 determining or calculating porosity from the neutron log, you
11 take your tightest zone on the neutron curve and you assign
12 a porosity to this of approximately one percent, you then find
13 a shale zone, what you think is good shale and you assign
14 a porosity of -- it may vary somewhere around forty percent.
15 From these two end points you set up a porosity scale. On
16 the K-15, for example, at a depth from nine four hundred to
17 ninety-four, fifty, roughly, your neutron is almost pegging
18 to the right, indicating a very tight zone up at the top of
19 the reef. Other zones can be pointed out in the J-14 at a
20 depth of fifty-six, eighty to ninety you have a very tight
21 zone. Near the base of the reef you have in the J-14 at a
22 depth of fifty-eight, oh, four, you have another tight zone
23 which is obviously a very tight stringer, possibly anhydrite
24 and I think you can go through these logs, and admittedly
25 this is qualitative since we are using gamma ray neutrons but

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1 you can see zones which are shaley, zones which are tight, so
2 I cannot agree with earlier testimony that you cannot tell
3 tight zones and shaley zones from electric log analysis.

4 Q Are you in accordance with Mr. Christianson's state-
5 ment that any well producing in the reef is in communication
6 with the whole reef?

7 A From the information I have heard and seen, I cannot
8 agree with this.

9 MR. DAY: All right, thank you, Dr. Rehkemper.
10 No other questions.

11 MR. RAMEY: Mr. Buell?
12

13 CROSS EXAMINATION

14 BY MR. BUELL:

15 Q Doctor, I'll be just as brief as possible. I was
16 diverted for just a moment but I was attempting to follow
17 your testimony where you were pointing out on Arco's DN-Three
18 some shale that you had found from the log that you have to
19 work with there?

20 A Yes, sir.

21 Q I believe you pointed out two shaley intervals,
22 one was at the extreme top of the reef, the other was at the
23 extreme bottom?

24 A Well, those are just some that are obviously shale.
25 There are some within the reef as well.

1 Q Find us one in the middle of the reef.

2 A Okay, right there. This is in the J-14 at fifty-
3 five, seventy-four to seventy-six.

4 Q All right, sir, do you think that shale interval
5 that you just stated for the record, forms an effective
6 barrier to communication in the Empire-Abo reservoir?

7 A I think in that particular local area, yes.

8 Q You heard your colleague, Mr. Noell, testify this
9 morning, based on his study of the reservoir that the gas cap
10 was expanding?

11 A Yes.

12 Q That water was encroaching?

13 A Right.

14 Q Communication looked excellent, in fact, the high
15 producing rates of the wells in the Empire-Abo Unit were
16 causing a premature encroachment of water into the Cox zone
17 in the Cox deviated well? Did you hear that testimony?

18 MR. DAY: Just a minute, Dr. Rehkemper. Did you
19 state that you are quoting Mr. Noell as saying that the
20 communication was excellent?

21 MR. BUELL: Yes, sir, he testified as to the gas
22 cap expanding as predicted, he testified as to the water
23 encroachment, he testified to the effect -- we can go back
24 and find it if you want to.

25 MR. DAY: My recollection was that he just couldn't

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1 tell you.

2 MR. BUELL: I'm talking about this morning. He
3 has changed his story. He testified that the high producing
4 rates from the Empire-Abo Unit were causing premature
5 encroachment of water into the Cox zone in the Cox deviated
6 well and that could not occur unless you have got good
7 communication.

8 MR. DAY: Well, are you concluding that it is
9 excellent or is he concluding that it is excellent?

10 MR. BUELL: We'll have to go back and --

11 MR. RAMEY: What is your question, Mr. Buell?

12 MR. BUELL: All right.

13 Q (Mr. Buell continuing.) You heard Mr. Noell testify,
14 one, that the gas cap was expanding as predicted?

15 A Yes, I believe that is correct.

16 Q You heard him testify, two, that water was encroach-
17 ing around the edge?

18 A I believe that is right.

19 Q Three, did you hear him testify that the high
20 producing withdrawal rates from the Empire-Abo producing wells
21 were causing water to prematurely encroach and water out the
22 Cox zone in the Cox deviated well?

23 A I can't say that I heard him say this.

24 Q Well, the record will reflect it. In the interest
25 of time, assume for the purpose of this question that my

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1 memory is correct, that he did say that, or words to that
2 effect, in that are you differing from him when you say you
3 find shale intervals within the body of the Empire-Abo reef
4 that would be an impediment to the free flow of communication?

5 A I think this is true, yes, that you can have local
6 variations in porosity and permeability which could isolate
7 zones within a reef.

8 Q Now, we are to local impediments of communication?

9 A I think we are looking at a local area possibly in
10 the subject well, Cox's deviated well.

11 Q On Arco's Exhibit DN-Three you found a shale streak
12 in about the center of the reef, would you go locate that
13 again and see if you can correlate it to the well on either
14 side of that?

15 A Well, of course, this is just -- I mean, there are
16 others. I believe that I testified that in the J-14 --
17 I'll back up.

18 Q Are you familiar enough with this reservoir, Doctor,
19 to realize that the area which you have just located, your
20 triangle on Arco's Exhibit DN-Three is where the secondary
21 gas cap is formed and is expanding?

22 A No, I'm not aware of that, but I say that there are
23 shale zones.

24 Q All right, sir.

25 A Now, I would have to get all of the logs and see

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1 where these zones might correlate. I mean, you are looking
2 at a northwest-southeast section. Given time and doing some
3 stratigraphic correlations, I may or may not be able to show
4 that these are continuous but I can say that within the wells
5 there are tight zones and there are shaley zones within the
6 reef.

7 Q I realize, Doctor, that you just looked at this
8 situation the last twenty or thirty minutes and you are working
9 under handicaps and I'm certainly willing to state that for
10 the record.

11 Let's go on, the hour is late. Mr. Christianson
12 testified that in his opinion and in his engineering judgment,
13 any well completed in the Empire-Abo reef formation that had
14 similar or identical producing characteristics to the other
15 wells then producing in the Empire-Abo reef Pool, in his
16 opinion, were in communication with other Empire-Abo reef wells.
17 You stated that you disagreed with that judgment?

18 A Right.

19 Q Would you point to me one well, to your own knowledge,
20 completed in and producing from the Abo reef formation that
21 is separated from the other wells in the Empire-Abo reef
22 Pool?

23 A Well, on Arco DN-Four I again compare M-16 to the
24 Cox EA Federal No. 1 and I say that those two wells are not
25 in communication. The pay zones are not in communication, this

1 one and that.

2 Q So in effect you are saying that the only well you
3 know of in the Empire-Abo reef formation that is separate
4 and distinct is the Cox well?

5 A Well, I say I can point to others.

6 Q Well, would you?

7 A I mean, I can illustrate where you do not have
8 continuity in porosity and permeability.

9 Q Doctor, everyone who has testified in this matter,
10 including Mr. Christianson, has testified that you cannot
11 correlate one little zone of porosity in one producing well
12 even to the next well. Everyone has testified to that, is
13 that all that you are saying?

14 A I'm saying that in some places you can but I'm
15 saying that you can correlate the zones but you cannot prove
16 or disprove continuity of porosity and permeability.

17 MR. BUELL: All right, sir. Doctor that is all I
18 have. I told Dr. Rehkemper this personally, I will say it
19 for the record. I did not intend my remarks in regard to
20 Cox's DN-Seven to infer that Dr. Rehkemper was trying to
21 mislead anyone. I thought my statement was that I mislead
22 myself in looking at that cross section, thinking that it
23 reflected structure but I think the record will reflect that
24 he very clearly and distinctly stated that it was a strati-
25 graphic section and not a structural cross section. Thank you.

1 Doctor, that's all I have.

2

3

REDIRECT EXAMINATION

4 BY MR. DAY:

5 Q Dr. Rehkemper, then your opinion about the Abo reef
6 field is that it has in local areas poor communication?

7 A Yes, sir.

8 MR. DAY: Thank you.

9

10

RECROSS EXAMINATION

11 BY MR. BUELL:

12 Q Doctor, let me ask you just one more question. I
13 want to be sure what your professional opinion is, clearly
14 and concisely on the record, as to whether or not in your
15 geological opinion, the Cox zone in the Cox deviated well
16 is producing from a separate and distinct accumulation of
17 hydrocarbons never heretofore produced by any other well and
18 not now in communication with any other well?

19 A No, I cannot state that.

20 Q So you are like Mr. Noell, you can't tell this
21 Commission one way or the other what your professional opinion
22 or judgment is with regard to communication or separation?

23 A All I can say is that there are instances where you
24 do not have porosity and permeability communication and I
25 feel you can do this between the M-16 and the Cox Federal

1 deviated hole.

2 MR. BUELL: Thank you, Doctor.

3 MR. LUCERO: I have a question.

4 CROSS EXAMINATION

5 BY MR. LUCERO:

6 Q You just used the words "local areas" in your answer?

7 A Yes.

8 Q How do you define the words "local areas"?

9 A I would say, of course, that's -- well, I would
10 say within, oh, maybe within a thousand or two thousand feet,
11 something like that. There might be areas, say between two
12 wells that are, say, two thousand feet apart, you can have
13 permeability barriers between those two wells.

14 Q Then your conclusion is that the words "local areas"
15 can be a variable?

16 A Well, by "local" I mean I don't think you can say
17 that throughout the entire reef you have no -- that the entire
18 reef is in communication. I think there are, in some areas,
19 if you were to map it very detailed, you would find where your
20 porosity, you do have porosity and permeability barriers
21 existing.

22 Q But the two words "local areas" indicate that there
23 is variability in your definition?

24 A Right, right.

25 MR. RAMEY: Any further questions. The witness may

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1 be excused.

2 (THEREUPON, the witness was excused.)

3 MR. RAMEY: Mr. Hinkle?

4 MR. HINKLE: I realize the hour is late but I would
5 like to put Mr. Christianson back on in rebuttal, just some
6 very short testimony.

7 MR. RAMEY: All right, will you take the stand
8 Mr. Christianson?

9
10 DIRECT EXAMINATION OF HUGH CHRISTIANSON

11 BY MR. HINKLE:

12 Q Mr. Christianson, you have heard the testimony of
13 Dr. Rehkemper?

14 A Yes, sir.

15 Q Do you agree with his testimony?

16 A No, sir, I don't.

17 Q Explain in what way you do not agree with it?

18 A Well, I have the advantage on Dr. Rehkemper that I
19 have looked at the cores on the wells on which the gamma ray
20 neutron log looked just as shaley as this interval here
21 in the Empire-Abo Unit No. J-14 on Arco Exhibit DN Number
22 Three and I have seen that through a zone that looks very much
23 like this as far as being highly radioactive, the permeability
24 from the core analysis shows good communication. When you
25 inspect the actual cores as they are brought out of the hole,

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1 because of oil stains in the vertical fractures, communication
2 right across areas, you look and there is a hunk of shale with
3 a fracture through it that is communicating and you know there
4 is oil there because it's stained. I have looked at that
5 sort of thing, so you really cannot go by what you see on the
6 gamma ray neutron log. The shale or the radioactive material
7 is probably there but because of this fracture-vug system
8 we've got in the reservoir, there is communication vertically
9 and horizontally through that very material. I've seen it
10 and that is the visual part of it and then, of course, in
11 this same area we have a great deal of evidence from field
12 performance that there is good vertical communication because
13 we've got this formation, this secondary gas cap, and you
14 can't have that unless your free gas percolated up and is
15 moving up into that cap and how do we know? By drill stem
16 tests that have been taken on some of these in-field wells,
17 for example, where we go in and test an interval, somewhere
18 down in here which actually is lower subsea than intervals
19 that did produce at low gas-oil ratios in the general area
20 and we find that the gas cap is there when we had prior
21 evidence at earlier times in the history of the reservoir
22 that it was not even here, it was above this one.

23 So, this is really all I wanted to bring out, in
24 addition to the fact that the engineering committee and the
25 geological people connected with it, did have an opportunity

1 over a period of months and months to attempt correlations
2 of the type Dr. Rehkemper said he would like to do and
3 concluded that you cannot correlate a particular porous zone
4 on a gamma ray neutron log with another particular porous zone
5 on these wells. So, that's all.

6 MR. RAMEY: Any questions of the witness?

7 MR. DAY: Very briefly.

8
9 CROSS EXAMINATION

10 BY MR. DAY:

11 Q Do you have those core analysis with you on these
12 wells?

13 A No, you'll have to take my word for it.

14 Q Are there any tight zones in the Abo reef?

15 A Tight zones, yeah, there are tight zones.

16 Q All right. Do you agree or disagree with this
17 statement with respect to the Empire-Abo field: Porosity
18 is distributed irregularly within the reef reservoir. Not
19 even offset wells can be correlated in the reef because
20 of this irregular porosity development, communication in local
21 areas is very poor. Do you agree or disagree with this
22 statement?

23 A There may be local areas, yeah, where communication
24 is poor, it's a relative --

25 Q I believe so, that's fine, Mr. Christianson. In

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1 many areas low porosities and permeabilities can be
2 attributed to excessive anhydrite depositions, this condition
3 is prevalent in the western end of the Empire-Abo field. Do
4 you agree or disagree with that statement?

5 A I haven't wholly decided yet.

6 Q Do you know William J. LeMay?

7 A Yes, just as an acquaintance, a geologist.

8 Q Who is he?

9 A He is a geologist who has done a great deal of
10 work on the Abo and on this type of reef development in
11 New Mexico.

12 Q Have you had an opportunity to read his article
13 that is printed in World Oil, Abo reef in southeastern
14 New Mexico?

15 A Yes, I've read that.

16 MR. DAY: No other questions.

17 MR. RAMEY: Did Mr. LeMay participate in any of
18 the engineering studies?

19 THE WITNESS: No, he did not. However, we had
20 that very article available to us among other internal Arco
21 studies and Amoco studies by geologists, as well as this
22 paper and other papers which we all read. I'm talking about
23 the engineering committee when we were doing our work.

24 MR. RAMEY: Any other questions? The witness may
25 be excused.

1 (THEREUPON, the witness was excused.)

2 MR. RAMEY: Anything further in this case?

3 MR. DAY: Just a brief summation, please, sir.

4 MR. RAMEY: If you will, Mr. Day.

5 MR. DAY: Thank you. We have testimony from the
6 Arco people and I'm looking at Arco DN-Three, that the reef
7 comes down and toes into the Amoco Diamond Federal No. 1
8 above the oil-water contact. There is a possibility of oil
9 in that lease to that extent that the Amoco Diamond Federal
10 Well is far to the south of the Cox Well.

11 We cannot agree, of course, with the two-and-a-half
12 acre limitation that Mr. Currens put on there, in view of
13 looking at this reef studied here and in the log correlations.
14 It has been agreed, I believe, between Mr. Christianson and
15 demonstrated by Mr. Rehkemper that in local areas there is
16 poor communication and there is evidence of poor communication
17 in the subject lease, the Cox lease.

18 There is oil underneath the lease, that has been
19 testified to several times. New Mexico has followed the
20 ownership theory for a number of years of oil in place.

21 There is testimony that this well will flood out
22 rather than receive additional gas. I think from what has
23 been submitted to the Commission it will flood out. I think
24 if you make a determination you will find that it will. And
25 on this basis, the basis that there is oil underneath the

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1 lease and goes pretty far down into the lease, that if it
2 is flooded out there will be a waste of oil, that has been
3 testified. And we feel that the allowable, taking into
4 account that there is poor communication at best, a penalty
5 allowable would be in order.

6 As far as I know, this is a case of first impression
7 in New Mexico but I will refer to the Sohio Petroleum Company
8 Parker Case in the Oklahoma Supreme Court in 1957, in which
9 Parker drilled a dry hole, backed up, deviated it and then
10 went to the Corporation Commission for permission to produce.
11 The Corporation Commission granted it, gave him an allowable
12 and there was testimony in that case where Sohio witnessed,
13 testified that the fault cut the unit and left only eight
14 producing acres. Mr. Parker witnessed, testified that the
15 entire lease had the oil creek sand. They gave him the full
16 allowable in that case.

17 In the Stuart, et al Humble Oil Refining Company,
18 set aside by the Texas Supreme Court in 1964, where an
19 operator deviated, the court, the trial court closed the well
20 in. The Supreme Court ruled in favor of the operator and
21 said that in overturning the lower court's decision, stated
22 that the allowable be permitted even though the deviations
23 were deliberate.

24 In the Anderson Pritchard Oil Corporation versus
25 the Corporation Commission, an Oklahoma case in 1951, the

1 court approved an allowable to the deviated well based on
2 producing acres to unit acres where the well drilled was closer
3 to the line than permitted.

4 We feel that an allowable such as discussed, presented
5 today by Dr. Noell and based on unit studies, would seem to
6 come in and out of this case as far as Arco and Amoco witnesses
7 are concerned as to whether it furthered their case or not, that
8 that would be a formula submitted to, suggested to this
9 Commission in fairness of production to allow Mr. Cox to
10 recover some of this oil that is in place and an adjustment
11 of any injury that may be possible to other leases connected
12 to it with poor communication, taking into account. Thank you,
13 sir.

14 MR. RAMEY: Mr. Buell?

15 MR. BUELL: May it please the Commission, I will
16 be just as brief as I possibly can.

17 At the outset let me say this with reference to
18 the outside of the State of New Mexico cases that Mr. Day
19 cited, that one of the first concepts, one of the first
20 precepts you learn in law is that each case must stand on
21 its own bottom and that's all we ask this Commission to do
22 is to let this case stand on its own bottom and we reviewed in
23 prior closing statements the surroundings of the directionally
24 drilling of this well. I don't intend to go into that,
25 except as a reminder, that let's do let this case be judged

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1 on its own merits.

2 A lot of mention has been made today of the Amoco
3 Diamond Federal No. 1 Well, the extreme right well on the
4 cross section, Arco's Exhibit DN-Three, and about all of the
5 possibilities that it has to be hydrocarbon bearing in the
6 Empire-Abo field. All of this was brought out by representa-
7 tives of Mr. Cox and not a one of them thought to tell you
8 gentlemen that Mr. Cox owns the Abo rights in that well and
9 if he thinks that it is bearing of hydrocarbons in the Empire-
10 Abo Pool, he can simply reenter it and make his completion.

11 I would point out to the Commission that in January,
12 on the twenty-first, Mr. Commissioner, this case was continued
13 to February the 24th in order that a definitive reservoir
14 study could be made by a consulting expert that Mr. Cox
15 intended to employ. We have seen that definitive reservoir
16 study here today. The engineering consultant expert told
17 this Commission frankly and honestly that he does not have an
18 opinion, he cannot make a judgment as to whether the Cox
19 completion in the Cox deviated well is in the Empire-Abo Pool,
20 or whether it is separate.

21 Dr. Rehkemper, the geological consulting expert,
22 told the Commission the same thing.

23 The testimony of Arco, I think, is clear, it is
24 concise and it is unrefutable, that is that the Cox zone
25 completion in the Cox deviated well is completed in the

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1 Empire-Abo Pool and is in communication with the Empire-Abo
2 Pool. I think one very definitive bit of evidence is the
3 fact that here it is producing right at solution oil-gas
4 ratio, after its commulative production, and the only way
5 it can be doing that since it is below saturation pressure
6 is for the gas to be migrating up structure and, gentlemen,
7 with the bottom-hole location of that Cox deviated well there
8 is no place up structure for it to go on the Cox lease,
9 it has got to be migrating up structure into the Empire-Abo
10 Pool. It has got to be in communication or we wouldn't see
11 that kind of gas-oil ratio performance.

12 Also I would call to your attention that neither the
13 engineering expert, Mr. Noell, nor the geological expert, Dr.
14 Rehkemper, had made a reservoir limit study of the Cox zone
15 in the Cox deviated well. Mr. Currens had made such a study.
16 He presented that study to this Commission and it is un-
17 refuted and uncontradicted in this record that that reservoir
18 had a maximum under the Cox lease of two-and-a-half acres.
19 I think very definitive proof of the limitations, the
20 smallness of that reservoir is the fact that it was not
21 productive in the randomly drilled Federal EA No. 1, it
22 was not productive in that and according to Dr. Rehkemper's
23 own testimony, it would have been found within the vertical
24 limits. It is not productive. The maximum reservoir that
25 he can have in that Cox zone under his lease is two-and-a-half

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1 acres. The record is uncontroverted and unrefuted that with
2 a reservoir that size, even with the most liberal estimate
3 of original oil in place, he has produced all of his oil in
4 place and the record stands unrefuted at this point that each
5 barrel of oil that is being produced from that Cox deviated
6 well is coming from the interest owners in the Empire-Abo
7 Unit.

8 We urge this Commission to take action and ratify
9 the order that was issued as a result of the Examiner Hearing
10 and require Mr. Cox to do the right thing, comply with the
11 order, if he can make a completion he can have his well. Thank
12 you.

13 MR. HINKLE: If the Commission please, I can't
14 add much to what Guy Buell has already said but I think the
15 Commission understands the facts of this case just as well as
16 we do. There is no question but what it is in violation of
17 correlative rights and drainage. As Guy has said, the
18 evidence is clear and uncontradicted, this is a limited
19 reservoir here, they have already produced much more oil than
20 was in it.

21 Now, I think this case has reached a point where,
22 while the Commission has this matter under consideration to
23 make its final decision, that the allowable ought to be cut
24 to a minimum during this period of time and in reaching the
25 decision, if you do, that you ought to follow the recommendations

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1 of Atlantic Richfield and order this well to be closed in,
2 unless he wants to re-drill it in the area that was
3 originally provided for in the order of the Commission.

4 MR. DAY: Of course, the Commission, I think, has
5 knowledge of the fact that any cessation of production from
6 this well would terminate the lease and we refer to the unit
7 studies as far as production acreage goes underneath the Cox
8 lease as far as any comments on Mr. Curren's testimony on it
9 and we submit to the Commission that, one, that Mr. Cox did
10 not willfully and intentionally violate the order of the
11 Commission, we resolved that pretty well and that is in almost
12 all of the earlier testimony that you have read. And, two,
13 adjust correlative rights, if there are any there, to take
14 into account the expertise of Dr. Rehkemper and the con-
15 currence of Mr. Christianson that there is poor communication.
16 We ask that an allowable be set for this well that will make
17 it economical to produce it. Thank you.

18 MR. LUCERO: Mr. Day, you refer to two citations,
19 or two cases, do you have the exact citation on them?

20 MR. DAY: I don't think I have. Let me see if I
21 have them. I don't think I have the exact citation on
22 these, no. On the first one it is the Oklahoma Supreme
23 Court 1957 and the second one is the Texas Supreme Court
24 1964 and then the third one is -- well, there is a citation
25 here, it's 1951 Oklahoma. It says 241 P2d 363. The appeal

1 was dismissed by the Supreme Court 342 U.S. 938 and then there
2 follows another one, 252 P2d 450, which I presume is the
3 same case in 1953.

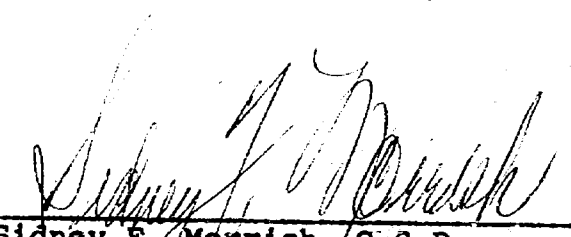
4 MR. RAMEY: Anything further in this case? The
5 Hearing is adjourned.

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REPORTER'S CERTIFICATE

I, SIDNEY F. MORRISH, a Certified Shorthand Reporter,
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ability.


Sidney F. Morrish, C.S.R.

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BEFORE THE
NEW MEXICO OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
January 21, 1976

COMMISSION HEARING

IN THE MATTER OF:

Application of Robert G. Cox for
amendment of Order No. R-4561, Eddy
County, New Mexico.

CASE
5571
(De Novo)

BEFORE: Joe D. Ramey, Director
Phil Lucero, Member

Daniel S. Nutter
Richard L. Stamets

TRANSCRIPT OF HEARING

A P P E A R A N C E S

For the New Mexico Oil Conservation Commission: William F. Carr, Esq.
Legal Counsel for the Commission
State Land Office Building
Santa Fe, New Mexico

For the Applicant: James E. Day, Jr. Esq.
FREEDMAN, DAY & IVY
Attorneys at Law
Adolphus Tower
Dallas, Texas 75202

APPEARANCES CONTINUED

For the Applicant:

Sumner Buell, Esq.
MONTGOMERY, FEDERICI, ANDREWS,
HANNAHS & BUELL
Attorneys at Law
350 East Palace Avenue
Santa Fe, New Mexico

For Atlantic Richfield
Company:

Clarence Hinkle, Esq.
HINKLE, BONDURANT, COX & EATON
Attorneys at Law
Hinkle Building
Roswell, New Mexico

For Amoco Production
Company:

Guy Buell, Esq.
Legal Counsel for Amoco Production
P. O. Box 3092
Houston, Texas

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1 MR. RAMEY: We will take the next case on the
2 docket.

3 MR. CARR: Case 5571, application of Robert G. Cox
4 for amendment of Order No. R-4561, Eddy County, New Mexico.

5 MR. RAMEY: Ask for appearances in the case.

6 MR. S. BUELL: Mr. Commissioner, Sumner Buell of
7 Montgomery, Federici, Andrews, Hannahs and Buell appearing
8 on behalf of Mr. Cox. Also appearing is Mr. James Day, Junior
9 of Dallas, Texas who will present the case.

10 MR. HINKLE: Clarence Hinkle of Hinkle, Bondurant,
11 Cox and Eaton appearing on behalf of Atlantic Richfield.

12 MR. G. BUELL: For Amoco Production Company, my name
13 is Guy Buell.

14 MR. RAMEY: I would ask at this time for all of the
15 witnesses to stand and be sworn in this case.

16 (THEREUPON, the witnesses were sworn.)

17 MR. RAMEY: Mr. Day, you may proceed at this time.

18 MR. DAY: Thank you, Mr. Ramey. If I may, if it
19 please the Commission, I would like to make an opening state-
20 ment to show the Commission the nature of our case and how
21 we look at it.

22 MR. RAMEY: All right.

23 MR. DAY: This case, I feel, can be divided into
24 two parts, one concerning the non-compliance with a drilling
25 permit issued earlier by this Commission and the other having

1 to do with whether or not the production from the Cox lease
2 communicates, or if it does, in what way it communicates with
3 the Empire-Abo field.

4 Concerning the first part, in May of 1973 Mr. Cox
5 appeared before this Commission, or the Examiner for the
6 Commission, and obtained a drilling permit allowing him to
7 deviate a well within one hundred feet of the surface location.
8 The time was running out on that lease a few months later, it
9 was a Federal lease but before its expiration Amoco drilled
10 a test well on the Cox lease. He learned of this later, which
11 had the effect of relieving him of having to develop that
12 lease in order to extend it. The effect of that drilling by
13 Amoco extended the lease to August 31st, 1975. The Amoco well
14 was drilled without the knowledge of Mr. Cox when they
15 commenced. He later asked for a log on the drilling well, on
16 the well that was completed. Amoco felt that they could not
17 release it. He contacted me, I contacted Amoco, they had the
18 same feeling but later on they released the log to some of
19 the shallow rights that belonged to Mr. Cox. The deep rights
20 belonged to Amoco.

21 A few months after that, the first of '75, I believe
22 it was, there was a fire in Mr. Cox's office. It destroyed
23 most of his records and smoke damaged the balance of them.
24 He was attempting to restore these records to meet his obliga-
25 tions to drill other drilling wells and commitments, as well as

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1 this well that is the subject of this hearing today.

2 At the very time that it was close to the expiration
3 of the subject lease he retained an engineer and a whipstock
4 service company and trusted his memory as to the permit which
5 had been destroyed and in a hurry got a drilling contractor
6 at an expensive rate and completed the well.

7 The Commission will hear testimony today that the
8 operator requested that the well be directed toward the north.
9 We will hear conflicting testimony to some degree from
10 the Eastman people who were the whipstock service people,
11 that the target area was to the northwest.

12 Unfortunately, Mr. Ratts the engineer who Mr. Cox
13 hired for this well is unavailable today, he was sitting on
14 another well and could not appear.

15 The well was commenced, the drilling superintendent
16 called Mr. Cox long distance to inform him that he was
17 concerned about the direction of the well. Mr. Cox will
18 testify that he looked into the matter and came out to the
19 lease site, employed additional Dyna tool drills at an expense
20 to him to try to turn the well back and time is running out
21 and, of course, great expense was incurred and as a practical
22 matter and the economics considered, the well was finally
23 bottomed.

24 I do not think there will be any conflicting
25 testimony that the well is bottomed on Mr. Cox's lease or that

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1 Mr. Cox has oil under his lease.

2 Mr. Cox immediately divulged and disclosed this
3 deviation in directional and bottoming to the Commission and
4 then applied for an application to permit this well to be
5 completed at that location and to be allowed to be produced.

6 The other part of it has to do with the reservoir
7 communication or what you might call the correlative rights.
8 At the hearing in October when the application, which is the
9 subject matter before this Commission now was first heard,
10 Mr. Cox introduced into the record his geological opinion.
11 Amoco and Arco moved for a continuance in order to study these
12 opinions and give it time to prepare its case in light of such
13 testimony. That hearing was continued until November. At
14 that hearing I appeared with Mr. Buell and the matter was
15 concluded adversely to Mr. Cox. The decision came out
16 approximately a month later, just before the holidays. After
17 a discussion with his attorneys, Mr. Cox felt and as his
18 attorney I so advised that an in-depth study of the reservoir
19 should be made and that he should employ an engineer, if
20 possible, who was familiar with the field. He ultimately
21 located and retained such an engineer but said engineer
22 informed him that he was not able to even commence the studies
23 that were necessary for this matter until February 4th, 1976.

24 We will ask the Commission for a continuance until
25 such time as that part of the case can be heard, which we

1 suggest as February 24th after consulting with dockets and
2 the time the engineer needs, I believe the Commission meets
3 on Tuesdays, in order that we might submit to the Commission
4 what we feel is the necessary in-depth study of the field and
5 its correlative rights. If the Commission pleases, we are
6 ready to commence unless there are comments from other counsel.

7 MR. RAMEY: Are there other opening statements?

8 Mr. Buell?

9 MR. G. BUELL: Yes, Mr. Ramey, if I may. I will be
10 very brief.

11 I would like to point out that as this case develops
12 I believe the Commission will see that there was no attempt
13 whatsoever on the part of Mr. Cox to either, one, comply with
14 the Commission order which authorized him to directionally
15 drill, or, two, to even begin to comply with his sworn testimony
16 presented in May of 1973, upon which the order was based.

17 As this record unfolds you will see that actually
18 the Commission was more generous to him as a result of that
19 May 1973 hearing than really what he asked for. Mr. Cox
20 will testify or the record shows that he testified at that
21 hearing he wanted to kick out of the old hole at about forty-
22 three hundred feet and then drill a straight hole to the Abo
23 reservoir. The kick-out point at forty-three hundred feet
24 was well within a hundred feet of the surface location. The
25 Commission rather than restricting him to just that area, gave

1 him authority to bottom the well anywhere within a hundred
2 feet of the surface location of the well. So in truth, in
3 fact, you gave him much more flexibility than he swore that
4 he actually needed. This record will show that he made no
5 effort to comply with either the order or to comply with his
6 sworn testimony.

7 With regard to the test well that Amoco drilled on
8 this lease, it is my understanding that Mr. Cox had the rights
9 down to sixty-two hundred feet, which would include the Abo
10 formation and we had the deeper rights. Our well was a test
11 well to the Morrow. We released to Mr. Cox a log of our test
12 well above sixty-two hundred feet, in that that was our under-
13 standing of his ownership in this lease, above sixty-two
14 hundred feet. We didn't release it to anyone else, we thought
15 that would be unjust to Mr. Cox in that he did have an expiring
16 lease, so we didn't release the log to others but we did give
17 Mr. Cox a copy down to sixty-two hundred feet.

18 I think the record of this case as it unfolds will
19 show beyond a shadow of a doubt, that the bottom-hole target
20 location that Mr. Cox wanted for his well was fifty feet from
21 the north line of his lease and fifty feet from the west line.
22 They did not hit that target precisely, as the evidence will
23 reflect. The well ended up approximately nine feet from
24 their west lease line, which is only nine feet from the east
25 line of our offsetting lease.

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1 Now, with regard to the continuance, Mr. Day is
2 absolutely correct. At the October 8th hearing Amoco did
3 move for a continuance. We moved for a continuance because we
4 were surprised by the evidence that Mr. Cox presented, that
5 his bottom-hole location had, in fact, been completed in a
6 virgin reservoir that had not heretofore been produced in the
7 Empire-Abo field and actually he testified that there was no
8 well in the Empire-Abo pool that was capable of producing
9 from it. At that time Mr. Cox had not released the log of
10 his directionally controlled well, so we had no geological
11 data in that regard at all. So that's the reason we moved for
12 a continuance, which was granted.

13 Amoco would certainly have no objection to a
14 reasonable continuance at this time for Mr. Cox. We would be
15 happy to accommodate him. We do believe a continuance to the
16 last of February is not reasonable. Amoco is perfectly willing
17 and will so stipulate that we will agree to a continuance for
18 the other phase of this case to February 5th. That's over
19 two weeks from today, it's the day after the next Examiner
20 hearing.

21 Also, I don't know what engineer Mr. Cox has selected
22 but I believe that engineer could finish that work in that
23 amount of time. Mr. Cox has all of the data. Mr. Cox has
24 already made his own intensive geological study of the
25 formations under this lease and in effect Mr. Cox is prepared

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1 to hand to whatever engineer he selected, practically the
2 entire case as far as collecting and gathering data and things
3 of that nature.

4 So, Amoco has no objection to a continuance to
5 February 5th; we would oppose a continuance to the last part
6 of February.

7 MR. RAMEY: Mr. Hinkle?

8 MR. HINKLE: I think Mr. Buell has covered very
9 aptly the first part of the case. As far as the continuance
10 is concerned, Atlantic Richfield would have no objection to
11 the continuance to February 5th as suggested by Mr. Buell.

12 MR. DAY: May I rebut very briefly? I'm not
13 trying to be argumentative.

14 MR. RAMEY: Yes, Mr. Day.

15 MR. DAY: As far as the statement of Mr. Buell about
16 the testimony in the first hearing of May of 1973, there is in
17 the record a question by Mr. Hinkle to the then engineer,
18 Mr. Allspaugh of Mr. Cox's employment. Unfortunately, Mr.
19 Allspaugh between that time and the time the well was commenced,
20 moved his residence to Kansas and was not available to serve on
21 this well that was drilled, the one before the Commission.
22 In that question he said, he asked how far is it off of there?
23 This is talking about kicking out on the first deviation. The
24 answer of the engineer at that juncture was: Approximately
25 ninety-five feet west of the surface location, approximately

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1 eight feet south.

2 In summation Mr. Hinkle made the statement, "Are
3 you willing to drill the well with the provision in the order
4 that you will not crowd the lease line any closer than one
5 hundred and sixty feet?"

6 So I do feel that the order that came out was
7 fair and not any gratuity in favor of Mr. Cox. I think the
8 Commission ruled fairly in its total consideration of the
9 testimony in that hearing.

10 As far as the intentions of Mr. Cox, may I point
11 out that the total lease expenditure by Mr. Cox and his
12 investors to date is somewhere around six hundred thousand
13 dollars. On this single well alone they spent two hundred
14 and seventy-four thousand dollars, a good deal of it in trying
15 to control the direction of the well. It would be very
16 fatuous for Mr. Cox to gamble two hundred and seventy-four
17 thousand dollars on the chance that his well would be allowed
18 to produce if he intentionally drilled to this area. Mr. Cox
19 has been nothing more than absolutely frank, his candor has
20 come out in that he has not attempted to hide or conceal
21 anything. He has testified before, before the Examiner of
22 this Commission, that he trusted his memory, that he went
23 without the permit and bottomed where he did and disclosed all
24 of the facts. There is no indication at all that he tried to
25 be devious in this matter, in any matter, except to divulge

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1 the full facts to the Commission and to try to show the
2 Commission that it was an unintentional directional, an un-
3 intentional violation of the Commission's drilling permit,
4 that he bottomed where it did under the economic and practical
5 aspects at that time, that he is bottomed on his lease, that
6 he has oil under his lease, which is admitted, that he be
7 allowed under some formula to produce.

8 As far as the time element goes, the Commission has
9 heretofore seen the statement of the engineer witness of Mr.
10 Cox. In that statement which was displayed to the Commission
11 earlier by Mr. Buell's office, Sumner Buell, the witness
12 stated that he could not possibly commence his study until
13 February 4th. To give him reasonable time to finish it and
14 with some consideration I'll admit, to my own trial docket, I
15 do urge that February 24th be granted. I see no injury to the
16 field or to the other parties. We are not calling back sub-
17 poened witnesses, we are volunteering appearing with our
18 witnesses and urge the Commission to consider that date under
19 such circumstances that may seem fair to all parties.

20 MR. RAMEY: We will make a decision on that later.
21 Mr. Buell?

22 MR. G. BUELL: May it please the Commission, I have
23 a feeling and my feeling has already been proven by no farther
24 along than we are this morning, that we are going to be
25 referring continuously back to the record of the May 1973

1 hearing, we're going to be referring back continuously to the
2 record in Mr. Cox's application before the Examiner for an
3 amendment to an order that issued as a result of the May '73
4 case, I wonder if it would be more of a convenience to the
5 Commission, as well as all of the parties, if we would in-
6 corporate into the record of this De Novo case, the record of
7 Case Number 4970, the case that was held on May 23rd, 1973,
8 as well as Case Number 5571, that was the case before the
9 examiner that was held on October the 8th and November the
10 19th, 1975 and I so move, Mr. Ramey.

11 MR. RAMEY: Are there any objections?

12 MR. DAY: Mr. Ramey, we object to that because we
13 feel that this is a De Novo hearing, those parts of the record
14 that Mr. Buell would like to cross examine Mr. Cox on or any
15 of our witnesses, he can feel free to use them as impeachment
16 and that purpose only and we object to the introduction of
17 the record in toto.

18 MR. RAMEY: Mr. Buell, we are going to deny your
19 motion. However, you can refer to the previous cases for
20 any information you deem fit and proper and that would apply
21 to this case.

22 MR. G. BUELL: All right, sir, I'll be happy to work
23 in that manner, Mr. Ramey, but I hope you won't get impatient
24 with me. It is going to make the hearing last longer and I
25 do beg your indulgence on referring back to the prior cases

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1 but actually Case 4970 is the bedrock for this De Novo case
2 that is before you today and if the applicant doesn't want that
3 record in this case and you've sustained his objection, well,
4 we'll sure operate in that way, Mr. Ramey.

5 MR. RAMEY: Okay, we have kind of changed our opinion.
6 We will allow the incorporation of Case 4970 into this record.
7 We will not allow the incorporation of Case 5571 in the record
8 and you may again refer to it, any portions of Case 5571 that
9 you deem necessary.

10 MR. G. BUELL: Thank you, Mr. Ramey. Could I make
11 this further suggestion to the Commission? We'll also be
12 referring to the exhibits that were introduced at the October
13 8th portion and the November 19th Examiner hearing. I think
14 it would avoid confusion for the Commission, as well as
15 confusion to we participants, Mr. Sumner Buell, if we could
16 agree on a procedure by which we would start numbering the
17 exhibits that will be presented at this De Novo hearing,
18 consecutively after the exhibits in the Examiner hearing.
19 For instance, the last exhibit that Mr. Cox introduced in
20 the Examiner hearing was Exhibit Eleven and I suggest that
21 we start out today numbering his exhibits twelve for De Novo
22 so that it will be definitely ascertainable in the record,
23 the exhibits that were introduced here, because we will be
24 continuously referring to exhibits that were introduced in
25 these prior cases.

1 MR. RAMEY: You will re-introduce the exhibits from
2 Case 5571?

3 MR. DAY: If the Commission please, I don't quite
4 understand Mr. Buell's statement. One, may I respectfully
5 enter our objection into the record to the introduction of
6 the testimony on Case 4970 in toto.

7 As far as the exhibits that we may present today,
8 I would prefer in my control of the hearing and my presentation
9 of the hearing that the Commission to have our witness
10 introduce the exhibits as he arrives at that point in his
11 testimony. As far as the engineering feature of the correlative
12 rights which we feel apparently we will have some kind of
13 continuance, we will reserve any exhibits that we have in that
14 area until such time as that hearing comes before the
15 Commission and at that time we would hopefully expedite and
16 have them numbered in advance of that hearing.

17 MR. RAMEY: It has been suggested by Commissioner
18 Lucero that perhaps the three of you should get together and
19 work out a numbering system.

20 MR. G. BUELL: I don't quite understand you,
21 Mr. Ramey.

22 MR. RAMEY: It has been suggested by Commissioner
23 Lucero that we take a five minute recess and you all get
24 together and work out a numbering system on your exhibits
25 but we would request that a DN be put in after each exhibit

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1 number, so that we can --

2 MR. G. BUELL: My only purpose is to avoid
3 confusion.

4 MR. LUCERO: Excuse me, that's why I made that
5 suggestion. Why don't we have the attorneys get together and
6 work out your numbering system on your exhibits and use them
7 from here on.

8 MR. DAY: Thank you, sir.

9 (THEREUPON, a short recess was taken.)

10 MR. RAMEY: Mr. Guy Buell?

11 MR. G. BUELL: May it please the Commission, while
12 we haven't reached an agreement, we have reached an accord.
13 The applicant would prefer to start out with his exhibits that
14 he will present today with a number one and we have agreed
15 that all of the exhibits that will be introduced today will be
16 identified DN Number One, Number Two, Number Three, according
17 to the presenter.

18 MR. RAMEY: Thank you, Mr. Buell.

19 MR. DAY: I so stipulate.

20 MR. RAMEY: Mr. Day, you may proceed.

21 MR. DAY: Thank you, sir.

22 MR. G. BUELL: And if it please the Commission, if
23 all of us in referring back to prior exhibits and comparing
24 with the exhibits that will be introduced today, will be
25 extremely careful to make that distinction in our questions

1 and in our answers, perhaps we can avoid too much confusion
2 in the record.

3 MR. RAMEY: I would suggest that.

4 MR. DAY: May it please the Commission, we will have
5 just one witness. I understand that Amoco or Arco subpoenaed
6 other witnesses which they may present and subject to my
7 cross examination.

8 At this time we will call Mr. Robert G. Cox.

9 MR. RAMEY: Mr. Day, before we proceed I would like
10 to ask Mr. Cox a couple of questions, if I may?

11 MR. DAY: Yes, sir.

12 MR. RAMEY: Mr. Cox, you are probably aware at this
13 time that the Commission has had an inquiry from the USGS,
14 from Senator Jackson's office and I wonder if you could
15 enlighten us any on what might have transpired?

16 MR. COX: Yes, sir, one of my clients when I told
17 them we could not get a continuation of the De Novo hearing,
18 that I had not had an opportunity to get an expert witness
19 and have my exhibits prepared that I wanted to render to the
20 Commission at the De Novo hearing, he apparently contacted
21 Senator Jackson or someone in Senator Jackson's office and
22 the night before I came out here I got a request from someone
23 in Senator Jackson's office to send them a telegram to that
24 effect, that I had requested a continuation and it had been
25 denied and I was not prepared to testify before the Commission

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1 based on the fact that my attorney that was slated to be,
2 one of my attorneys, was slated to be in court during the
3 time of the hearing and also the expert witness would not
4 be available to meet with me until after February 4th and I
5 had to go to Artesia to meet with him. And that is the
6 summation of what I know happened. They asked me to send them
7 a telegram to that effect and I did and I had no knowledge
8 that they had contacted the Commission.

9 MR. RAMEY: Senator Jackson's office asked you to
10 send a telegram?

11 MR. COX: Yes, sir.

12 MR. RAMEY: And they dictated the telegram to you
13 in essence?

14 MR. COX: In essence.

15 MR. RAMEY: There is another name that has popped
16 up. Do you know Mr. Lynn O'Connor?

17 MR. COX: Yes, I do.

18 MR. RAMEY: What is --

19 MR. COX: Lynn O'Connor is my brother-in-law. He
20 is an investor with me in a number of ventures.

21 MR. RAMEY: Would this have been the investor that
22 started this business?

23 MR. COX: It probably was. It was, yes, sir.

24 MR. RAMEY: Thank you.

25 MR. COX: I'm not only speaking for Lynn O'Connor,

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1 other investors, you know, are concerned too and there might
2 have been other inquiries besides his.

3 MR. RAMEY: Thank you. I just wanted to make sure
4 that the integrity of this Commission was not being challenged.

5 MR. COX: No, sir, it was not.

6 MR. RAMEY: You may proceed, Mr. Day.

7 MR. DAY: If it please, in an examination of this
8 witness, I feel that perhaps a narrative testimony would be
9 the best and the simplest and the briefest way to get at it.
10 I may intersperse some questions from time to time but if
11 we may proceed by narrative testimony from him I feel that is
12 best and I urge the Commission to allow that. May I examine
13 the witness from the table?

14 MR. RAMEY: Yes, you certainly may.

15
16 ROBERT G. COX
17 called as a witness, having been first duly sworn, was
18 examined and testified as follows:

19
20 DIRECT EXAMINATION

21 BY MR. DAY:

22 Q Mr. Cox, would you give the Commission your full
23 name, please?

24 A Robert G. Cox.

25 Q And where do you live, Mr. Cox?

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1 A I live at 4808 Ridgeside Drive, Dallas, Texas.

2 Q And what kind of business are you in?

3 A I'm a petroleum geologist.

4 Q As such, what duties do you perform?

5 A I both operate wells, drill wells, watch wells,
6 set up drilling programs and so forth.

7 Q Do you drill for yourself?

8 A Yes, sir.

9 Q How many employees do you have?

10 A One.

11 Q How many employees maximum have you had during
12 the years 1973 to 1976, to date? At any one time?

13 A At any one time, three, including myself.

14 Q You have appeared before the Commission on various
15 hearings before?

16 A The Texas Commission twice.

17 Q I mean the Oil Conservation Commission for the
18 State of New Mexico.

19 A In May of '73 and in October of '75 and November
20 of '75.

21 MR. DAY: May I submit the qualifications of the
22 witness as having heretofore testified before the Commission?

23 MR. RAMEY: Yes, we consider the witness qualified,
24 Mr. Day.

25 MR. DAY: Thank you.

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1 Q (Mr. Day continuing.) Mr. Cox, how experienced
2 are you in testifying before any commission of any state?

3 A I have testified five times, including the three
4 times before this Commission.

5 Q Three times before this Commission. Would that
6 be on this particular permit, this particular lease, the
7 drilling of this particular deviated well?

8 A Yes, sir.

9 Q And the other two times were where?

10 A Before the Texas Railroad Commission.

11 Q At any time before the Texas Railroad Commission,
12 have you ever testified as to seeking permits for directional
13 wells?

14 A No, I have not.

15 Q So this is your first experience?

16 A This is my first experience.

17 Q Would you please tell the Commission the circum-
18 stances from the time you secured the permit to directionally
19 drill this well until you bottomed it?

20 A Recalling memory, sometime in March or April or
21 May of '73 we requested a permit to deviate this well. At
22 that particular time we had trouble acquiring a drilling
23 contractor. I had contacted numerous ones and they said
24 possibly they could get in by the August 1st deadline date.

25 Sometime in mid June, no, July, I believe, I got a

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1 call from someone in Artesia telling me that Amoco had moved
2 a rig onto my location and was drilling a well. I contacted
3 the USGS and Mr. Knauf acknowledged that and he said that it
4 would perpetuate the lease for another two years so that I
5 was not in any dire need of getting the well commenced and
6 down in order to perpetuate, I mean, hold the lease. So, at
7 that time I had two years to go and I couldn't find a drilling
8 contractor, especially in 1974. It was a very difficult year
9 to acquire a drilling contractor. Everyone seemed to be
10 busy in New Mexico and we couldn't get it in our 1975 year-end
11 program, so I defrayed it until the early part of '75. I
12 mean the '74 program. I couldn't get it in until '75.

13 At that particular time I had eight wells scheduled
14 to be drilled in Texas. I was working on them and on
15 January 11th a fire broke out in our office complex destroying
16 approximately eighty percent of it, heavy smoke and water
17 damaging all of our equipment. That was equipment, type-
18 writers, everything was taken to a restoration company, all
19 of our records were boxed up. It took, oh, a month to
20 two months to get it all back and during that time I was
21 attempting to go ahead with my drilling program in Texas which
22 comprised drilling about seven wells and workover of three
23 others.

24 I wrote to the USGS sometime in May and told them
25 that I was attempting to secure a drilling contractor for the

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1 Number 1 EA Well, which is the one in question.

2 Q Excuse me, Mr. Cox, may I interrupt just briefly?
3 Do you have any corroborative material pertaining to the fire?

4 A Yes, I do.

5 Q May I see it?

6 MR. DAY: Would you please mark that as DN-One?

7 MR. S. BUELL: I'll do that.

8 (THEREUPON, applicant's Exhibit DN-One
9 was marked for identification.)

10 A If you may excuse me, maybe there is something on
11 that that is not pertinent to --

12 Q (Mr. Day continuing.) Well, Mr. Cox, I will hand
13 it to you and ask you to describe the material that is contained
14 and what is now marked as Exhibit DN-One. If there is anything
15 in there that is not material to this exhibit you may detach
16 it.

17 A The first page is a story in the Dallas Morning News
18 dated January 12 entitled, "Destruction Heavy in a Five-Alarm
19 Blaze." The other is an article on January 12th in the Dallas
20 Times Herald describing, "Fire guts office complex, firemen
21 hurt, damages high."

22 Q If you will just state more briefly the contents.

23 A Okay, the other is bills from the various restora-
24 tion companies on the materials that was lost, damaged and
25 had to be replaced.

1 Q Have you examined every document attached thereto to
2 make sure that it pertains to the fire?

3 A Yes, sir.

4 Q Then that exhibit contains newspaper articles
5 describing the fire and the bills you incurred in trying to
6 restore some of your records that could be restored.

7 (THEREUPON, a discussion was held off
8 the record.)

9 MR. G. BUELL: When was the fire, January 11th?

10 A Yes, sir.

11 MR. RAMEY: Of what year?

12 A 1975.

13 MR. DAY: Mr. Commissioner, we submit DN-One
14 Exhibit for the record.

15 MR. RAMEY: Without objection it will be admitted.

16 MR. G. BUELL: We have no objection, Mr. Ramey,
17 we never challenged the fact that there was a fire and fires
18 are expensive and also inconvenient.

19 (THEREUPON, Applicant's Exhibit DN-One
20 was admitted into evidence.)

21 MR. RAMEY: You may proceed, Mr. Day.

22 Q (Mr. Day continuing.) Mr. Cox, I believe you were
23 testifying after that that you were attempting to get a
24 drilling contractor and you made comments about your other
25 drilling programs, will you proceed, please?

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1 A We did not have the records for the drilling of
2 some of the wells that were a part of our '74 program that
3 was carried over into '75. We commenced our first well, I
4 think, February 11th 1975 and finished our last well sometime
5 in June of 1975.

6 Q Continue.

7 A Shortly prior to the time of the finishing up of
8 the last well, I sent a set of report forms to the USGS
9 advising them that I was trying to secure a drilling contractor
10 to reenter the EA Number 1 and they wrote back to acknowledge
11 the sundry report forms and said the well had to be completed
12 as a commercial producer by August 1, 1975. I immediately
13 panicked and I called the USGS and they made a double check and
14 said that Amoco had not filed their termination of their
15 communitization agreement or whatever they call it. I had
16 until August 31st to make a commercial producer out of it
17 or the lease expired. At that time I --

18 Q Excuse me, sir, you said August 31st, '75 to
19 secure production?

20 A Right.

21 Q Or the lease would expire?

22 A Right.

23 Q Excuse me. Go ahead.

24 MR. G. BUELL: If it please the Commission, I'm
25 having extreme difficulty in following this narrative

1 testimony. I'm trying my best but I hope you will be patient
2 with me when I may have to go back. It's hard for me to follow
3 the continuity and we jumped from January '75 to August of '75
4 and then we jumped back and I'm having difficulty, so I hope
5 you will bear with me when I attempt to cross examine Mr. Cox.

6 MR. RAMEY: We'll bear with you, Mr. Buell.

7 Q (Mr. Day continuing.) Will you please continue?

8 A I contacted Bob Ratts and asked him to check on some
9 drilling --

10 Q Please identify Bob Ratts?

11 A Bob Ratts is a petroleum engineer in Hurst, Texas,
12 that had done some prior work on the Federal EA Number 1 Well,
13 and for him to see if he could secure a drilling contractor
14 and set up a deviation program or get a surveying company to
15 handle the deviation of the well.

16 Q Go ahead.

17 A Mr. Ratts called me sometime early in June, if my
18 memory recalls, and he said that he would be in the office at
19 nine o'clock in the morning with a representative of Eastman
20 Whipstock and they came at nine o'clock, it was a very busy
21 day, we talked intermittently, I had to leave the office
22 numerous times. Mr. Coats the Eastman representative worked
23 on a deviation program with Mr. Ratts and myself. Then I
24 had to leave the office and Mr. Coats waited around out in
25 the reception room and I came back, took him to lunch and I

1 had someone take him to the airport. I can't recall which
2 and that's the only contact that I had with Mr. Coats.

3 I acquired a drilling contractor approximately two
4 weeks later. Cactus said they had a rig in Hudspeth County
5 that they were moving back up north and they could possibly
6 get on the well sometime in the early part of July. On
7 approximately July 3rd or 5th, I can't recall whether it was
8 before or after, they brought me a drilling contract which we
9 briefly discussed some of the day work rates and so forth on
10 them and they took it back and changed it up and they said
11 that due to the holidays they would probably have trouble
12 getting a rig in there prior to July 10th or 11th.

13 Over the weekend I worked on this program. I set
14 down and looked at the past history that I had, out of the
15 files of my clients and at the advice of some other people I
16 changed my location that had been suggested to due north,
17 anticipating it to migrate to the northwest and we were going
18 to encounter a southeast dip.

19 Q Why did you feel that you would encounter a dip?

20 A From the two previous surveys that had been run.

21 Q Did one of those have to do with the old Aztec well
22 that was drilled before you acquired the lease?

23 A Yes, sir.

24 Q And you did a survey on that well?

25 A Yes, sir.

1 Q Was that well drilled with a conventional drilling
2 company?

3 A Yes, sir, to my knowledge.

4 Q And what did the survey reveal at that well that
5 Aztec had drilled?

6 A Somewhere in the neighborhood of a hundred and
7 seventy-one or a hundred and seventy-seven feet west and
8 twenty-three feet south.

9 Q Were you in any way connected with drilling that well,
10 directly or indirectly?

11 A No, sir.

12 Q Go ahead. You testified that you were anticipating
13 a dip?

14 A Right. I called Bob Ratts, he wasn't in. I sent
15 him a letter and a plat and mailed it out, I think it was
16 on a Sunday night and the following day, which was Monday
17 and Tuesday, I believe you and I were in Hamilton County
18 working on ratifications on the pipeline system and I think I
19 found out Wednesday night that they had moved the rig in on
20 Tuesday and spudded and they couldn't get out of the old hole
21 and they had to plug back and make another attempt and they
22 were going to be waiting on cement thirty-six hours or something
23 like that. Mr. Ratts was running the show and reports --

24 MR. RAMEY: Mr. Cox, may I interrupt? I'm a little
25 unclear. Now, Aztec drilled a well on this location?

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1 A. Yes, sir.

2 MR. RAMEY: You drilled a well?

3 A. I reentered the well.

4 MR. RAMEY: You reentered the Aztec well?

5 A. Right.

6 MR. RAMEY: Is the Aztec well the same well?

7 A. Yes, sir, and I deviated from it, yes, sir.

8 MR. RAMEY: That's the subject of this case?

9 A. Yes, sir.

10 MR. RAMEY: And then you stated that you had set a
11 target area to the north and west and you changed that to
12 north, did you state that?

13 A. I had not set the target area. All I had asked for
14 was a recommendation, you know, but as I said, talking to some
15 other engineers, the dominant from our other survey, the
16 dominant east dip or the migration of the drill to the west
17 suggested that in my new hole it would do the same thing so
18 it would ~~be best~~ to go off to the north because the migration
19 would naturally drift me to the west.

20 MR. RAMEY: Thank you.

21 MR. LUCERO: Did you have data on the Aztec well
22 available to you?

23 A. No, sir. Prior to the time that we entered it, we
24 went to Hobbs to the office to see what we could find out on
25 drilling time, samples and so forth and the log and they did

1 not have any available, so we reentered the Aztec well.

2 MR. RAMEY: What Hobbs office are you talking
3 about?

4 A The Hobbs, New Mexico office.

5 MR. RAMEY: The Oil Commission office?

6 A No, sir, the Aztec office and asked them for their
7 records. We were looking for drilling time, you know, drilling
8 rigs and the samples and so forth. They did not have them.
9 That was drilled back in 1959 or '60, I can't recall which
10 and they didn't have a record of it and, where am I at now?

11 MR. LUCERO: We're still on the Aztec well.

12 A We went into the Aztec well, they had cut off the
13 casing at around forty-one, forty-two hundred. We went back
14 in on the Aztec well, washed it down and bolted it onto the
15 existing casing stub that was there at forty-two hundred,
16 knocked out the plugs and washed it down and they had not
17 gotten a log all the way to total depth. They had drilled it,
18 I think, to sixty-two ten and their log was at a minus
19 sixty-one, seventy, or something like that. So, we drilled
20 the plug out and cleaned it on down to sixty-two, ten and
21 immediately got a show of oil and gas, good pressure but
22 it bled off quickly.

23 Q (Mr. Day continuing.) Mr. Cox, may I interrupt you?
24 What you are describing now is an earlier attempt to reenter
25 the old Aztec well to complete it as it was and does not

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1 pertain to the directional drilling of the subject well?

2 A No, sir, it does not.

3 MR. LUCERO: Excuse me, that's why we wanted to
4 clarify that.

5 Q (Mr. Day continuing.) Thank you. Would you go now
6 to the time that you drilled into the well and took off in
7 the present well?

8 A According to our records they cut the casing off at
9 about a minus four thousand, I mean, four thousand and ten,
10 and they set a plug and their first attempt to back off, I
11 mean to drill it, they drilled it to thirty-nine, oh, three
12 to four thousand and twelve and couldn't get out of the old
13 hole. They then put another hundred sacks of cement in it
14 with some additives and plugged back to thirty-six, fifty-two.
15 The Dyna-Drill records, according to Cactus, suggested that
16 they got -- they drilled the second run thirty-nine, oh,
17 three to -- I mean, the second run from thirty-seven, fifty-
18 five to thirty-seven, seventy-five, with one Dyna-Drill and
19 thirty-seven, seventy-five to thirty-eight, oh, seven with
20 another one and thirty-eight, oh, seven to thirty-eight,
21 twenty-six. There might be some mistakes in here and that's
22 why I really wanted to go over it, but anyway, they suggested
23 that they made three attempts on a second attempt to kick off,
24 to kick the well off.

25 They ran a Dyna-Drill at thirty-eight, twenty-six to

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1 thirty then ran into -- well, that was all they could get
2 was four feet on it. They came out and ran another one from
3 thirty-eight.

4 Q Mr. Cox, you are talking about the attempt to kick
5 off with the Dyna-Drill from the old casing?

6 A Right.

7 Q They ultimately did kick off?

8 A Yes, sir.

9 Q All right, then what happened after that?

10 MR. RAMEY: When you say "they", you in fact mean
11 "you". This is your operation that you are talking about at
12 this time, is it not?

13 A Yes, sir, I was talking about the engineer and
14 the drilling contractor and Eastman.

15 MR. RAMEY: This is under your operation?

16 A That's right, yes, sir.

17 MR. RAMEY: It's not under the Aztec operation?

18 A No, sir, this is under my operation, yes, sir.

19 Q (Mr. Day continuing.) I think "they" in that
20 context is the witness himself looking at it, his own
21 organization.

22 A They finally kicked off --

23 Q Wait, Mr. Cox, where were you during this time,
24 were you on the drill site?

25 A No, sir, I was in Hamilton County most of that time,

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1 as you know.

2 Okay, we kicked off, I got a call from Bob Ratts
3 that the direction was going north, forty-five degrees west
4 and they were looking for a soft spot to turn the hole in
5 and did we have any drilling-time records. Well, I didn't
6 have any on the old Aztec well but I did have on our Number 2
7 well, so I read them, approximately three hundred feet of
8 drilling time over the phone and immediately put a copy of
9 the log, he didn't have a copy of the log with him, in the
10 mail and some drilling-time reports and sent it to him and
11 then I was contacted three or four days later, I think it
12 was around forty-four hundred or somewhere. Now, Mr. Buell
13 might -- I can't recall of these incidents, it has been seven
14 months since all of this went on and I didn't keep notes but
15 I was contacted by Ronnie Anderson of Aztec that --

16 Q Ronnie Anderson of Aztec?

17 A I mean of Cactus Drilling Company.

18 Q What was his position with Cactus?

19 A I believe Ronnie is Assistant to the Vice President
20 and contracts.

21 Q Drilling contractor?

22 A Yes, and Ronnie came to my office and he said he
23 received a call from the drilling superintendent in Hobbs
24 and that he was quite concerned about the northwest migration
25 and that if we didn't get it turned around that we would be

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1 off our lease prior to the time we ever got to our anticipated
2 total depth.

3 So, I immediately, that night when I got home,
4 contacted Ratts and told him to make all efforts to turn the
5 thing back to the northeast, back away from the lease line
6 and away from -- back towards our anticipated target area
7 and I believe at that time they were looking for a soft spot
8 in which to turn it and they made a run at forty-six hundred --
9 would you excuse me if I go down and get something out of my
10 briefcase?

11 Q May I hand it to you?

12 A I don't know if you can find it.

13 They made an attempt to turn it at forty-six,
14 eighty-seven. They drilled with a Dyna-Drill from forty-six,
15 eighty seven to forty-seven, nineteen and it is my understanding
16 that they had to wait thirty to sixty feet before they could
17 run a single shot survey in there to see how much they had
18 changed their angle of deviation and their slope.

19 And again they turned in a report and said they were
20 having no luck, they couldn't find any soft spots and so
21 forth to turn it and it was still migrating to the northwest.
22 I instructed them to use any measure necessary to try to
23 turn it back and they made a Dyna-Drill run at fifty-two,
24 twenty-seven to fifty-two, forty-one when a Dyna-Drill wore
25 out. They went back in with another Dyna-Drill and went from

1 fifty-two, forty-one to fifty-two, eighty when that bit
2 wore out. At about fifty-five, eighty-five is when I reached
3 location and we made a Dyna-Drill trip at fifty-eight,
4 twenty-three to fifty-eight, forty-seven when the Dyna-Drill
5 wore out and the cones were almost off and they said that
6 the recommendation was that I just try to get it down because
7 they couldn't turn it, the rock was too hard and it was just
8 burning up the bits.

9 Q Then did you bottom the well at that time?

10 A Yes, we bottomed it -- we thought we bottomed it
11 at sixty-two, thirty-one.

12 Q And then you bottomed it at what?

13 A Well, they then ran a log and found that the log
14 wouldn't go but to sixty-two hundred so I instructed them to
15 strap the drill pipe out when they came out to make sure that
16 there wasn't an error and at that particular time I was due
17 back in Dallas and I had been there about a week or ten days
18 the length of time and I left the location and they strapped
19 the pipe back in and found that they had added in a joint of
20 pipe on the talley board that was not in the string and they
21 really weren't at sixty-two, thirty-one, they were just at
22 sixty-two hundred, so I told them at the time that if they
23 did find that condition to drill about thirty feet of rat
24 hole and come on out and set pipe and I left and drove to
25 Midland to catch a plane. They couldn't get in touch with me

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1 and they found the error and they drilled twenty more feet
2 and encountered a drilling break at sixty-two, ten, if I
3 recall, and bottomed it at sixty-two, twenty.

4 That was on a Saturday. Three days later Mr. Ratts
5 brought samples into my office and I looked at them. They
6 had shows in them. I instructed him to immediately line up
7 a well completion unit because we were fighting a deadline,
8 we had to have this thing on commercial production within a
9 month and he located a well servicing company. They went
10 in and I said start down below first and work your way up
11 and he perforated from sixty-two, oh, two, I mean, sixty-two,
12 oh, eight to sixty-two, twelve and he couldn't break it down
13 and they went in and perforated from sixty-two, twelve to
14 sixty-two, eighteen and it broke down and after we recovered
15 about twenty to forty barrels over the load, they were getting
16 some gas, oil and abundant water.

17 And they called into the -- it was Dowell's
18 recommendation that we get the ocean and that we never could
19 pump it down and to plug it back. I said, all right, so we
20 plugged back and we attempted a completion at sixty-two,
21 sixty-four to seventy and eighty to eighty-four, which was
22 non-successful. We came back up the hole and attempted another
23 completion at around sixty-two, twenty to thirty.

24 These might not be the right figures because I
25 don't have anything in front of me, but it's close to them.

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1 MR. NUTTER: Mr. Cox, you would mean sixty-one,
2 eighty-one rather than sixty-two, eighty-one?

3 A Yes, sir, yes, excuse me.

4 About six days before the lease was to expire we
5 couldn't get anything out of it and I told them to knock the
6 plug out and go on down because the well servicing contractor
7 when I was on the job said it looked like it had about five or
8 ten percent oil cut to it, so we went back in and had to re-
9 perforate and we perforated sixty-two, twelve to sixteen and
10 gave it a two thousand gallon acid job and we started
11 swabbing and after we got our load back we started getting
12 some gas and oil and we ran a -- I went and told the USGS and
13 we ran a swab test on it and I think it swabbed at the rate
14 of twenty-three barrels of oil and a hundred and some odd
15 barrels of water a day and so they said to file that as your
16 completion since it was prior to August 31st.

17 I left the location and told them to hang it on
18 the pump, that was August 30th.

19 Q (Mr. Day continuing.) Mr. Cox, going back to before
20 the well commenced, did you secure any estimates of the cost
21 of Dyna tools?

22 A Yes, that was one of the reasons that I wanted to
23 talk to Eastman was that I wanted what it would cost me
24 because that was all going to be on day work, what it would
25 cost to run a Dyna-Drill in the hole and a cost estimate that

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1 I could use on the AFE.

2 Q Do you have that estimate with you?

3 A Yes, sir, I do.

4 Q Would you get it for me, please, along with your
 5 total cost to Eastman?

6 A Yes, sir.

7 Q Mr. Cox, I hand you what has now been marked as
 8 Exhibit DN-Two and ask you if this is the cost estimate of
 9 Eastman to you, in which they estimated what the cost would
 10 be to directionally drill the well?

11 A Yes, sir, this was submitted to me by letter. The
 12 reason for outlining in red the bits is that's what we paid
 13 for ourselves. I paid for myself.

14 Q Direct, without having to pay Eastman for them?

15 A Right.

16 Q How many Dyna tools does that cover, I mean the use
 17 of it or whatever you do with it?

18 A Three W-7 type sealed bearing bits. Three, one was
 19 to get off the --

20 Q We've been through that. Three Dyna-Drills, is
 21 that right?

22 A Right.

23 Q Now, the date of DN-Two is dated?

24 A June 12th, 1975.

25 Q Is this your final bill from Eastman?

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1 A This is one of the final bills and then I got an
2 additional bill from them for extra time that they had to
3 spend on the well.

4 Q What is the date of that final cost bill?

5 A August 13, 1975.

6 Q All right. On your estimate the cost was, without
7 the sealed bearing bits that the operator paid for direct,
8 was then ten thousand, seven hundred and thirty-two dollars?

9 A That is correct.

10 Q And how much is your final bill?

11 A Eighteen thousand, seven hundred and eighty-two
12 dollars and ninety-two cents, plus --

13 Q Well, that's all right. I think that estimate was
14 five hundred dollars?

15 A Five hundred and fifty dollars for additional time
16 they had to spend on the well.

17 Q All right, sir.

18 MR. DAY: Again I apologize to counsel, we don't
19 have an extra copy but we will furnish them.

20 MR. G. BUELL: No problem. Again we have no
21 objection. I fail to see what this has to do with regard to
22 proving up whether or not he complied with the Commission's
23 order.

24 MR. DAY: With counsel's non-objection specifically,
25 we submit DN-Two and Three for the record.

1 MR. RAMEY: Without objection they will be
2 admitted.

3 (THEREUPON, Applicant's Exhibits DN-Two
4 and DN-Three were admitted into evidence.)

5 Q (Mr. Day continuing.) Mr. Cox, you stated that
6 the estimate shows the cost of what was anticipated to
7 directionally drill a well with three Dyna tools. How many
8 Dyna tools were actually used?

9 A From Cactus' record it looks like approximately
10 seven or eight. There is a little discrepancy in there.

11 Q So then, in fact, you used more than twice the
12 number of Dyna-Drills in trying to directionally control the
13 well?

14 A That's right.

15 Q May I have those drilling logs that you just
16 referred to?

17 A Yes, sir.

18 Q This is the complete --

19 A That is the complete day work sheet from Cactus
20 Drilling Company.

21 Q Do you have another copy of this.

22 A I have Cactus' back in the office. They brought
23 it to me the other day and I reproduced one copy and I can
24 reproduce more.

25 Q All right, thank you.

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1 MR. DAY: May it please the Commission, I tender
2 DN-Four into the record for the purpose of showing the
3 number of Dyna tools that we used.

4 MR. RAMEY: This is, I assume, just a daily drilling
5 report from Cactus Drilling Company?

6 A Yes, sir.

7 MR. RAMEY: I assume somewhere in here it will
8 state that a Dyna-Drill was run, or something?

9 MR. DAY: Mr. Ramey, may the witness approach
10 you and show you on the log where it shows where they stopped
11 for the Dyna-Drill?

12 MR. RAMEY: Yes, if he would, please. That seems
13 to be the point in submitting this is to show the Dyna-Drills?

14 MR. DAY: Yes, sir. To show that they attempted
15 to control the well.

16 MR. RAMEY: You say seven or eight Dyna-Drills were
17 used?

18 A Yes, sir.

19 MR. RAMEY: You don't know whether it is seven or
20 eight?

21 A Well, it was where they were trying to get off.

22 (THEREUPON, a discussion was held off
23 the record.)

24 MR. G. BUELL: May it please the Commission, may
25 I inquire if the sole purpose of this exhibit is to prove up

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1 the fact that on seven different occasions Dyna-Drills were
2 run in the deviated well?

3 MR. DAY: We are intending to enter them into the
4 record for that purpose, Mr. Commissioner, to show the efforts
5 made by the operator to control the direction of the well
6 as compared with the estimate made by Eastman at the
7 beginning.

8 MR. G. BUELL: May it please the Commission, Amoco
9 will stipulate that based on all the records we have examined,
10 seven Dyna-Drills were run in the well.

11 MR. DAY: The confusion about the Dyna tools at the
12 kick-off point, where it becomes seven or eight, Mr. Cox could
13 not determine, but that was at the kick-off point, there were
14 either two or three.

15 MR. RAMEY: Mr. Guy Buell, with the stipulation do
16 you think it is necessary to submit this?

17 MR. DAY: No, sir, we withdraw DN-Four.

18 MR. RAMEY: Thank you.

19 MR. G. BUELL: We will present brief testimony in
20 that regard, Mr. Ramey.

21 MR. RAMEY: Thank you.

22 MR. DAY: Then I would not know what Mr. Buell's
23 cross examination would be, but we reserve the right to
24 re-tender DN-Four.

25 MR. RAMEY: Certainly.

1 Q (Mr. Day continuing.) Mr. Cox, let's turn to the
2 point of surveys. Now, you know that the original drilling
3 permit was for multi-shot surveys, did you discuss surveys
4 for the direction of this well with Eastman?

5 A Yes, they told me that on a single-shot survey they
6 had to make a survey at certain points to establish their
7 drift and/or angle of deviation.

8 Q And what did they recommend at that time?

9 A I can't recall them recommending anything at that
10 time.

11 Q Did they at any time make an expression to you of
12 the type of survey that would be used and how?

13 A No.

14 Q Was this well surveyed?

15 A Yes, it was.

16 Q How was it surveyed?

17 A By a single-shot survey.

18 Q Why a single-shot?

19 A Well, they had to run a single shot, from my
20 understanding, in order to orient the tool one way or the
21 other or to determine what direction they were going.

22 Q All right, at that time, did your memory serve
23 you to the fact that there were multi-shot surveys required
24 in the drilling permit?

25 A Yes.

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1 Q You knew at that time that you had multi-shot
2 requirements?

3 A Not multi-shot. I felt pretty confident in the
4 order in that I had permission to deviate in the matter of
5 running surveys to show my bottom-hole location, such as I had
6 submitted to them before on my first well.

7 Q All right, so, you knew you had to make a survey?

8 A Right.

9 Q And that survey was made by single shots?

10 A Right.

11 Q How frequently are the multi-shots required by the
12 drilling permit, was it about one hundred foot intervals.
13 Would you state, if you know, the intervals of the single-
14 shot surveys?

15 A Well, they varied, anywhere between thirty feet and
16 ninety feet, but I think throughout the interval drilled it
17 averaged to somewhere around seventy-one or seventy-two feet.

18 Q That these surveys were made?

19 A Right.

20 MR. G. BUELL: Mr. Day, may I interrupt you to make
21 a stipulation; it might save us some time? I know we are
22 all interested in being as brief as we can.

23 If it please the Commission, Amoco is willing to
24 stipulate that we accept the accuracy of the single-shot
25 survey as is currently in the file of the Commission. We are

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1 not insisting that that portion of the order that required
2 a multi-shot survey be enforced by the Commission. We accept
3 the accuracy of the single-shot survey. I think that is what
4 he is trying to prove up now is the accuracy of the single-
5 shot survey.

6 MR. DAY: So stipulated.

7 May I ask, I don't recall if the first stipulation
8 Mr. Buell proposed, which I accepted, was very kind and very
9 good, but I didn't recall Arco --

10 MR. HINKLE: We do not object to the stipulation.

11 MR. DAY: You do not stipulate, but you do not
12 object to it.

13 MR. HINKLE: We so stipulate.

14 MR. DAY: You stipulate to the first one and this
15 one?

16 MR. HINKLE: Yes, sir.

17 MR. DAY: Thank you. So stipulated here.

18 Q (Mr. Day continuing.) Mr. Cox, just maybe one or
19 two more question that I can think of at this point. Would
20 you describe the diameter of the drill pipe on this subject
21 well as being a small diameter or a large diameter?

22 A I believe it's considered a small diameter, three-
23 and-a-half inches.

24 Q Three-and-a-half inches?

25 A Uh-huh.

1 Q Now, Mr. Cox, you testified earlier that you had
2 gone into the old Aztec well and attempted to complete it; I
3 believe you drilled another well and attempted to complete it;
4 did you secure any production of oil in those earlier attempts?

5 A Yes, we did.

6 Q And would you describe or tell what happened to
7 that production?

8 A Well, when we would shut it in the water would come
9 at us and it would take a long time to reestablish production
10 back into it.

11 Q Were you able to reestablish production then after
12 the water?

13 A No, not at an economic rate.

14 Q Then after you discovered oil by the drilling of
15 these other two wells -- by the way, where was that second well
16 located?

17 A One hundred and twenty-five feet east of the
18 Number 1 Well.

19 Q Of the Aztec well?

20 A Of the Aztec well.

21 Q When you say Number 1 Well, you reentered the Aztec
22 Well?

23 A Yes, sir.

24 Q So you secured production, shut it in for comple-
25 tion purposes and when you got back there it was flooded out?

1 A. Right.

2 MR. DAY: May it please the Commission, we will
3 pass the witness.

4 MR. RAMEY: How about a fifteen minute recess.

5 (THEREUPON, a short recess was taken.)

6 MR. RAMEY: The hearing will come to order.

7 Mr. Cox, will you take the witness stand, please?

8 MR. COX: Yes, sir.

9 MR. G. BUELL: May it please the Commission, I have
10 a few questions.

11 MR. RAMEY: Mr. Buell.

12

13 CROSS EXAMINATION

14 BY MR. G. BUELL:

15 Q Mr. Cox, I'm going to ask you a few questions about
16 your qualifications and I want to state at the outset for your
17 benefit and the benefit of the Commissioners, that I mean this,
18 that I'm not in any way challenging the fact that you are
19 qualified, in fact my questions are tended directly to enhance
20 your qualifications. I realize that your qualifications are
21 on record with this Commission in prior cases, but neither of
22 these gentlemen were in attendance there and in fairness to
23 them and in fairness to you. As a matter of fact, Mr. Cox,
24 you have a Master's degree in geology, do you not?

25 A. That is correct.

1 Q Would you name the school and the year in which you
2 obtained that?

3 A I obtained it from the University of Iowa in 1956.

4 Q Then I believe the record will show that after
5 graduation you went to work for some company and worked for
6 them in the capacity of geologist for some six years?

7 A That is correct.

8 Q Would you state for the record the name of the
9 company?

10 A Standard Oil Company of Texas.

11 Q All right, sir, and then I believe that would bring
12 us up to about 1962, you went into business for yourself, both
13 as a consulting geologist for other operators as well as an
14 independent operator?

15 A That is correct.

16 Q Is it possible for you to tell us which predominated
17 your consulting phase or as an independent operator?

18 A Through 1970, more of a consulting phase, as a
19 consultant to other operators.

20 Q All right, sir, throughout the testimony here today
21 and previous hearings you mentioned the number of wells you
22 had drilling and the rigs you had running, could you state
23 for the record approximately how many wells you yourself
24 operate at this time?

25 A Oh, approximately --

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1 Q Just roughly, Mr. Cox.

2 A Twenty some odd.

3 Q How many wells do you have drilling at this time?

4 A I have one commencing February 1st.

5 Q All right, sir, so the Commissioners will better
6 understand the complete background of your activities on your
7 Federal EA lease, I believe at the time that you obtained a
8 lease on that property, Aztec Oil and Gas had drilled their
9 Number 1 well and produced it for awhile and then abandoned it,
10 is that correct?

11 A That's correct.

12 Q And your first activity on that lease was to reenter
13 and attempt a recompletion in the old Number 1 hole?

14 A Yes, sir.

15 Q And that old hole had been randomly drilled, there
16 had been no deliberate attempt to directionally control it or
17 deviate it in any way, as far as you know?

18 A As far as I know.

19 Q All right, sir, I believe your testimony is that
20 you reentered the Number 1 in October of '68, does that jibe
21 with your memory?

22 A That's right, approximately.

23 Q And let me ask you this, I don't believe you
24 testified to this, that it was temporarily abandoned in January
25 of 1972, does that sound about right?

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1 A Approximately.

2 Q All right, sir, now, with respect to the reentry
3 and the attempted recompletion in the Number 1 Well, did
4 you do all of the geological work yourself or did you hire
5 a consultant?

6 A I did the geological work in the area immediately
7 around the well.

8 Q All right, sir, then after you failed at re-
9 completing Number 1, you then drilled the Cox Fedederal EA
10 Number 2, is that correct?

11 A Yes, that's correct.

12 Q And I belive that well was spudded about November 29th,
13 1971, is that correct? Not about, it was spudded on November
14 29th, 1971, is that correct?

15 A Approximately.

16 Q And according to records that you placed in the
17 Commission's files, it was shut in in September of 1972, does
18 that jibe with your membory?

19 A Approximately. I said approximately, I can't recall
20 the exact dates.

21 Q Has that well ever been abandoned or is it still
22 in the shut-in stage?

23 A It has been abandoned.

24 Q All right, sir, I think the record will also
25 reflect and I believe you testified, that you yourself caused

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1 to be run on both the old Aztec hole, Number 1 and the well
2 you drilled, Number 2, directional surveys?

3 A That is correct.

4 Q What is the purpose of what we have been referring
5 to as a directional survey, Mr. Cox?

6 A To determine what the bottom-hole location was.

7 Q In other words, in this area or in any area we know
8 that wells have a tendency to drift and quite often the
9 bottom-hole location, more often than not the bottom-hole
10 location is not precisely under the surface location?

11 A That is my understanding.

12 Q And if you as a geologist or a reservoir engineer,
13 if he knows the precise bottom-hole location of a well, such as
14 in your case the old Number 1 and your new Number 2, he can
15 more critically engineer it or geologize it, is that not
16 correct?

17 A Yes, I believe so, yes.

18 Q Let me ask you this: For what reason did you cause
19 these directional surveys to be run on the old Number 1 and
20 the Number 2, they cost money?

21 A The primary reason for the old Number 1 is that we
22 thought we would be in the same horizon as the Number 1 and
23 when we weren't, we were only a hundred and twenty-five feet
24 away and we did not have the same section and it was the
25 opinion that the well had naturally migrated north, as all

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1 wells were supposed to have done in the field according to
2 the contractor. I couldn't understand the discrepancy in the
3 logs, that's why I had the survey run.

4 Q It would help you in your further geological studies
5 if you knew precisely where the bottom-hole locations were?

6 A Yes, sir.

7 Q All right, sir, now, I don't believe I asked you
8 this but with respect to the drilling of your new Number 2,
9 did you do all of the geological work on that yourself?

10 A No, sir.

11 Q Did you hire a consultant to help you with it?

12 A Yes, sir.

13 Q Who was the consultant?

14 A It was -- I can't remember his name but he was
15 a petroleum geologist out of Artesia.

16 Q He was another geologist?

17 A Yes, sir.

18 Q Well, did you and he generally agree on the geology
19 underneath that lease or did you have differences of opinion?

20 A I had no differences of opinion with him.

21 Q All right, sir, now according to records you filed
22 with the Commission, the directional survey on your Number 2
23 was run in August of 1972, does that jibe with your memory?

24 A Yes, sir.

25 Q And the directional survey on Number 1 was run in

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1 February of 1973, does that check with your memory?

2 A Yes, sir.

3 Q Let me ask you this: Has anyone, to your knowledge,
4 gone into either the old Number 1 or your new hole, Number 2,
5 since you temporarily abandoned or plugged and abandoned?

6 A No, sir.

7 Q And both of them were abandoned prior to 1973?

8 A The Number 1 wasn't abandoned, it was --

9 Q Your records show that the Number 1 was temporarily
10 abandoned in January of 1972?

11 A No, we set a plug against the horizon, the productive
12 horizon, so that we would not communicate with it in the
13 Number 2 well.

14 Q Isn't that commonly what you call temporarily
15 abandoning when you cement off your perforations?

16 A Right, but I mean we hadn't abandoned all the way
17 on up, we set the plug.

18 Q So, between the time that these wells were
19 temporarily abandoned or plugged and abandoned, all prior to
20 1973, no one else, to your knowledge, did any work on that
21 lease in those wells?

22 A No, not following the survey, no.

23 Q All right, sir, let me ask you this, and I'm going
24 to get a transcript reference so that your counsel can follow
25 me and I'm going to summarize or I'll just quote your testimony

1 from the May 23rd, 1973 hearing. You recall that date, don't
2 you?

3 A I don't recall the exact date but I recall there
4 was a hearing.

5 Q In May of '73. That's where you requested the
6 Commission to give you authority to directionally drill and
7 control a reentry into the Number 1 well, is that correct?

8 A That is correct.

9 Q All right, sir, on page four in response to a
10 question from your counsel, who at that hearing was Mr. Kellahin,
11 he asked you: Mr. Cox, will you please state briefly what
12 is sought by this application? This is at the bottom of
13 page four. Your answer: (Quote) We are petitioning the
14 Commission to sidetrack our Number 1 hole in order to restore
15 it as close to vertical as we possibly can to test the Abo
16 section at six thousand, six hundred and sixteen feet to
17 six thousand, six hundred and eighty feet in a virgin hole.
18 (End of quote.)

19 A Yes, sir.

20 Q That was your sworn testimony at that hearing?

21 MR. DAY: If you please, I can give you this to
22 go by.

23 Q (Mr. G. Buell continuing.) I thought you were
24 following, Mr. Cox, I'm sorry.

25 A No, I don't have a copy of it.

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1 Q Can you remember it sufficiently without me reading
2 it again?

3 MR. DAY: That's on page four?

4 MR. G. BUELL: That's on page four, at the bottom.

5 A Okay.

6 Q (Mr. G. Buell continuing.) Do you want me to read
7 it again?

8 A Yeah, I can read it, it says: We are petitioning
9 the Commission to sidetrack our Number 1 hole in order to
10 restore it as close to vertical as possible, to test the
11 Abo section at sixty-one, sixteen to sixty-six, eighty in a
12 virgin hole.

13 Q All right, sir, and at that time you had in your
14 possession, all of the data that was then available on the
15 Federal EA lease and from the Number 1 Aztec Well and your
16 Number 2 Well that had been drilled thereon?

17 A Yes, sir.

18 Q All right, sir, you also had a consulting petroleum
19 engineer who represented you as a witness, is that correct?

20 A That is correct.

21 Q His name was D. I. Alspaw, A-l-s-p-a-w. Would you
22 turn in that transcript that you have before you, to page
23 fourteen and I'll read a portion of his answer, if you think
24 I'm taking it out of context I'll ask you to please read the
25 entire answer but in the interest of time I'm just going to

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1 read the last paragraph of his answer found at the bottom of
2 page fourteen.

3 (Reading.) Our objective here was, of course, to
4 kick the well off by controlling the weight on the bit return
5 and returning it to the verticle and bottom the well out in
6 a location within close proximity of the Number 20 that we
7 see here on the deviation survey. I believe that is about
8 four thousand to forty-two hundred feet. (End of reading.)

9 MR. LUCERO: Excuse me, Mr. Buell, before you
10 answer it. I think you said "our objective" and the copy I've
11 got here it says, "our objection."

12 MR. G. BUELL: Yes, sir, I was sure that was an
13 error, your honor, and I just made that correction myself.
14 Our reporters try hard but sometimes they do get a word wrong
15 and it is obvious here that objection wouldn't fit at all and
16 I assure you that I'm not taking it out of context.

17 MR. LUCERO: No, I was just trying to point it out
18 for the record.

19 Q (Mr. G. Buell continuing.) Would you agree with me,
20 Mr. Cox, that objective more nearly fits than objection?

21 A I believe you are right, Mr. Buell.

22 Q Do you see any part of his answer there that I
23 didn't read that you think in fairness to you should be read?

24 A Not without adding anything to it.

25 Q Sir?

1 A Not without adding anything to it.

2 Q All right, sir, I believe that the testimony --

3 MR. RAMEY: Just a minute, Mr. Buell, may I ask a
4 question? What is the Number 20 here, "in close proximity to
5 the Number 20"?

6 MR. G. BUELL: I was just getting ready to go into
7 that, Mr. Ramey. Shot point Number 20 is on the directional
8 survey that was in the record and in previous testimony I
9 recall it was on November the 19th, we can reenter it today,
10 if you like. It was testified that shot point Number 20
11 fell within the hundred foot radius of the surface location,
12 conforming to the Commission's order.

13 MR. RAMEY: I was trying to relate that to a well
14 but it's a shot point.

15 MR. G. BUELL: Directional survey shot point and it,
16 as you will see in one of our later exhibits, it does fall
17 within the hundred foot radius.

18 Q (Mr. G. Buell continuing.) All right, sir, let me
19 ask you this, Mr. Cox: If you had done what you told the
20 Commission you wanted to do and what your engineer told the
21 Commission you wanted to do, you would have complied with the
22 order that you are asking to amend today, would you not?

23 A I don't believe, Mr. Buell, that was his indication.
24 His idea was to get out, at least kick out at least one
25 hundred to a hundred and fifty feet away from the shot point

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1 there and return it to as close to vertical as possible.

2 Q I certainly don't want to be unfair to you, Mr. Cox,
3 so I will withdraw that question and I'll prove that through
4 my own witness, Mr. Commissioners, and another exhibit, that
5 that shot point would fall within a hundred-foot circle.

6 MR. DAY: We object to counsel testifying into the
7 record that he can prove it up when he gets to it, if you
8 please.

9 MR. G. BUELL: I'm sorry, I just announced my
10 intention, I'll be more careful.

11 MR. DAY: Thank you.

12 Q (Mr. Buell continuing.) All right, sir. Mr. Cox,
13 as you recall there has been some question with regard to
14 the supervision that existed on your directionally drilled and
15 controlled hole. For one thing, Mr. Benscoter's statement
16 that he made where he said that he saw a failure of communica-
17 tion between you and Mr. Ratts and between both of you and
18 Eastman, do you recall his testimony or would you like for me
19 to --

20 A I don't recall because I haven't had a chance to
21 read the transcript.

22 Q In all fairness to you, let me find it and read
23 it.

24 I'm reading at the bottom of page two thirty-five
25 in the transcript on the November 19 portion of Case 5571.

1 Do you have that transcript before you?

2 A No, I don't but I'll take your word for it.

3 MR. G. BUELL: Would counsel furnish it to Mr. Cox
4 so he can see if I'm reading it correctly? I just have one
5 copy and I couldn't give you one and read it.

6 Page two thirty-five, the last paragraph of Mr.
7 Benscoter's statement.

8 Mr. Day, would I again be testifying if I at this
9 time advised the two Commissioners that Mr. Benscoter is an
10 investor in this well and made a statement at the November 19th
11 hearing?

12 MR. DAY: That is correct, that is so. Thank you,
13 Mr. Buell.

14 Q (Mr. G. Buell continuing.) I will now read it. Have
15 you found it, Mr. Cox?

16 A On page two thirty-five?

17 Q Yes, sir. The last paragraph of his statement.

18 (Reading.) Now it appears to me from what I have heard today
19 there has been a communication problem also from Mr. Cox to
20 Mr. Ratts and to Eastman and from Eastman back to Mr. Cox.

21 (End of reading.)

22 Did I read that correctly?

23 A That is what it says here in the record.

24 Q All right, sir, let's go into a little more detail
25 about the function of Mr. Ratts and I'm talking about Robert

1 Ratts, R-a-t-t-s, that you have already mentioned here today.

2 As I understand your testimony, he was a consulting
3 engineer that you hired to look after the directional drilling
4 of your well because you were busy with other things?

5 A That's correct.

6 Q If I'm not mistaken, at that time, Mr. Cox, I believe
7 you had at least four wells drilling and also you were super-
8 vising the installation of a gas pipeline, is my memory correct?

9 A That is correct.

10 Q Mr. Ratts testified that he went out to the location
11 on July 1, 1975, is that when you instructed him to go to the
12 location?

13 A He went out on July 1 to pull the casing from the
14 Number 1 Well, cut it off in an attempt to back off, which
15 he ended up cutting off and bringing it out.

16 Q So, he went to the well, the location, on July 1,
17 1975 on your instructions?

18 A Yes, sir.

19 Q All right, sir, what were his instructions from you
20 with regard to making reports to you on the progress of the
21 directional drilling of that well?

22 A Give me reports, daily reports.

23 Q Pardon?

24 A Give me daily reports.

25 Q Now, how did you instruct him to do that, were these

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1 to be written or to you over the telephone orally, or just
2 how?

3 A Over the telephone, orally.

4 Q In other words, he was instructed to call you every
5 day?

6 A I can't recall if he was instructed to call me every
7 day or not, Mr. Buell.

8 Q All right, sir, in Mr. Ratts personal conversations
9 with you in his daily reports and I certainly go along with
10 you that he might have missed one one day or the other but
11 in his almost daily reports to you, did he ever mention any
12 concern about the direction the wall was going?

13 MR. DAY: If the Commission please, this seems to
14 me to be two questions in one. He testified that he did not
15 recall that Mr. Ratts was to make daily reports. There has
16 been the assumption in the questions to Mr. Cox that he made
17 almost daily reports. Mr. Buell can question further as to
18 how frequent those reports were but we object to the form of
19 the question.

20 MR. G. BUELL: Mr. Day, let me apologize to both
21 you and to Mr. Cox and this Commission. I certainly was not
22 trying to trap him in any way. I thought he said his instruc-
23 tions to Mr. Ratts were to call me every day and he testified
24 that, of course, some days he couldn't.

25 A I don't recall giving him instructions to call me

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1 every day, to call in, I mean, to give us daily drilling
2 reports and he did some days and some days he didn't. When
3 there was no activity he didn't give us a report.

4 Q All right, sir, do you recall how often his daily
5 reports came in to you?

6 A No, sir, I couldn't answer that, exactly how many
7 days out of the twenty-four they came in.

8 Q I don't want to be unfair to you, Mr. Cox, but you
9 do recall that he made several reports to you on the progress
10 of the well over the telephone?

11 A Yes, he did.

12 Q All right, sir, in any of those calls, did he ever
13 express any concern about the direction the controlled deviated
14 hole was going?

15 A Yes, he did.

16 Q All right, I'm going to ask you, when did he first
17 tell you that he had a concern, what date?

18 A I can't recall the date but it was sometime prior to
19 forty-four hundred feet when they called in requesting the
20 drilling time or some way to pick a soft spot so they could
21 run a Dyna-Drill to attempt to turn it back.

22 Q Would you mind stating about what depth you were
23 when he first expressed concern, I missed it?

24 A Somewhere around forty-four hundred feet.

25 Q Forty-four hundred feet?

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1 A Yes, sir.

2 Q All right, sir, in that connection then, Mr. Cox,
3 I'm going to have to ask you and I'm going to be referring to
4 Mr. Benscoter's testimony again, statement, and you were
5 present when Mr. Benscoter made his statement?

6 A Yes, sir.

7 Q He was put on the stand by your counsel, was he not?

8 A Very late at night.

9 Q And I'm going to read from his statement on page
10 two thirty-two of the transcript for November 19th and in
11 this portion of his testimony or statement he was talking
12 about various phone calls that he has had from you and in the
13 interest of time I'm going to start six lines down from the
14 top of page two thirty-two and again if you or counsel feel
15 I'm taking anything out of context, please read any or all
16 of his statement into the record that you so choose.

17 I'm going to start quoting him where he says, "A
18 day after that --"

19 A Could I just take time and go back and read what was
20 said prior to that?

21 Q Would you rather do that now or after I read this?
22 Oh, you want time, go ahead and take it, Mr. Cox.

23 A Yes, sir, okay, go ahead.

24 Q All right, I am now starting six lines down from
25 the top of page two thirty-two, starting with the words,

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1 "A day after --"

2 (Reading.) Quote. A day after that he called me and
3 said -- and will you agree with me when he says "he" he is
4 talking about you, Mr. Cox?

5 (Reading.) -- he called me and said he had received a
6 call from Cactus, from the drilling people, saying that they
7 didn't care what our engineer said or what the Eastman people
8 might be saying, the well was out of control and it was going
9 to the west, we were going over the lease line. (End of
10 reading.)

11 Did I read that correctly, close quote.

12 A Right, as far as an unsophisticated investor's
13 answer to a question would be.

14 Q Now, later on on that page he pins down the date
15 you called him and the reason he can pin it down was that he
16 was in Hawaii on his vacation and his birthday was July 22nd
17 and that was the reason he could remember when you called,
18 which as I see it, from what he said it would be July 21st.
19 Would you agree with that, after you have had a chance to
20 read it?

21 A Yes, sir, it probably was July 21st.

22 Q All right, sir, according to drilling reports that
23 you had furnished the Commission, on July 21st the well was
24 drilling at five thousand, forty-one feet, some six hundred
25 feet deeper than the forty-four hundred feet you said when

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1 Mr. Ratts first expressed concern.

2 A What's your question?

3 Q Mr. Cox, let me apologize, I'm trying to make this
4 as clear as possible. I'm going back now to Mr. Benscoter's
5 statement where you told him that Cactus told you that they
6 didn't care what our engineer was saying, did you have any
7 engineer on that well other than Mr. Ratts?

8 A No.

9 Q They didn't care what Mr. Ratts was saying or what
10 the Eastman people might be saying, the well was out of
11 control and according to your testimony, Mr. Ratts expressed
12 concern to you six hundred feet up the hole at forty-four
13 hundred feet?

14 A Yes, sir, he asked me for drilling time, going
15 back again and reiterating, he asked for drilling time to
16 turn the well.

17 Q And would you tell me again who it was from Cactus
18 Drilling Company that called you, you stated, but I missed it.

19 A He did not call me, he came to my office, Ronnie
20 Anderson.

21 Q Thank you for correcting me. What was his name,
22 please?

23 A Ronnie Anderson.

24 Q Was that the only purpose of his visit or did he
25 come to see you on other business and just mentioned this

1 in passing?

2 A He came over I think particularly on that. I
3 can't recall that we discussed other things.

4 Q All right, sir, Mr. Cox, I believe you can agree
5 with me, will you not, whenever it is an operator's intention
6 to intentionally use a tool and directionally deviate a well
7 and control the progress of that deviated hole, that prior to
8 initiating the deviation, a target bottom-hole location or
9 a target area is selected?

10 A I imagine so. This has been the first time I have
11 ever been involved in a deviated hole and I imagine the target
12 would be selected.

13 Q All right, sir, I'm trying to go at this as brief
14 as possible.

15 A I know.

16 Q The testimony that we have in the record of our
17 previous hearings on this are rather confused as to who
18 selected the target bottom-hole location and who selected
19 the target area that encompassed that bottom-hole location
20 on what were Amoco's Exhibits Two and Three at the November 19th
21 hearing. Do you recall that?

22 A Yes, sir, partially, yes.

23 Q Sometime in your testimony you told me that you had
24 selected that target, at other times you told me that you had
25 agreed with that target and then at other times under

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1 questioning from Mr. Sumner Buell you said you had nothing to
2 do with the selection and that you hadn't agreed to it, is
3 that a fair summary?

4 A Yes, well, I don't want to answer that question
5 because I had very little contact with the Eastman people
6 prior to the drilling of the well.

7 Q All right, sir, let's try to clear up, at least
8 my confusion about what the previous record shows. Let me
9 ask you this: Who selected the target location for the bottom-
10 hole of your deviated well to be fifty feet from the north
11 line and fifty feet from the west line of your lease?

12 A I believe Eastman selected it.

13 Q Eastman selected that. All right, sir, I believe
14 you testified that your only meeting with anyone from Eastman,
15 until you went out on location yourself, the last few days of
16 drilling, was a Mr. Coats?

17 A That is correct.

18 Q And I believe your testimony is that Mr. Ratts had
19 Mr. Coats come to your office?

20 A That is correct.

21 Q All right, sir, let me ask you this: Did Mr.
22 Coats select the bottom-hole location of the well?

23 A Without bending my memory, I would say, yes. If
24 I could elaborate on it, I told Eastman I wanted to get
25 somewhere approximately a hundred and fifty feet north of my

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1 take-off point to get away from the area of prior stimulation
2 which would be a hundred and fifty or a hundred and seventy-
3 five feet, give or take.

4 Q Let me ask you this: What are Mr. Coat's qualifica-
5 tions as a geologist or a petroleum engineer?

6 Q I have no idea. All I know is that he is the
7 Eastman representative and I imagine he has contacted numerous
8 operators like myself and set up programs and made recommenda-
9 tions.

10 Q So if he is a geologist or an engineer you are not
11 aware of it?

12 A No.

13 Q And as I understand your testimony you gave him
14 carte blanche authority to select the bottom-hole location
15 for this well, your well, and the target area that would
16 encompass that bottom-hole location?

17 A I don't believe I gave him carte blanche authority
18 to select the area. I asked him for a recommendation and a
19 cost estimate that I could use on an AFE.

20 Q In your discussion with Mr. Coats I believe you
21 have already testified that it continued from about breakfast
22 time through lunchtime, into the afternoon, off and on?

23 A Periodically, yes.

24 Q Did you ever give him any idea of what your
25 geological judgment was on the best place reservoir-wise to

1 bottom hole your deviated and directionally controlled well?

2 A Yes, to the north.

3 Q What did you tell him, Mr. Cox?

4 A Well, I told him I wanted to go to the north to
5 the fat part of the structure as I have indicated before.

6 Q You told him north, you didn't tell him northwest?

7 A No.

8 Q All right, sir, now, at that time when you entrusted
9 the bottom-hole target location of your deviated and
10 directionally controlled well, I think the testimony of the
11 past records will reflect that your investors have something
12 over three hundred thousand dollars invested in this property,
13 do you recall that?

14 A Yes, sir.

15 Q And yet you as an experienced geologist with
16 intimate knowledge of the subsurface conditions under your
17 Federal EA lease, you turned over to a man that you didn't
18 know any of his qualifications, you didn't know whether he
19 was a geologist, you didn't know whether he was a petroleum
20 engineer, to make this critical selection in what you knew
21 would be an expensive venture, is that your testimony?

22 A I didn't expect it to be an expensive venture.

23 Q I'll agree with you that it cost more than you
24 anticipated but you knew it was going to cost money when
25 you started out to do it?

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1 A Right.

2 Q But yet you with all your background and all of
3 your knowledge, you turned over to, as far as you knew,
4 someone that was completely unskilled and untrained, the right
5 to select the target location for your bottom-hole?

6 A I anticipated that he was skilled and trained in
7 the operations of Dyna-Drills, Turn-a-Drills, whipstocks or
8 whatever they use to deviate wells. When you hire an expert
9 company such as Eastman or Cactus Drilling Company or such as
10 that, you anticipate that they know what they are doing,
11 wouldn't you agree with that?

12 Q You would expect them to know the geology of your
13 lease even though they had never seen the logs or a structure
14 map?

15 A No, we are not talking about the geology, we are
16 talking about the expertise of the individual.

17 Q All right, sir, then as I understand the continuity
18 of after that meeting toward the latter part of June, according
19 to your testimony, you received a plat from Eastman, I believe
20 almost identical to Amoco's Exhibits Two and Three at the
21 November 19th hearing?

22 A Uh-huh.

23 Q Which showed a target bottom-hole location for
24 your well, fifty feet from the north line, fifty feet from
25 the west line and a hundred foot square that enclosed that

1 bottom-hole location?

2 A Yes, sir.

3 Q And let me ask you this: At the October the 8th
4 hearing, Mr. Cox, you testified that your instructions to
5 Eastman were to control this well such as it bottomed within
6 a hundred feet of the surface location, which would comply
7 with the Commission's order?

8 A No, sir, I can't recall the testimony.

9 Q All right, sir, would you get the transcript of
10 October the 8th and I believe it is at the bottom of page
11 thirty. Please take all of the time you would like, Mr. Cox,
12 to go back. I'm referring to your answer at the bottom of
13 page thirty.

14 A Well, there is a mistake in there, it wasn't the
15 surface location, it was the take-off point.

16 Q I'm going into the fact a little later, Mr. Cox,
17 that at the November 19th hearing you requested permission to
18 change your testimony. But wasn't that your answer on October
19 the 8th at the bottom of page thirty, that your target area
20 was within a hundred feet of the surface location of the
21 Number 1 Well?

22 A Yes, according to what I have testified here,
23 correct.

24 All right, sir, in fairness to you, I'm also going
25 to ask you if you did not on November 19th, 1975, ask for

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1 permission from the Examiner to change that testimony?

2 A Yes, I did, yes.

3 Q And in all fairness to you, I believe your testimony
4 in that regard is found on page seven of the November 19th,
5 1975 transcript, you have that before you?

6 A Okay.

7 Q All right, sir, and the Examiner gave you permission
8 to change it and on page seven is where you changed the
9 testimony?

10 A Uh-huh, that is correct.

11 Q In fairness to you, I believe you later testified
12 that you got confused on cross examination and by me and that
13 you really hadn't meant to say it but you said it and it was
14 wrong, and you wanted to change it?

15 A Yes, sir.

16 Q All right, sir, you introduced at that portion of
17 the hearing, the October 8th, 1975 portion, as your Exhibit
18 Five, a narrative that more or less summarizes the activities
19 from start to finish on the deviation and directional control
20 of your well, do you recall that exhibit?

21 A There are so many exhibits in there.

22 Q May I borrow from the Commission's file on the
23 October 8th hearing, Cox's Exhibit Number Five, so that he
24 can look at it?

25 It's on legal sized paper, about four pages.

1 I'm just going to refer to the first paragraph,
2 Mr. Cox, and I'll wait until Mr. Day has a chance to look at
3 it, and I'm going to read that first paragraph. Please follow
4 me to make sure I get it correct.

5 I'm reading the first paragraph of Cox's Exhibit
6 Five, entered into evidence at the hearing on October 8th,
7 1975. (Quote.) Our original intent was to take off in a
8 northerly direction, to bottom within one hundred, dash, one
9 hundred and fifty feet from our old hole, to get away from the
10 effects of the numerous stimulations (acid and fracs) treat-
11 ments the Abo zone had been subjected to in both Aztec's and
12 our attempts to effect a commercial completion in the old hole.
13 (End of reading.)

14 Did I read that correctly?

15 A. You read it correctly but when I'm referring to
16 the old hole, I'm referring to the take-off point.

17 Q. How are you defining the old hole, now?

18 A. To our take-off point.

19 Q. All right, sir, is there anything in your use of
20 the words "original intent", do I note from that that you may
21 have changed your intent?

22 A. I changed my intent sometime late in June and not
23 to rehash it, I sent a letter which you have a copy of, to
24 Mr. Ratts changing the location.

25 Q. Mr. Cox, remember now, this was presented on

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1 October 8th, 1975. It was an exhibit that you probably
2 prepared in the quietness and confines of your office, not
3 one single question was asked you while you were preparing
4 it, you could have been confused by cross examination. Is
5 this a correct statement of what your intent was?

6 A If we change that from where we were taking off
7 from our old hole, it is probably a correct statement but
8 this here particular exhibit was taken from what records I
9 had gotten in from Mr. Ratts, from Eastman's record that I
10 turned into the USGS and from what notes that my secretary
11 had taken in phone calls and reports in from Ratts.

12 Q Mr. Cox, are you talking about data now that you
13 received during the drilling of the well or after the well
14 was completed, is that what you are referring to?

15 A You asked me where this came from, about the
16 confines of my office and so forth and so on. I'm saying
17 this here was an explanation as to why our hole was bottomed
18 where it was. I think the last paragraph says it.

19 Q What I'm afraid of and it is not fair to you, Mr.
20 Cox, but unless I'm confused, the record now reflects that
21 you conceived your original intent that you put in the first
22 paragraph of Exhibit Five, that you conceived your original
23 intent after the well was completed and that's not the case,
24 is it?

25 A I'm having trouble following you. I conceived our

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1 original intent after the well was completed. I'm not
2 following you.

3 Q All right, I realize we are having problems and
4 that is why I want to be sure this record is clear because
5 I know this is extremely important to you and it is extremely
6 important to us.

7 A We had to have an intent prior to the time we drilled
8 the well.

9 Q Let me ask you this: Were the thought processes
10 that resulted in the first paragraph of Exhibit Three, gone
11 through, arrived at and formulated in the latter part of
12 June, 1975 or immediately prior to your hearing on October 8th?

13 A In the latter part of June.

14 Q So this was your intent at the time the well was
15 kicked out of the old hole and was being directionally drilled
16 and controlled?

17 A Yes, sir.

18 Q And by using the word "original" there, you are not
19 inferring or implying that you later changed that intent?

20 A Yes, I changed the -- no, I didn't change the
21 original intent. We're confusing two different things, one
22 was Eastman's recommendations, one was my recommendation to
23 Ratts, that my recommendation to Ratts was my original
24 intent.

25 Q So the use of the word "original" was not meant to

1 imply that you at any later date changed your mind about where
2 you wanted that well to end up?

3 A. No, I don't think so.

4 Q. All right, sir, that was your intent the latter part
5 of June '75 and that was your intent on October 8th, 1975?

6 A. Yes, sir.

7 Q. All right, sir, I'm going to direct you -- you may
8 still have it open before you -- to the transcript of
9 November 19th, 1975, to page seven. We discussed that a
10 moment ago in connection with where you changed your testimony.

11 And a little past the middle of that page I'm going
12 to read to you, starting with the words, "We were intending"
13 and I'll give you time now, if you would like, to go back and
14 read your entire statement to make sure again that I'm not
15 taking anything out of context. When you have read the
16 earlier part, give me a signal and I'll read from the remainder
17 of your statement.

18 A. Well, would you like to have me read it? (Reading.)
19 We were intending to go north-northeast, taking off from our
20 point about eighty-five feet west of our surface location and
21 bottom the well somewhere between a hundred and fifty feet
22 north of our surface location and eighty to a hundred feet
23 west of our surface location. (End of reading.)

24 I was trying to pin it down then to the surface
25 location because we were being confused by the take-off point

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1 and the surface location all of the time.

2 Q All right, sir, would you carefully analyze your
3 language that you used in the first paragraph of Exhibit Five
4 with the statement that you just read from the transcript of
5 the November 19th, 1975 hearing at page seven, and see if
6 those two announced intentions are compatible or if they are
7 in any way in conflict?

8 A Well, maybe from a standpoint of footage, yes, but
9 I would say we were intending to go off north-northeast,
10 taking off from our point about eighty-five feet, where here I
11 said I was taking off in a northerly direction.

12 Q Could you speak up just a little, Mr. Cox, I'm
13 having trouble hearing you and I'm sure people further away
14 from you are having trouble.

15 Mr. Cox, if you use your definition of the phrase,
16 "old hole", is there any conflict between those two statements?
17 I'm not trying to trap you.

18 A There apparently is a conflict because I keep
19 referring to my take-off point and, of course, the original
20 order stated the surface location of the old hole and that
21 is where I become confused many times myself.

22 Q All right, sir, would you take all the time you
23 would like to reflect and then tell us which truly states
24 your intention, the testimony you gave on November 19th, 1975
25 on page seven or the first paragraph of your Exhibit Five?

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1 A I believe page seven.

2 Q All right, sir, I'm going to ask you some questions
3 now about your Exhibit Eleven presented November 19th, 1975.
4 In that connection could I borrow the Commission's records,
5 your copy of that exhibit so that Mr. Cox can have it before
6 him?

7 Exhibit Number Eleven is a two-part exhibit, one
8 is a letter on the letterhead of Geo Tech and the other is a
9 plat.

10 (THEREUPON, a discussion was held
11 off the record.)

12 MR. G. BUELL: Do we have another copy of the plat
13 that was attached to that Exhibit Eleven?

14 MR. DAY: If the Commission please, we ask that any
15 exhibits that be produced for the purpose of this hearing be
16 from the Commission's own records.

17 MR. G. BUELL: Would you make that same request,
18 Mr. Day, even though Mr. Cox might have a copy of his Exhibit
19 Eleven with him today?

20 MR. DAY: Mr. Buell, you may make other efforts to
21 prove up what you want to prove up without having to take
22 records from non-existing records from the Commission.

23 MR. G. BUELL: I take it that your answer is, no?

24 MR. DAY: Mr. Buell, I'm saying you can prove it
25 up as you want to prove it up but if you are referring to

1 exhibits that are not existing in the Commission's records,
2 I object.

3 MR. G. BUELL: I'm sorry, I didn't realize that
4 Mr. Cox was denying that he introduced Exhibit Eleven.

5 MR. DAY: Mr. Buell, I don't think we are at that
6 point.

7 MR. RAMEY: I would suggest that we recess for
8 lunch at this time. We have to look up some exhibits.

9 MR. DAY: Until what time?

10 MR. RAMEY: Make it one thirty.

11 (THEREUPON, the hearing was in recess.)
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AFTERNOON SESSION

MR. RAMEY: The hearing will come to order.

Mr. Cox, will you please resume the stand? Mr. Buell, you may proceed.

Q (Mr. G. Buell continuing.) Mr. Cox, I can't recall whether I asked you this or not but if I am repeating I hope you and everyone else will forgive me. But when Mr. Ratts was your man, your engineer in charge out at the well, does that mean that he was going to be at the well or check on the well every day or would he just spend one day a week out there and then go back in four or five days, just what do you mean and what is a normal assignment and what was the assignment of Mr. Ratts with regard to supervising the drilling of the well?

A He was to be on the well twenty-four hours a day.

Q In other words, when he went out there on July 1 he was to stay there until --

A No, he pulled the pipe, as I said before, on July 1, I think he got it pulled on July 5th and then the drilling contractor called him and said they were moving in on the location. I think it was July 8th, around in there, they contacted him and told him they were moving in on the location and he took off for the well.

Q Well, where I was puzzled and we are getting now into your Exhibit Number Eleven at the November 19th, was the

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1 fact that it was your testimony that you mailed the letter
2 to him at his home in Hurst, that he did not see the letter
3 until he came back from the well on July 31st.

4 MR. DAY: If the Commission please, before the
5 witness answers, I don't know that Exhibit Eleven or whatever
6 it is has been identified.

7 Q (Mr. G. Buell continuing.) Are you confused about
8 Exhibit Eleven, Mr. Cox?

9 A Yes, I am.

10 MR. DAY: I don't believe Mr. Cox has seen Exhibit
11 Eleven before or has properly identified it.

12 May I ask, is this exhibit from the records of
13 the Commission?

14 MR. RAMEY: Yes, it is.

15 MR. DAY: Thank you.

16 A Yes, uh-huh.

17 Q (Mr. G. Buell continuing.) All right, sir, you
18 now recognize your Exhibit Number Eleven?

19 A Right.

20 Q It is a two-part exhibit, a transmittal letter
21 addressed to Mr. Bob Ratts and attached to it is a plat.

22 A Right.

23 Q Now, in your testimony you said that you sent that
24 to him at his home in Hurst and the address on there is to a
25 residence in Hurst?

1 MR. DAY: Is the Commission please, is this testimony
2 from a prior record or has the witness testified to that
3 already today? I'm confused as to where the testimony comes
4 in, Mr. Buell.

5 MR. G. BUELL: I'm referring to his previous
6 testimony and I'm getting to that.

7 MR. DAY: All right, thank you.

8 A I mailed it to him on July 6th.

9 Q (Mr. G. Buell continuing.) All right, let me find
10 the transcript reference where you testified, Mr. Cox, that he
11 did not get it until July 31st. Would you turn to page two oh
12 nine in your transcript for November 19th, 1975?

13 A Page what, Mr. Buell?

14 Q Page two zero nine. The answer I'm asking you to
15 refresh your memory about is about the middle of the page,
16 it starts off "August the -- I mean July when he come back
17 in from the well. He had been out on the well from July 7th
18 to July 31st."

19 A Give me that page number again, apparently I can't
20 pick up your --

21 Q All right, about the middle of page two oh nine,
22 where you start the answer "August the", then there are a couple
23 of little dashes, you hesitated, then you say, "I mean
24 July when he came back in from the well. He had been out
25 on the well from July the 7th to July the 31st.

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1 A Right.

2 Q So on July 31st the well was at total depth?

3 A That is correct.

4 Q So Mr. Ratts did not see this communication
5 represented by your Exhibit Eleven until after the well was
6 all the way to total depth?

7 A Right.

8 Q All right, sir, let me ask you this: Did you ever
9 mention the material covered in this letter to Mr. Ratts in
10 your many telephone conversations with him?

11 A Yes, in regards to getting back to the northeast
12 when they were going gradually to the northwest but I don't
13 think I specifically mentioned the letter but when I got out
14 there I found out that he didn't have the letter and I didn't
15 have a copy of the letter myself.

16 Q Mr. Cox, was there any way that you could have sent
17 a copy of this letter out to the area where the well location
18 is?

19 A I'm sure that I could have.

20 Q But you didn't do that?

21 A No, because I did not realize that they were moving
22 in on the well on July 7th or 8th, whenever they did, I
23 thought it was later on in the week, they were to contact him,
24 I was out of town.

25 Q And although you knew that he was going to be at

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1 the well continuously from July 7th until it reached total
2 depth, which was July 31st, still on July 6th you mailed
3 this to his home, is that correct?

4 A No, he was not going to be on the well continuously
5 from July 1st. He was going out and pull the casing and lay
6 it down and then go back out when the drilling rig was
7 available.

8 Q You misunderstood my question. According to the
9 data that you furnished the Commission, Cactus had their rig
10 over the hole on July 7th?

11 A That's apparently correct.

12 Q And in your testimony that we just read, you said
13 that he was out on the well from July 7th to July the 31st?

14 A July 6th. Could I see Cactus' records from the
15 file? I don't know if that is what date they did have.

16 MR. DAY: You are referring to the drilling log?

17 A I think it was put in evidence.

18 MR. DAY: No, I think we took it back.

19 A They moved on the 8th, moved in on the 8th.

20 Q (Mr. G. Buell continuing.) Mr. Cox, may we clear
21 up something right here? Maybe I misunderstand but most
22 drilling reports of the type that I think you are looking at,
23 ones that I've had experience with, on the 8th they are
24 reporting activity that occurred on the 7th, on the 9th they
25 are reporting activity that occurred on the 8th. Hasn't that

1 been your experience with drilling reports, so when you are
2 looking at July 8th --

3 A I believe the report I would get would be a day
4 late but I believe what they would document on their drilling
5 report would be the date they did the work.

6 Q So you think that all of the information on that
7 report that is carried by July the 8th, actually occurred
8 on July the 8th and not on July 7th, is that your testimony?

9 A The date, July 7, 8, rig up; July 9, drill cement;
10 July 10, set whipstock; July 11, plugged back, wait on
11 cement; July 12, wait on cement. I imagine that's the
12 dates it was conducted.

13 Q All right, sir, then why in your testimony that we
14 just referred to and read into the record on page two oh nine
15 of the transcript dated 11, 19, '75, did you say that Mr.
16 Ratts was on the well from July 7th to July 31st?

17 A I imagine they contacted Mr. Ratts on the 7th and
18 told him that they were moving in.

19 Q Is your testimony that you really don't know where
20 you pulled July 7th out of the air when you gave it on
21 November 19th, Mr. Cox?

22 A All I know is that they called him, I was out of
23 town and they called him and said they were moving in and
24 it was approximately a Tuesday or a Wednesday and I was out of
25 town during the time they moved in. I might have pulled it

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1 out of the air, the 7th or 8th, there might be a difference
2 in the date, I don't know.

3 Q How about the seven, thirty-first part of that answer
4 did you pull that out of the air?

5 A Seven, thirty-one -- sixty-two, thirty-one depth.

6 Q Mr. Cox, perhaps we are not being fair to the
7 Commissioners in that I should have pointed out, I guess,
8 through you, that actually this letter we are referring to,
9 the first part of Exhibit Number Eleven, is a letter to Mr.
10 Ratts which in effect you let him know that you had changed
11 your mind about the target location on the Eastman plat and
12 in the plat that accompanies this letter you are giving him a
13 new target location for your directionally controlled well,
14 is that correct?

15 A Yes, basically after much advice.

16 Q And, of course, what I'm trying to establish is
17 whether you had any hope at all in view of your testimony,
18 that he was on the well July 7th, for you to mail him a
19 letter no earlier than July 6th at his home in Hurst, Texas
20 and expect him to get it before he went to the well?

21 A I already testified that we didn't know when they
22 were moving in on the well, they didn't advise us. It was
23 sometime probably the latter part of that week because we
24 were having trouble getting trucks.

25 Q All right, sir, since Mr. Ratts never got this

1 letter until July 31st when the well was at total depth, he
2 did not have this document to evidence your change in mind as
3 to the target bottom-hole location or the target area?

4 A Not this letter in his possession, no, sir.

5 Q And would you suspect that that was the reason that
6 he testified that when the well was kicked off out of the
7 old hole, he instructed Eastman to kick it out to the north-
8 west.

9 MR. DAY: We object to that question, if it please
10 the Commission, it is a subjective question. He could not
11 possibly know what the intentions or thoughts of Mr. Ratts
12 were at that time.

13 MR. RAMEY: Objection sustained.

14 Q (Mr. G. Buell continuing.) Mr. Cox, would you
15 turn to page fifty-three of the November 1975 transcript and
16 take all the time you need to go back and see that this is
17 where Mr. Ratts is under cross examination, page fifty-three?

18 A Okay.

19 Q And I'm interested in the question in the upper
20 third of the page, what were these specific instructions that
21 you gave to the Eastman representative the first time the
22 Dyna-Drill was put in the hole?

23 MR. DAY: If the Commission please, were these
24 questions directed to Mr. Ratts?

25 MR. G. BUELL: Yes, this is the cross examination of

1 Mr. Ratts.

2 MR. DAY: We object to any testimony of Mr. Ratts
3 being introduced into this record. Mr. Ratts is subject to
4 subpoena by Amoco or Arco, he is not here for cross examination
5 at this hearing, he is not available for cross examination, he
6 is not a witness here today and we object to any testimony from
7 the prior record as to Mr. Ratts. If they wanted him here they
8 could have subpoenaed him.

9 MR. G. BUELL: If it please the Commission, as the
10 Commission records will reflect, on November 19, 1975 Mr. Ratts
11 insofar as the record is concerned, that I can see, voluntarily
12 appeared as a witness for Mr. Cox. His testimony was propounded
13 by Mr. Sumner Buell and Mr. Day and I had no idea since this
14 is a De Novo hearing and they considered Mr. Ratts' testimony
15 so critical to their case on November the 19th that he wouldn't
16 be here today.

17 MR. DAY: We appreciate Mr. Buell's comments on
18 the testimony in the records, however, we do object to Mr.
19 Buell cross examining Mr. Ratts in absentia.

20 MR. RAMEY: I think I will sustain the objection.
21 I don't believe we can ask this witness to testify on the
22 testimony of others, Mr. Buell.

23 MR. G. BUELL: Thank you, Mr. Commissioner.

24 Q (Mr. G. Buell continuing.) All right, sir, let's
25 look at your letter dated July the 6th, Mr. Cox, and the first

1 paragraph which says that you received a plat from Bo Coats
2 from Eastman concerning the approximate target which was
3 suggested when we briefly met a few weeks ago.

4 The approximate target which was suggested, could
5 you amplify on that a little, please, for my benefit?

6 A That is what you have on your plat. It is in the
7 northwest quadrant, approximately fifty feet from the north
8 line and fifty feet from the west line or in the northern
9 portion of our lease, of our forty acres.

10 Q And this was the approximate target that was
11 suggested by you?

12 A I don't believe it was suggested by me, I believe
13 it was suggested by both Mr. Ratts and Mr. Coats. I had no
14 experience in Dyna-drilling or the accuracy of how well they
15 could put it on the spot.

16 Q You further say in your letter, "When we briefly
17 met a few weeks ago." Are you talking to the meeting
18 between you and Mr. Ratts and Mr. Coats?

19 A Yes.

20 Q A meeting that by your own testimony lasted from
21 breakfast, through lunch and on into the afternoon?

22 A Probably Mr. Coats and Mr. Ratts and I had the
23 opportunity to talk less than an hour all told, except at
24 lunch.

25 Q All right, sir, let's go down to the next paragraph

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1 and remembering this letter is dated July the 6th, 1975,
2 the next paragraph says, "After getting a copy of the
3 deviation surveys run in the Number 1 and Number 2 wells,
4 it appears that normal migration is dominant to the west from
5 the surface down to the top of the Abo (approximately fifty-
6 two hundred feet) -- ", and I'll read this since you
7 gentlemen are letting him look at your copy -- "where it
8 changes to NW --" I'm sure you mean northwest by that.
9 "Parenthesis, see attached plat."

10 Did I read that as accurately as I can?

11 A Yes.

12 Q After getting a copy of the deviation surveys, Mr.
13 Cox, you had those deviation surveys in your possession for
14 how many years at the time you wrote this letter?

15 A Those deviation surveys I don't believe were in my
16 possession. I believe they were lost in the fire. I believe
17 they came from Mr. Lipski's.

18 Q Well, we know you had them on May 23rd, 1975 because
19 you offered both of them as exhibits in your case?

20 A Yes, sir.

21 Q And any tendency they show --

22 A May nineteen what? I had them in my possession
23 when?

24 Q At the May 23rd, 1973 hearing.

25 A Yes, sir.

1 Q And any tendency they showed for a dominant
2 migration west, they showed it in May of 1973 as they did
3 in July of 1975, did they not?

4 A Yes, sir.

5 Q So you had all of these data at the time you made
6 your recommendation to the Commission in May of 1973 as to
7 what you would like to do if they approved it?

8 A Yes, they were all submitted to the Commission.

9 Q All right, sir, is there anything of significance
10 in the third paragraph that you would like to point out to
11 the Commission since you are looking at their copy and I have
12 no particular comments on this but I thought you might have
13 and in all fairness to you, if you have any please make them?

14 A Well, reading through, an article that was given
15 to me by an engineer, "Surveying and Steering while Drilling
16 with a Mud Motor" which was in the July issue of Petroleum
17 Engineer, which he brought over after he had discussed it
18 with me. It says, "Mud motors, while quite successful,
19 introduced variables of their own which were not measurable
20 and were quite unpredictable in practice."

21 Q Excuse me, Mr. Cox, where are your reading now?

22 A I'm down to -- you are asking me to amplify on my
23 third paragraph and why I made that change, isn't that what
24 you asked me?

25 Q Yes, I mean, but aren't you reading from something

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1 now?

2 A Yes, I am. This is from the Petroleum Engineer,
3 issue of July, 1975, written by Gailen D. Marshall, Senior
4 Staff Engineer, Sperry-Sun Well Surveying Company, Sugarland,
5 Texas.

6 Q All right, sir, are you through reading now?

7 A No, you haven't given me a chance.

8 Q Well, I didn't mean to interrupt, go ahead.

9 MR. RAMEY: What was the date on that, Mr. Cox?

10 A July 5th. I won't go through it all but --

11 (Reading.) Torque lag is the condition when torque is applied
12 to the drilling string at the surface of the borehole to
13 achieve a turn of the toolface down hole at the deflection
14 device on top of the mud motor.

15 Mud motors, while quite successful, introduced
16 variables of their own which were not measurable and were
17 quite unpredictable in practice. All mud motors have a common
18 characteristic known as reactive torque, a resultant force
19 due to the mud motor turning to the right and supplying
20 power to the drill bit. The reactive torque is difficult, if
21 not impossible, to accurately predict.

22 The reactive torque from the mud motor causes the
23 complete down-hole drilling assembly to turn to the left as
24 mud circulation is started. As drilling weight is applied to
25 the drill bit, the tendency to turn left is even more severe.

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1 (End of reading.)

2 There is a lot more but I think that is adequate.

3 Q (Mr. G. Buell continuing.) All right, thank you,
4 Mr. Cox.

5 In the next paragraph you talk about the stimulation
6 treatment that the Number 1 randomly drilled hole was given
7 and the Number 1 and the Number 2 Well that you drilled was
8 given, is that not correct?

9 A That's correct.

10 Q Were not these stimulation treatments available to
11 you at the time of your testimony at the May 23rd, 1973 hearing?

12 A Yes, they were.

13 Q So that's no new data in July of 1975?

14 A No.

15 Q All right, sir, I have no questions on the next
16 paragraph. In fairness to you, let me ask you again if you
17 would like to comment on that for the benefit of the
18 Commissioners?

19 A Which paragraph, sir, the next to the last paragraph?

20 Q Yes.

21 A (Reading.) Suggestions are that we should take off
22 at a high enough angle to make sure we clear this stub and
23 then drop back. On checking the production offsetting us, the
24 J well was cutting considerable water and there are rumors
25

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1 that its oil production is not as high as reported. We
2 know that the F-3 and F-12 are producing four hundred to
3 four hundred and fifty barrels a day water free so the
4 north central quadrant of our lease looks more prospective.

5 (End of reading.)

6 Q All right, sir, do you have any comments other
7 than just reading? I have no questions.

8 A Well, just what I'm saying, that's why I didn't
9 want to go northwest.

10 Q All right, sir, in the last paragraph you simply
11 advised Mr. Ratts that you tried to reach him at the motel
12 but he had checked out and then you gave him where you would
13 be in Hamilton, at the Spotted Horse Motel?

14 A Right.

15 Q All right, sir, early in your testimony today you
16 mentioned receiving a call while you were in Hamilton. Was
17 that Mr. Ratts acting on this information that you gave him?

18 A I can't recall me saying getting a call from Mr.
19 Ratts.

20 Q No, you said you got a telephone call while you were
21 in Hamilton. My question is: Was that call from Mr. Ratts?

22 A Yes, I believe it was, that they couldn't get out
23 of the old hole.

24 Q Yes, I believe your testimony was that the plug
25 you had set. Let me ask you this right here for the benefit

1 of the Commissioners. What is the purpose of this plug that
2 you set?

3 A The plug was as a take-off point for the whipstock.

4 Q In other words, you need a plug to set your Dyna-Drill
5 on to kick out of the old well hole?

6 A To my understanding you do. I'm no expert on
7 Dyna-Drilling or --

8 Q I believe our Commissioners will concede, Mr. Cox,
9 that you and I probably know more about that than they do.

10 A Well, I'm sure they know more than I do.

11 Q Well, maybe not one of them.

12 MR. LUCERO: Which one, Mr. Buell?

13 Q (Mr. G. Buell continuing.) Mr. Cox, and the
14 thrust of this telephone call you got from Mr. Ratts while
15 you were in Hamilton, is that Hamilton, Texas?

16 A Yes, sir.

17 Q Was that the cement plug you had set --

18 A I don't recall whether it was in Hamilton, Texas or
19 back in Dallas, Texas or whether I was in Ballinger or where
20 I was but I received a call that they couldn't get out of the
21 old hole. All I said in this letter is where I would be
22 in Hamilton, I would be in Hamilton, Texas at the Spotted
23 Horse if they needed to get in touch with me.

24 Q If I understood you correctly this morning, you
25 testified that you received a call in Hamilton, would you

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1 like that testimony to be changed that you received a call
2 in either Hamilton or Dallas?

3 A I can't recall whether it was Hamilton or Dallas.
4 I travel around a lot, I can't really say.

5 Q I realize that. I have the same problem, Mr. Cox.
6 But you do remember getting a phone call from Mr. Ratts
7 telling you that the cement plug had given away?

8 A Yes, sir.

9 Q And they weren't out of the old hole yet?

10 A And they had to plug back.

11 Q Let me ask you this: Since your letter of July
12 the 6th had attempted to instruct him that you had changed
13 your mind about going to the northwest, instead you wanted to
14 go to the north, why didn't you tell him then to orient the
15 Dyna-Drill to the north?

16 A I was under the assumption that he had the letter
17 and on the other hand, he was the engineer in charge of the
18 well and setting the orientation. I don't know anything
19 about setting orientations of Dyna-Drills or how the
20 mechanism works or anything like that. I'm not an expert
21 in this field and I appreciate your trying to make me one but
22 I'm not.

23 Q You will agree with me, will you not, Mr. Cox, at
24 the time, before you were out of the old hole, that he could
25 have instructed Eastman to orient the Dyna-Drill in any

1 direction?

2 A He could have already told them to orient it to the
3 south.

4 Q Yes, or the north, as you say in this letter, or to
5 the east?

6 A Yes.

7 Q But instead the drill was oriented to the northwest?

8 A From my understanding and looking at the reports, yes.
9 It looks that way.

10 Q All right, sir, unless you have some other comments
11 you would like to make on the text of the transmittal letter,
12 I'm ready now to discuss the plat that was attached to it.

13 A That is about as much as I can go. I can't add
14 anything to it anymore than I put in the letter.

15 MR. G. BUELL: Just a moment, Mr. Commissioner, let
16 me see if we have another copy of his plat so you all can be
17 looking at it. I know it is difficult for you to follow.

18 MR. RAMEY: I would suggest that, Mr. Buell, if
19 you have one.

20 (THEREUPON, a discussion was held
21 off the record.)

22 MR. G. BUELL: The copy of the plat attached to
23 Exhibit Eleven that I have just handed to the Commissioner
24 has been identified by Mr. Cox, just by eyeball looking at
25 it, it appears to be an exact copy of that that he is looking at.

1 Q (Mr. G. Buell continuing.) All right, sir, explain
2 please to the two Commissioners, what you proposed to show
3 Mr. Ratts by that plat?

4 A One was going off in a north direction, that the
5 migration of the bit into the south and east, the south and
6 east dip, was going to carry it normally back to the northwest
7 anyway.

8 Q All right, sir, so the horizontal, heavy, straight
9 lines that we see running in an almost true north direction,
10 is a path that by this letter and by this plat you are
11 instructing Mr. Ratts to kick out of the hole and go in
12 that direction, is that correct?

13 A Well, that is the direction I wanted to go. How
14 they kicked out I don't know but from talking to other
15 people, they brought this to my attention that the dip would
16 catch us and we would probably end up thirty or forty feet
17 from our target area. You are asking me technical questions
18 that I'm really not qualified to answer. My intent was to
19 go north, as I said in the letter. The plat shows where I
20 feel like the bottom of the hole would probably end up.

21 Q Well, I'm not trying to get you in an area, Mr.
22 Cox, in which you haven't previously testified because this
23 was your exhibit, prepared by you and presented by you, so
24 I'm not trying to get you into an area that you haven't
25 testified about before and I understood your testimony in

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1 explaining this exhibit, that that line I directed you to was
2 the line you felt if they had followed in orienting the
3 Dyna-Drill and coming out of the hole, that they would have
4 eventually ended up approximately where the line to the left
5 of that goes?

6 A No, I don't know that much about it. You notice
7 I've got a prospective area in there in yellow, I didn't know
8 where it would end up.

9 Q So at that time, July 6th, 1975, you would have been
10 happy if you had ended up anywhere in this area labeled,
11 "prospective area"?

12 A Right, that area or any place in that area labeled
13 in yellow. I can't see too well how far the yellow goes over
14 but I would have been satisfied with it.

15 Q Mr. Cox, where I'm having my difficulty, you have
16 testified that this letter of July 6th, 1975 and this plat
17 that was attached to it, was your instructions to Mr. Ratts
18 that you no longer wanted to follow the deviation plan that
19 appeared on the Eastman plat, is that correct up to there?

20 A That is correct up to there.

21 Q But that you wanted him to follow this deviation
22 plan that you showed on the plat attached to your letter?

23 A Yes, sir.

24 Q All right, sir, in the interest of time let me ask
25 you this: I believe at the request of the Examiner on November

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1 the 19th, you sealed off on this exhibit, your prospective
2 area with respect to the surface location of the well, do
3 you recall that?

4 A I don't believe I did, I believe the Examiner did.

5 Q Well, would you do that, please, and tell the
6 Commission whether or not even if these instructions had
7 gotten in the hand of Mr. Ratts and he followed your instructions
8 faithfully and the well had been bottomed in the area that
9 you have labeled "prospective area", whether or not that would
10 have been in, within the limits, granted by the Commission
11 in your order?

12 A No, sir, as I testified before, I wasn't aware of
13 the conditions. I was confident of the terms of the order in
14 that I had permission to deviate but had not -- I had to run
15 surveys. I was not cognizant of the fact that I deviated,
16 and I testified to that. I think I testified to the Examiners,
17 an informal meeting, to everyone, where the bottom of my
18 well ended up and that I intentionally deviated it and so, I
19 mean, this hammering away as to why this was here and this was
20 here.

21 MR. DAY: Mr. Cox, would you reserve your comments
22 about the type of questions.

23 A Okay.

24 Q (Mr. G. Buell continuing.) So, Mr. Cox, regardless
25 of intent, if the deviated and controlled well had followed

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1 your instructions to Mr. Ratts, it still wouldn't have
2 conformed to the Commission order?

3 A No, sir.

4 Q And it did follow the deviation plat shown on the
5 Eastman plats, one of which was furnished you, and it also
6 was outside of the purview and requirements of the Commission
7 order?

8 A Yes, sir.

9 Q All right, sir, I believe you testified that your
10 fire was January the 12th, 1975, is that correct?

11 A January the 11th.

12 Q January the 11th.

13 MR. DAY: May it please the Commissioners, we have
14 never denied that Mr. Cox trusted his memory as to the
15 drilling permit and went in the direction, either a hundred
16 to a hundred and fifty feet off, or whatever it was. If
17 Mr. Buell is continuing questioning in this area, we have
18 never denied it, if that is what you are trying to establish.

19 MR. G. BUELL: If it please the Commission, I believe
20 I have established that and I thought it should be firmly
21 established in this record for you gentlemen to consider in
22 making your decision, regardless of what Mr. Cox's intention
23 was. One thing is crystal clear, he had no intention of
24 complying with the Commission's order.

25 MR. DAY: If you please, in the opening remarks made

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1 by myself and during the direct testimony of Mr. Cox he
2 stated that he trusted his memory, he went to his memory on
3 what he thought the drilling permit stated, later he found
4 himself to be wrong in this thinking at the time of drilling
5 and it is redundant that he has so testified on direct and on
6 cross that he was and he now finds he was not in compliance
7 with the drilling permit.

8 I'm not trying to say -- we are perfectly willing
9 for you to cross examine but if we are going into the same
10 area it is redundant and I don't think it is necessary.

11 MR. G. BUELL: I was through with that area. I did
12 not intend to be redundant but I did want this record crystal
13 clear, aside from comments from counsel, that Mr. Cox had no
14 intent to comply with the Commission order and I think the
15 record is crystal clear.

16 MR. DAY: The only comments I make is that he so
17 testified on direct and again on your cross.

18 MR. G. BUELL: I had a hard time following him on
19 direct. I distinctly understood him to say that Mr. Ratts
20 called him in Hamilton, Texas, then he says on cross that it
21 might have been in Dallas.

22 MR. DAY: Well, you are going again, what difference
23 does it make? He said he went outside the limits of the
24 drilling permit. I don't understand what difference it makes
25 whether he was a hundred feet, a hundred and fifty feet in one

1 direction and eighty-five or ninety in the northeast or west
2 or when he got the calls or what.

3 MR. G. BUELL: If it please the Commission, if I
4 have confused Mr. Day I apologize.

5 Q (Mr. G. Buell continuing.) Now, Mr. Cox, you said
6 your fire was January 11th, 1975. This well commenced drilling
7 early in July of 1975.

8 A July 8th, I believe.

9 Q Did you make any attempt in that intervening six-
10 months period to get a copy of the Commission order and refresh
11 your memory?

12 A No, I did not.

13 Q Mr. Cox, were you able to forget your sworn
14 testimony at the May 23rd, 1973 hearing as easily as you forgot
15 what was in the Commission order?

16 A I really don't know what my sworn testimony was in
17 the May 23, 1973 hearing because I didn't have a copy of the
18 transcript.

19 Q You read it this morning. You mean you have already
20 forgotten it again?

21 A I got it from Sumner Buell but I did not have a copy
22 of it.

23 MR. G. BUELL: May it please the Commission, that's
24 all I have by way of case.

25 MR. HINKLE: We have no questions.

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1 MR. RAMEY: Anything further?

2 MR. DAY: If I may, just a couple of questions.
3

4 REDIRECT EXAMINATION

5 BY MR. DAY:

6 Q Mr. Cox, the name of Don Benscoter has been brought
7 up, is Mr. Benscoter an oil engineer, petroleum engineer,
8 geologist or in any way skilled in the oil business, to your
9 knowledge?

10 A No, he isn't.

11 Q Mr. Cox, what was the original time estimated within
12 which to drill this test well, subject well?

13 A Somewhere between ten to twelve days.

14 Q And how much time did it actually take?

15 A I believe from July 8th to July 31st would be
16 roughly twenty-three or twenty-four days.

17 Q Mr. Cox, between the time of the fire, or after the
18 time of the fire, did you in any way try to reestablish your
19 records?

20 A Reestablish them?

21 Q Yes.

22 A What we could get back that wasn't completely fire
23 damaged, you know, or illegibly smoke damaged, it is pretty
24 hard to tell, you know, just what records you lost because
25 you have got a file full of records. We wrote to the USGS

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1 and advised them on sometime in March or April that we had
2 had the fire and had lost all our correspondence in regards to
3 N.M. six eight five two and would they send us the sundry
4 report forms.

5 Q That was two months after the fire?

6 A Yes, sir, two months after the fire.

7 Q An earlier exhibit shows that you were attempting
8 to salvage some of your records by having smoke damage, whatever
9 they do to documents to remove the smoke and make them legible.
10 What else were you doing between that time and the time that
11 you commenced the well?

12 A We were drilling six wells.

13 Q And operating, I believe you testified on the cross
14 examination, some twenty wells?

15 A Right.

16 Q And you had a maximum of three employees in the
17 whole time?

18 A Yes, sir.

19 MR. DAY: Thank you, Mr. Cox.

20 MR. RAMEY: Any other questions of the witness?

21 Mr. Buell?

22

23 FURTHER CROSS EXAMINATION

24 BY MR. C. BUELL:

25 Q Mr. Cox, you aren't testifying that you completely

1 forgot that the Commission issued an order after your May 23rd,
2 1973 case?

3 A No, I knew I had permission to deviate and run a
4 survey, I know I didn't have any idea it was a multi-shot.

5 Q Your memory just failed as to what was in the
6 order?

7 A Yes, sir.

8 Q Certainly you realize with a telephone call to the
9 Commission or your attorney here in Santa Fe you could have
10 gotten a complete new copy of the order?

11 A I imagine I could have, Mr. Buell, there are a lot
12 of things that I imagine I could do.

13 MR. G. BUELL: Thank you, Mr. Cox.

14 MR. RAMEY: Any other questions of the witness?

15
16 CROSS EXAMINATION

17 BY MR. LUCERO:

18 Q Mr. Cox, with respect to that plat attached to
19 Exhibit Eleven where you have it, I believe, shaded in yellow,
20 the prospective area.

21 A Yes, sir.

22 Q How were the outer limits of that prospective area
23 on the east and west sides determined?

24 A I just drew them in. You know, I felt like it would
25 fall somewhere in through there.

1 Q Did you use any geologic data available to you to
2 determine these outer limits?

3 A Well, the only thing I was using from a geological
4 standpoint was that to the north was the fatter part of the
5 reef and that was the direction of which if I was going to
6 encounter production that would be the more favorable area.

7 MR. LUCERO: I have no further questions.

8 MR. RAMEY: Any other questions?

9 MR. DAY: Mr. Cox, have you ever been in this
10 position before, about going to any commission in violation
11 of any drilling permit?

12 MR. COX: No.

13 MR. DAY: In all of your experience and history of
14 drilling wells?

15 MR. COX: No.

16 MR. DAY: Thank you.

17 MR. RAMEY: Any other questions? The witness may
18 be excused.

19 MR. COX: Thank you.

20 (THEREUPON, the witness was excused.)

21 MR. DAY: If the Commission please, on the premises
22 under which I first commenced examination, this will end my
23 direct examination and testimony proffered to the Commission
24 concerning the circumstances of the drilling of the well
25 under the drilling permit. We would reserve the right to

1 recall our witness in rebuttal.

2 MR. RAMEY: Do you anticipate putting any witnesses
3 on other than those you have subpoenaed?

4 MR. DAY: I have not subpoenaed any, sir.

5 MR. RAMEY: Mr. Buell, didn't you request it?

6 MR. S. BUELL: I think those witnesses, Mr. Ramey,
7 go to the geology and engineering involved, which hopefully
8 will be the subject matter of another session.

9 MR. NUTTER: Mr. Ramey, I wonder if I could have
10 Mr. Cox back on the stand just a minute to clarify a couple
11 of points in the well file?

12 Mr. Cox, I wonder if I can clarify a couple of
13 points in the well file with you?

14 (THEREUPON, the witness was recalled.)

15 MR. S. BUELL: Take the witness stand.

16 CROSS EXAMINATION

17 BY MR. NUTTER:

18 Q Mr. Cox, on July 8th, 1975, you filed with the USGS
19 a Form 9331, which was a notice of intention to repair a
20 well and on that 9331 you stated, operations as described
21 in sundry notices and report forms dated July 19, 1973 were
22 commenced July 8th, 1975. Now, on July 19th, 1973 when you
23 filed this 9331, you stated you were going to move in, pull
24 the casing, plug back and set the whipstock and point five,
25 directionally drill seven and seven-eighths-inch hole in

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1 accordance with Order Number R-4561 of the New Mexico Oil
2 Conservation Commission. Now, apparently on July 8th of '75
3 when you filed the 9331 and stated that the work that you
4 declared that you were going to do in 1973 would now be done
5 in July of '75. You apparently had reference to this same
6 form, did you have this form in your possession?

7 A Yes, sir, the USGS sent it to me. They sent me the
8 last sundry report forms.

9 Q They sent you a new copy of this?

10 A Yeah.

11 Q Well, when you had this form in your hand it made
12 reference to Order Number R-4561 and stated that the hole was
13 going to be drilled in accordance with that Order. You
14 realize that there must be some conditions or terms in the
15 Order if you are going to drill it in accordance with it?

16 A Well, yes, as I said, my memory -- in my memory I
17 had to run a survey to show my bottom-hole location and I
18 had permission to deviate the well off to the north. That is
19 to the best of my memory.

20 Q It also in July of '73 in the form which you had
21 received a copy of back from the USGS, said that you would
22 run a multi-shot deviation survey, now you were aware of that,
23 of course?

24 A No, sir, I didn't know the difference between a
25 multi-shot and a single shot. They instructed me that we had

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1 to run a single shot on the way down to control the deviation
2 of the hole and make changes in our whipstock. I didn't know
3 the technological difference between a single and a multi-
4 shot survey. The survey was a bottom-hole survey, as far as
5 I was concerned.

6 Q Well, now, when the USGS furnished us a copy of
7 the forms that were attached, they furnished us a copy of
8 the Order. They didn't furnish you with a copy of the Order,
9 they furnished us with a copy of our own Order but when they
10 sent you a form they didn't send you a copy of our Order?

11 A No, sir, they did not.

12 MR. DAY: Mr. Nutter, what Order is that that was
13 attached?

14 MR. NUTTER: A copy of the original Order that
15 authorized the deviation, R-4561.

16 MR. DAY: 4561?

17 Q (Mr. Nutter continuing.) Now, November 1st of
18 1974 you filed with the GS Form 9331 and they received it in
19 December 17th, 1974 and you stated at that time that you
20 were unable to acquire a contractor to perform the planned
21 whipstock attempt to straighten up the hole. As late as
22 December of 1974 were you still planning to straighten the
23 hole?

24 A By straightening the hole our intent, I said, was to
25 get off the stub and get out and get away from the area of

1 influence, the hundred and fifty foot area which the engineers
2 thought was influenced and I guess their idea was to straighten
3 up the hole.

4 Q When you filed this and said you were going to
5 straighten up the hole, that didn't mean that you were going
6 to drill and bottom it within a hundred feet of the surface
7 location?

8 A No.

9 Q I see.

10 MR. NUTTER: That's all. Thank you.

11 MR. RAMEY: Any further questions of the witness?

12 MR. DAY: No, sir.

13 MR. RAMEY: He may be excused.

14 (THEREUPON, the witness was excused.)

15 MR. RAMEY: Mr. Buell?

16 MR. G. BUELL: Mr. Ramey, should I assume that we
17 are proceeding under the fact that we will have all of the
18 testimony relating to the deviation of the hole before we go
19 into any other matters?

20 MR. RAMEY: Yes, sir.

21 MR. G. BUELL: In that case then I do have one
22 witness, Mr. Currens. He has one big exhibit he needs to put
23 on the wall, if you would like to take a short recess.

24 MR. RAMEY: Let's take a five minute recess.

25 (THEREUPON, the hearing was in recess.)

1 MR. RAMEY: Mr. Buell, you may proceed.

3 DANIEL R. CURRENS

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

7 DIRECT EXAMINATION

8 BY MR. G. BUELL:

9 Q Mr. Currens, would you state your complete name, by
10 whom you are employed and in what capacity and in what location,
11 please?

12 A Daniel R. Currens, Senior Staff Engineer, Amoco
13 Production Company, Houston, Texas.

14 Q Mr. Currens, I realize you have testified at previous
15 Commission hearings and your qualifications as a petroleum
16 engineer are a matter of public record in the Commission files
17 but in order that the two Commissioners will be acquainted
18 with your qualifications, particularly as it would affect
19 the Empire-Abo pool, would you briefly give your educational
20 background and your work experience since graduation, please?

21 A All right, sir, I was graduated from Texas A & M
22 with a B.S. degree in chemical engineering in 1954. Upon
23 graduation I was employed by what was then Stanolind Oil and
24 Gas Company, subsequently Pan American Petroleum Corporation,
25 now Amoco Production Company. I started with that company

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1 around Odessa, Texas. Subsequently I was in Hobbs, New Mexico,
2 did a tour in the Army, returned from the Army to our
3 District Office in Roswell, New Mexico where I was engaged
4 primarily in reservoir engineering work. That would have
5 been in 1957 and I was there until 1959 and that encompasses
6 the time of discovery of the Empire-Abo pool and I did
7 reservoir engineering work on the Empire-Abo pool at that
8 time. Subsequently, I was in Lubbock, still following
9 New Mexico and I was in the Fort Worth Division Office. I
10 then had assignments there that had to do with operations,
11 reservoir engineering, unitization, a variety of things. I
12 was area engineer in Monahans, Texas, in Brownfield, Texas,
13 with the engineering responsibility for all producing
14 operations in those areas. Subsequently, I was in Fort Worth
15 and now in Houston.

16 MR. G. BUELL: Thank you, Mr. Currens. Are there
17 any questions with respect to Mr. Currens' qualifications
18 as a petroleum engineer?

19 MR. RAMEY: No, the Commission considers him
20 qualified.

21 MR. G. BUELL: Mr. Currens, I believe everyone has
22 a set of your exhibits. Mr. Day, do you have a set?

23 MR. DAY: Yes, sir.

24 MR. G. BUELL: In that connection, Mr. Day, if I
25 understood correctly this morning, the exhibits that Mr. Cox

1 submitted, the DN exhibits, that you said you had a copy and
2 would make a copy and furnish us, did I understand you
3 correctly?

4 MR. DAY: Yes, sir.

5 MR. G. BUELL: Thank you.

6 Q (Mr. G. Buell continuing.) Mr. Currens, turn first
7 to what has been identified as Amoco's Number DN-One.

8 MR. DAY: Mr. Currens, before you answer, if I may
9 suggest that maybe this stipulation would expedite the
10 hearing greatly. We will stipulate that the Cox well is
11 bottomed eight feet from the west line and fifty-eight feet
12 from the north line of the Cox lease. Will that expedite
13 matters?

14 MR. G. BUELL: I think that it should shorten matters
15 some, Mr. Commissioners, and I appreciate the stipulation.

16 MR. DAY: May I further offer another stipulation.
17 I believe Arco ran a survey, a surface survey and the
18 location is three hundred and thirty feet from one line and
19 three hundred and thirty-one from the other and I so tender
20 that stipulation.

21 MR. G. BUELL: That is my recollection of the on-the-
22 ground survey and Amoco would so stipulate to it.

23 MR. DAY: Arco?

24 MR. HINKLE: I stipulate except as to where the
25 well is bottomed there. There could be an error as far as

1 some error there but we will stipulate that the survey shows
2 that.

3 MR. G. BUELL: I want the record to clearly reflect
4 that that is all I'm stipulating to in regard to the surface
5 survey.

6 MR. DAY: Well, to the surface survey you stipulate
7 and everybody so stipulates. As to the location of the well,
8 as I understood Mr. Hinkle, he is stipulating that the well
9 survey shows that it is bottomed there.

10 MR. HINKLE: That's right, but there may be an
11 error in the survey and I think maybe Eastman's witnesses
12 might testify that there could be some deviation, an error,
13 a percentage of error where it could be bottomed over the lease
14 line, as far as that goes.

15 MR. DAY: Does Amoco then stipulate that the survey
16 shows the well bottomed where it is subject to the conditions
17 of Arco, do you agree with Arco?

18 MR. G. BUELL: I'm going to have Mr. Currens so
19 testify.

20 MR. DAY: So this is stipulated?

21 MR. G. BUELL: It's stronger than a stipulation, it
22 will be through the sworn testimony of our witness.

23 MR. DAY: Well, I was hoping to abort some testimony
24 which would not be necessary in that area when you get to the
25 meat of it.

1 MR. G. BUELL: I'm a firm believer in reducing all
2 of the surplus time that we can but this is an important case,
3 both to Mr. Cox, to Amoco, to Arco and to all of the interest
4 owners in the Empire-Abo unit. For that reason encumbent upon
5 I would be derelict if I didn't make a full case before you
6 two gentlemen and I intend to make a full case. I will save
7 all the time I possibly can but unless you set me down that
8 is my intention and I think you gentlemen deserve it.

9 MR. LUCERO: I think the question before us now is,
10 do you stipulate or not. If you don't, proceed, if you do,
11 why just stipulate, or are you going to go ahead with it?

12 MR. HINKLE: As to the surface location, we do, yes,
13 sir.

14 MR. G. BUELL: Yes, sir, the surface location.

15 MR. RAMEY: But you do not stipulate that the well
16 is bottomed on the lease?

17 MR. HINKLE: My idea is that there could be a
18 percentage of error, regardless of where the map or plat shows
19 it to be bottomed. It could be bottomed otherwise and I
20 think the testimony of Eastman will so show that.

21 MR. RAMEY: Mr. Buell, you may proceed and take as
22 much time as you need.

23 MR. G. BUELL: Actually in our testimony we go a
24 little further than the testimony I am about to elicit from
25 Mr. Currens. Unless he surprises me, his testimony will be

1 that with a well only nine feet from our lease line,
2 from a reservoir engineering standpoint, it is completely
3 immaterial insofar as violating correlative rights whether
4 it is nine feet from our line or nine feet over onto your
5 property.

6 MR. RAMEY: Please proceed.

7 Q (Mr. G. Buell continuing.) Mr. Currens, would you
8 direct our attention, please, to what has been identified as
9 Amoco's Exhibit DN Number One?

10 A Yes, sir.

11 Q What is that exhibit?

12 A Exhibit DN-One is a plat of the area of the Empire-
13 Abo pool and other wells that were drilled in the area of the
14 Cox Federal lease. It shows a portion of Eddy County, New
15 Mexico, the Section 12 that is in the southeast corner of
16 the exhibit is labeled, you will note at the top of it, Cox
17 US EA. That simply shows the location of the original Aztec,
18 surface location of the original Aztec EA 1, which was
19 subsequent to the Cox EA 1 and the Cox EA 2, Empire-Abo wells,
20 both producers and dry holes in the area and some other wells
21 that were drilled in the area. It is an orientation plat,
22 is what it is.

23 Q In that connection, Mr. Currens, in that some of
24 the offsetting properties to Mr. Cox's Federal EA lease are
25 within the Empire-Abo unit and in the past hearings we have

1 been referring to the wells by their old lease name and then
2 some referred to them by their unit designation. Does not
3 this orientation map show the old lease designation as well as
4 the unit designation for the wells in and around Mr. Cox's
5 lease?

6 A Yes, it does.

7 Q So with this map we can locate a well whether it
8 is called by its old designation or the unit designation?

9 A Yes, sir.

10 Q Do you have any other comments on that exhibit, Mr.
11 Currens?

12 A No, sir, I don't believe so.

13 MR. DAY: If the Commission please, may I have
14 the witness on voir dire on this exhibit?

15 MR. RAMEY: Yes, you may.

16 MR. DAY: Thank you.

17 Mr. Currens, referring to what has been marked as
18 Amoco DN-One, you have shown various wells in various sections,
19 are these all of the wells that are presently on these locations,
20 is it not true that some inside locations have been made?

21 MR. CURRENS: As far as I know these are all of the
22 wells on these locations.

23 MR. DAY: You are not aware of any wells that have
24 been drilled inside of these perimeters and completed.

25 MR. CURRENS: Taken from base map records we have

1 in our office I don't have them spotted, no, sir.

2 MR. DAY: All right, thank you.

3 MR. RAMEY: Is that all, Mr. Day?

4 MR. CURRENS: Unless I inadvertently overlooked
5 one, to the best of my knowledge that is correct.

6 MR. DAY: To the best of your knowledge?

7 MR. CURRENS: Yes, sir.

8 MR. DAY: But you could have overlooked some?

9 MR. CURRENS: That's possible.

10 MR. G. BUELL: In that connection, Mr. Commissioners,
11 we were as careful as possible in preparing this map but
12 since it isn't a substantive map, it is more or less an
13 orientation map to help you and others keep up with the
14 progress of the hearing, it is conceivable that we've
15 overlooked one but we don't think we did.

16 Are you through, Mr. Day?

17 MR. DAY: Yes, thank you.

18 Q (Mr. G. Buell continuing.) Mr. Currens, if you
19 have no other comments on Amoco's Exhibit DN Number One, would
20 you turn your attention, please, to what has been identified
21 as Amoco's Exhibit DN Number Two. I believe in addition to
22 giving everyone of interest a smaller version of this exhibit,
23 you have on the wall for ease in discussing it, a larger
24 exhibit?

25 A Yes, sir. On the wall is a large copy of what

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1 has been marked as Amoco's Exhibit DN-Two, reduced copies of
2 that, which are simply shot down copies of the base from
3 which this was made, those that have been distributed.

4 This exhibit reflects the surface location.

5 Q Pardon me, Mr. Currens, would you explain what the
6 border of the exhibit reflects before we go into the surface
7 location of the Number 1 Well?

8 A All right, sir, this exhibit has a red border around
9 it which is the depiction of the eighty-acre unit.

10 Q Forty acre.

11 A Forty-acre unit, pardon me. The forty-acre unit
12 on which this well was drilled. Forty-acre state-wide rules,
13 which are forty acre applied to the Empire-Abo and the
14 drilling unit is forty acres and this is to scale, showing
15 forty acres on the scale. It is noted down in the lower
16 right-hand corner of the exhibit.

17 Q All right, sir, so when we are looking at this
18 exhibit, we are looking at the forty-acre unit upon which the
19 well on Mr. Cox's Federal EA is located?

20 A Yes, sir.

21 Q All right, sir, would you go ahead, please?

22 A It shows in the northwest quarter of the exhibit,
23 the surface location of the Cox EA Federal Number 1 as three
24 hundred and thirty-one feet from the north and three hundred
25 and thirty feet from the west line and then it shows, with a

1 westerly trending, a blue line with a number of dots on it.
 2 On out, taking the south fork of the blue line, the location
 3 of the bottom-hole of the original Aztec EA Federal 1, with
 4 its bottom-hole location shown as being twenty-two point six,
 5 five feet south and a hundred and seventy-one point eight,
 6 seven feet west of the surface location, and its true vertical
 7 depth, measured depth and the closure.

8 Now, our data that are taken from the Eastman survey,
 9 which was submitted in the May 1973 hearing on the drilling
 10 permit and the directional deviation order on this well --

11 Q Before we get into that, let me ask you this: Is
 12 the surface location of the Number 1 Well three thirty and
 13 three thirty-one from the north and the west lines as close
 14 as a well could be located in that northwest quarter of the
 15 forty-acre unit without an exception from the Commission?

16 A Yes, sir. Well, three thirty, three thirty would
 17 be the closest, yes, sir.

18 Q Eliminating the one foot?

19 A Yes, sir.

20 Q All right, sir, would that put that well, the
 21 surface location, in the center of the northwest ten acres of
 22 this forty-acre unit?

23 A Yes, sir.

24 Q All right, sir, now what else have you shown on
 25 this exhibit?

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1 A Shown as a circle, it's marked as a one-hundred-foot
2 radius around the surface location of Number 1, it's a blue
3 line, it's a blue circle that represents the one-hundred-foot
4 radius that was granted as the tolerance in the order that
5 was issued on directional drilling on this well.

6 Q That is the area that the Commission authorized
7 Mr. Cox to directionally drill and control and bottom his
8 well within that hundred-foot radius?

9 A Yes, sir.

10 Okay, again starting at the surface location and
11 coming out to where the blue line that moves to the west
12 forks and taking the northwest fork of that blue line, the one
13 that moves up to the north, that's a trace of the data supplied
14 at the October hearing from Eastman records and their computa-
15 tion of the directional survey that was run on the new deviated
16 hole, the directionally drilled hole.

17 That bottom-hole location is shown as north two
18 hundred and sixty-eight point five, six and west three hundred
19 and twenty point five, nine feet, with respect to the surface
20 location. It shows the measured depth, true vertical depth and
21 the closure.

22 Q So really what we have here is a composite of the
23 directional surveys run on the old Number 1 hole which is
24 drilled, randomly drilled, that is the lower more directional
25 survey and then the upper most is the one that runs to the

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1 northwest, is the directional survey on the directionally
2 drilled and controlled deviated hole by Mr. Cox?

3 A Yes, sir.

4 Q All right, sir, now we got into some testimony
5 this morning with regard to the number of Dyna-Drill runs
6 that were made. Do you, on this exhibit, reflect the
7 occurrence of any Dyna-Drill runs?

8 A Yes, sir, I do.

9 Q How have you done this?

10 A By red arrows I have marked five places where the
11 Dyna-Drill was put in the hole initially at that spot, after
12 the well was kicked off and got -- to kick off, actually to
13 get the first kick off and the directional drilling. You will
14 recall in this morning's testimony there was some difficulty
15 in their initial attempt to sidetrack the old hole, the
16 plug failed and so on. These are those Dyna-Drill runs after
17 the new plug was set and kicked off, as I understand the
18 drilling records.

19 Q Now, that is the confusion between the five and
20 the seven. The two were run before they ever got out of
21 the old hole. One time, I believe the records show because
22 the plug failed, the other time they had a casing part?

23 A Yes, sir, that's the way I read the drilling reports
24 on the well.

25 Q So the way you studied the drilling reports, there

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1 were seven Dyna-Drill runs in this well?

2 A. That's the way I understand the drilling report.

3 Q But only five that were meaningful from the
4 standpoint of deviating it and directionally controlling it?

5 A. Yes, sir.

6 Q Then you have shown those five there?

7 A. Yes, sir.

8 Q Do you have any other comments about that?

9 A. No, sir, I don't believe so.

10 Q All right, sir, let me ask you this while we are
11 looking at this exhibit and I will ask you this based on
12 your experience as a reservoir engineer. From the standpoint
13 of the location of this well, nine feet east of our property
14 line, from the standpoint of violating the correlative rights
15 of the owners of interest west of Mr. Cox's line, our interests,
16 does it make any difference whether this well is nine feet
17 from our line, on Mr. Cox's lease or nine feet from our line,
18 on the inside of our lease?

19 A. For all practical purposes, from the reservoir
20 standpoint, no, it doesn't.

21 Q With a well completed at that location, in your
22 opinion as a reservoir engineer, does it violate the correlative
23 rights of the offset owners who are only nine feet away?

24 A. Yes, sir, it would.

25 Q All right, sir, do you have any other comments in

1 that regard?

2 A No, sir, I don't.

3 Q All right, will you turn now, please, to what has
4 been identified as Amoco's Exhibit DN Number Three, what is
5 that exhibit?

6 A Exhibit DN Number Three is taken from page two of
7 the Cox Exhibit Eleven that was discussed earlier in this
8 hearing today, the Exhibit Eleven from the November 19th,
9 1975 hearing.

10 Q And on that exhibit, at my request, have added some
11 additional data?

12 A Yes, sir, that is correct.

13 Q One thing that I asked you to add and I asked you to
14 add it in red, is the one-hundred-foot radius circle, the
15 target area permitted Mr. Cox by this Commission's order, have
16 you done that?

17 A Yes, sir, I have.

18 Q Let me ask you this: Does that show that even if
19 Mr. Cox's orders had gotten to the proper people and had been
20 followed, would the well have been completed within the
21 hundred-foot circle?

22 A No, sir, it would not as I understand the orders
23 that he gave, it would not.

24 Q All right, sir, did I not also ask you, based on
25 Mr. Cox's testimony on page seven of the November 19th, 1975

1 hearing, and I'll read it once more so the record will be
2 clear.

3 (Reading.) We were intending to go north-northeast,
4 taking off from our point about eighty-five feet west of our
5 surface location and bottom the well somewhere between a
6 hundred and fifty feet north of our surface location and
7 eighty to a hundred feet west of our surface location. (End
8 of reading.)

9 At my direction have you scaled on this plat those
10 footages that Mr. Cox testified on November 19th, 1975, was
11 his actual, true intent with regard to deviating this well?

12 A Yes, sir, I have.

13 Q How have you shown that on this exhibit?

14 A It is shown by a short, brown line that is pointed
15 to by a red arrow.

16 Q All right, sir, now that scaled off does not even
17 fall within his prospective area as reflected on this plat?

18 A No, sir, it does not.

19 Q The testimony that I just read and the footages
20 represented by that brown -- why is that such a long mark
21 there?

22 A Well, it's representing twenty feet. The testimony
23 was that he wanted to be a hundred and fifty feet north and
24 eighty to a hundred feet west of the surface location.

25 Q I see, so it is a finite point on the hundred and

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1 fifty feet north?

2 A Yes, sir.

3 Q But to cover the eighty to a hundred feet you had
4 to have a line that is twenty feet long?

5 A Yes, sir.

6 Q All right, sir, now that does not fall within his
7 prospective area that he presented on the same date, November
8 19th, 1975, does it?

9 A No, sir, it doesn't.

10 Q All right, sir, now I'm going to direct your
11 attention back to Amoco's Exhibit DN Number Two for a moment.
12 I'm going to read, and counsel I'm reading from the transcript
13 of May 23rd, 1973, the testimony of Mr. Cox right at the top
14 of page nine.

15 (Reading.) We are petitioning the Commission to
16 be allowed to retrieve the casing down to the depth of
17 approximately forty-two hundred feet, set a plug, sidetrack
18 the hole by means of a motor drill because the angle is so
19 slight a whipstock would be impossible to attempt that with
20 and try and restore the hole as near to vertical as mechanically
21 possible and to test the Abo formation in a virgin hole. (End
22 of reading.)

23 On our DN Number Two exhibit, can you find the
24 depth of forty-two hundred feet on old hole Number 1?

25 A Yes, sir.

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1 Q Now, if Mr. Cox had done what he swore to the
2 Commission he wanted to do and kicked off at that point,
3 returned the well to vertical, drilled a straight hole, would
4 he have been within the hundred-foot radius permitted by
5 the Commission's Order?

6 A Yes, sir.

7 Q All right, sir, now I'm going to read from the
8 same transcript, the testimony of Mr. Alspaw, Mr. Cox's
9 consulting engineer as to what he thought Mr. Cox wanted to
10 do and I'm reading from the bottom of page fourteen, Mr. Day.

11 MR. DAY: Who is testifying?

12 MR. G. BUELL: Mr. Alspaw, Mr. Cox's consulting
13 engineer who was presented as Mr. Cox's witness at the May '73
14 hearing.

15 Q (Mr. G. Buell continuing.) (Reading.) Our objective
16 here was, of course, to kick the well off by controlling
17 the weight on the bit return and returning it to the
18 vertical and bottom the well out in a location within close
19 proximity of the Number 20 that we see here on the deviation
20 survey. I believe that is about four thousand to forty-two
21 hundred feet. (End of reading.)

22 First, can you locate on the directional survey of
23 the old hole the depth of four thousand to forty-two
24 hundred feet?

25 A On the directional survey in old hole 1, one of the

1 points was four thousand feet, one of the points was forty-
2 two hundred feet of the place where the directional shots
3 were taken.

4 Q That shot point 20, is that what you are referring
5 to?

6 A No, actually four thousand feet is shot point 20,
7 forty-two hundred is shot point 21. Shot point 20 is four
8 thousand feet.

9 Q Go to the Exhibit DN Number Two and see if you can
10 locate on the survey depicted there, of the old hole, either
11 four thousand or forty-two hundred feet?

12 A Well, they are both shown.

13 Q Well, actually Mr. Cox said he wanted to kick out
14 at forty-two hundred feet?

15 A Yes, sir.

16 Q All right, let's look at four thousand.

17 A All right, sir, that is the next point to the east
18 of the forty-two hundred point.

19 Q If the testimony of Mr. Alspaw had been followed
20 and they kicked out there, drilled a straight hole, would that
21 hole have been bottomed within the permissive limits of the
22 Commission's hundred-foot radius target area?

23 A Yes, sir.

24 Q Do you have anything else you care to add at this
25 time, Mr. Currans?

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1 A I think not.

2 MR. G. BUELL: If it please the Commission, that's
3 all we have by way of direct of Mr. Currens.

4 We would like to offer Amoco's Exhibits DN Number One
5 through DN Number Three, inclusive.

6 MR. RAMEY: Without objection the exhibits will
7 be accepted.

8 (THEREUPON, Amoco's Exhibits Number DN-One
9 through DN-Three, inclusive, were admitted
10 into evidence.)

11 MR. RAMEY: Any questions of the witness?

12 MR. DAY: Mr. Hinkle?

13 MR. HINKLE: No, sir.

14
15 CROSS EXAMINATION

16 BY MR. DAY:

17 Q Mr. Currens, I seem to recall from the earlier
18 hearing that you had an exhibit similar to this but you
19 didn't have all of this blank space on there and you have
20 added this since?

21 A Yes, sir, that is correct.

22 Q Have you testified before a conservation commission
23 before?

24 A Yes, sir.

25 Q Have you appeared with Mr. Buell before on these

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1 hearings?

2 A Yes, sir.

3 Q Would you venture to estimate how many times you
4 have been a witness?

5 A It would be an estimate, certainly, perhaps in
6 fifty matters.

7 Q Now, you testified that you took this from Eastman's
8 records and when was that, has it been put into the record
9 that you examined them?

10 A Well, I have two directional surveys that are
11 depicted here. One is on the old hole Number 1. It was
12 dated February 27, 1973 and it was an exhibit at the May '73
13 hearing.

14 Q Now, the other one which you overlayed and took
15 from Eastman, when was that?

16 A That was the one dated July 8th, 1975. It was
17 entered in the October 1975 hearing. You will recall, perhaps,
18 there were two entered there. This is the one that uses the
19 radius of curvature method of calculation which was the one
20 I recall that Mr. Cox wanted.

21 Q I question whether you took the Eastman records and
22 the Eastman records you got from the October '75 hearing?

23 A The October '75 hearing and the May '73 hearing.

24 Q No, sir, I'm talking about the Eastman records. Did
25 Eastman introduce records in February of '73 too?

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1 A From the Exhibit of the Eastman survey, I recall
2 this as being Cox's Exhibit Three.

3 Q I'm getting confused.

4 A I'm sorry.

5 Q No, it's my fault. Where you are now showing the
6 well as being bottomed?

7 A Yes, sir.

8 Q That information you took from records that were
9 submitted in the October '75 hearing?

10 A Yes, sir.

11 Q All right, those were Eastman records?

12 A As Cox's Exhibit Number Three and Eastman --

13 Q They were Eastman records?

14 A It says submitted by Eastman Whipstock, Inc. on
15 the top of it.

16 Q From your reviewing that data of Eastman's, do you
17 find that the well bottomed on the Cox lease?

18 A Yes, sir, I have simply plotted the information
19 they have and it shows that location.

20 Q Incidentally, as I understand your testimony, you
21 are stating that for the purposes of your case concerning
22 correlative rights, it would make no difference whether the
23 well is bottomed on the Cox lease or across the lease line?

24 A I have stated sir, that --

25 Q I'm sorry, Mr. Currens, could you answer yes, or no?

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1 A Would you repeat the question, please?

2 MR. DAY: Would you read it back, please, Mr. Reporter?

3 (THEREUPON, the last question was read

4 back by the Reporter.)

5 Q (Mr. Day continuing.) Can you answer that yes or

6 no, Mr. Currins?

7 A That was not my testimony.

8 Q What difference does it make to you in correlative
9 rights where the well is bottomed, whether or not on the Cox
10 lease where you have shown it or across the lease line onto
11 another lease by the same amount of feet?

12 A My testimony was that from a reservoir engineering
13 standpoint, from the way that a reservoir would see this hole,
14 if it were bottomed nine feet east of the lease line or nine
15 feet west of the lease line, from a reservoir engineering
16 standpoint it is not of particular significance.

17 Q And that does not go to correlative rights, or it
18 does?

19 A Yes, sir, it does from the standpoint that being
20 only nine feet, there is certainly a violation of correlative
21 rights.

22 MR. DAY: Mr. Reporter, would you go back to the
23 question asked the witness by Mr. Guy Buell regarding the
24 bottoming of the well as to what difference it makes to
25 correlative rights. I may be confused in what the record says

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1 but I would like to have that testimony reviewed, please?

2 (THEREUPON, the hearing was in recess.)

3 MR. RAMEY: The hearing will please come to order.

4 Mr. Day, continue, please.

5 MR. DAY: Thank you. Mr. Reporter, will you now
6 read back the question and answer and question and answer that
7 you have now located?

8 MR. REPORTER: (Reading.) Question: All right, sir,
9 let me ask you this while we are looking at this exhibit and
10 I will ask you this based on your experience as a reservoir
11 engineer. From the standpoint of the location of this well,
12 nine feet east of our property line, from the standpoint of
13 violating the correlative rights of the owners of interest
14 west of Mr. Cox's line, our interests, does it make any
15 difference whether this well is nine feet from our line, on
16 Mr. Cox's lease or nine feet from our line, on the inside of
17 our lease?

18 Answer: For all practical purposes, from the
19 reservoir standpoint, no, it doesn't.

20 Question: With a well completed at that location,
21 in your opinion as a reservoir engineer, does it violate
22 the correlative rights of the offset owners who are only
23 nine feet away?

24 Answer: Yes, sir, it would. (End of reading.)

25 MR. DAY: All right, thank you.

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1 Q (Mr. Day continuing.) Mr. Currens, are those your
2 correct answers and are those your true answers to those
3 questions?

4 A Yes, sir.

5 Q You have shown on this exhibit, three Dyna-Drills,
6 you are aware that it has been stipulated that a total of
7 seven Dyna-tools were used?

8 A I have shown on this exhibit five places that it
9 was run.

10 Q That's not my question, Mr. Currens. You are aware
11 that there was a stipulation earlier with your client that
12 there were seven that were used, but you first said that
13 your exhibit showed three and it does show three and I'm
14 asking you if you are aware of the stipulation that was made
15 this morning?

16 A Well, the exhibit shows five, sir.

17 Q All right, two plus three, okay, thank you. You
18 are aware that it has been stipulated that seven Dyna-Drills
19 were used?

20 A Yes, sir. I discussed that in my testimony.

21 MR. DAY: Thank you, that's all I have.

22 MR. RAMEY: Any other questions of the witness?

23 Mr. Stamets?

24 CROSS EXAMINATION

25 BY MR. STAMETS:

1 Q Mr. Currens, assuming now that there were no
2 spacing requirements of the Oil Conservation Commission and
3 money was not an object to protect the rights of the interest
4 owners under the forty acres offsetting Mr. Cox's acreage to
5 the west, that's labeled M-16 on Exhibit DN Number One, would
6 you have to drill a well nine feet or an equal distance away
7 from the east line of that forty acre tract?

8 A That would afford an opportunity for compensating
9 drainage and protection of correlative rights, yes, sir, it
10 would.

11 Q What about the former Gulf B lease, Number L-16
12 immediately to the north of the M-16, would the same thing
13 be true there?

14 A Some additional well would be required there for
15 compensation to that particular forty acres too, yes, sir.

16 Q And what about L-17 then to the east?

17 A To the north?

18 Q To the east of L-16.

19 A Yes, there would need to be another similarly
20 located well with respect to the Cox well to afford --

21 Q What you would wind up with, under those conditions,
22 would be four wells located within approximately one hundred
23 feet of one another?

24 A Yes, sir, essentially.

25 Q Now, in your opinion, knowing the Empire-Abo

1 reservoir, do you feel that the addition of three more wells
2 in this field at the approximate locations that we have talked
3 about here, do you feel that would recover any significant
4 amount of additional oil from the Empire-Abo pool, enough to,
5 say, cover the cost of drilling three additional wells?

6 A No, sir, I do not believe it would.

7 Q Would that in your opinion constitute economic waste?

8 A Yes, sir, it would.

9 Q Now, if all four of these, the real well we have
10 here and the three hypothetical wells, were produced at that
11 point within a hundred feet of one another, could reservoir
12 damage occur or, say, water influx or gas-oil ratio problems
13 occur that would actually result in reduced recovery in that
14 area of the reservoir and possibly waste?

15 A It could, yes, sir.

16 MR. STAMETS: No other questions.

17 MR. RAMEY: Mr. Day?

18

19 FURTHER CROSS EXAMINATION

20 BY MR. DAY:

21 Q Mr. Currens, you are aware in your experience that
22 in adjusting of correlative rights, infringing wells have
23 been penalized of their production through their allowable?

24 A Yes, sir.

25 MR. DAY: Thank you.

1 MR. RAMEY: Any further questions of this witness?
2 Mr. Buell?

3 MR. G. BUELL: I have one question on redirect.
4
5

6 REDIRECT EXAMINATION

7 BY MR. G. BUELL:

8 Q Mr. Currens, when you look at the bottom-hole
9 location of that well only nine feet from our line, can you
10 think of any effective penalty that the Commission could
11 apply to that bottom-hole location nine feet from our line
12 that would make the well an economic well without at the same
13 time violating our correlative rights?

14 MR. DAY: If the Commission please, I would rather
15 the witness would be asked what his opinion is and not that
16 that would be answering for the Commission. I ask that the
17 question be rephrased as to whether or not a penalty would
18 adjust the correlative rights or not, but not to what the
19 Commission could do or not do. He is not answering for the
20 Commission. I am objecting to the suggestion.

21 MR. G. BUELL: I apologize again. The way Mr. Day
22 phrased it is certainly the way I intended to ask it.

23 Q (Mr. G. Buell continuing.) Mr. Currens, can you,
24 as a reservoir engineer, see any effective penalty that this
25 Commission could apply, that would allow this well, bottomed
only nine feet from our lease line, produce at economic rates

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1 without violating the correlative rights of the offset
2 owners?

3 A No, sir.

4 MR. G. BUELL: That's all.

5 MR. DAY: No questions.

6 MR. LUCERO: I have one question.

7 MR. RAMEY: Mr. Lucero.

8
9 CROSS EXAMINATION

10 BY MR. LUCERO:

11 Q With respect to this map, DN-Two submitted by Amoco,
12 north is not shown on this map, are the two directions, the
13 two lines that are shown there oriented to a true north as
14 they would be on the ground?

15 A Yes, sir, this is the north line of the lease. The
16 direction north would be the direction of this line that is
17 marked on the west line. North is to the top of this exhibit,
18 west is to the left.

19 Q I realize that in general but I'm talking as to
20 true north and the accuracy of scale with respect to degrees
21 and minutes and the radius that you show.

22 A Sir, it's relative. I believe it is with respect
23 to magnetic north as opposed to true north. I believe it is
24 magnetic since that is the nature of the surveys that are
25 run, magnetic north as opposed to true. That is my impression

1 of the way the surveys are run.

2 MR. DAY: Mr. Currens, I didn't understand your
3 answer to the Commissioner's question. Is that lease line
4 a true north and south line on the left or a true east and
5 west line on the top? Do you know this from a ground survey?

6 MR. CURRENS: No, sir, I do not know this from a
7 ground survey.

8 MR. DAY: Thank you. That's all.

9 MR. RAMEY: Any further questions of the witness?
10 He may be excused.

11 (THEREUPON, the witness was excused.)

12 MR. DAY: If the Commission please, as you know
13 we have proposed a continuance for the purpose of getting
14 into the reservoir and the communications of the stratum and
15 we would like to reserve further questions of Mr. Currens if
16 he appears at a later hearing, should it be granted. Thank
17 you.

18 MR. G. BUELL: Mr. Currens will be here.

19 I would like at this time to call Mr. Vickers who
20 has been subpoenaed.

21 If it please the Commission, I'm going to move as
22 rapidly as I can. I believe we have a good chance of finishing
23 before five o'clock and I know that all of us would prefer
24 that.

25

R. B. VICKERS

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

DIRECT EXAMINATION

BY MR. G. BUELL:

Q Mr. Vickers, you have been subpoenaed to appear today, have you not?

A Yes.

Q Would you state your complete name, by whom employed, in what capacity and what location?

A R. B. Vickers, Directional Drilling Engineer or Supervisor, excuse me, with Eastman Whipstock in Midland, Texas.

Q All right, sir, this record reflects that Eastman Whipstock was the company that handled the Directional drilling, deviating and control of Mr. Cox's Federal EA Number 1, you are aware of that?

A Yes.

Q Were you the Eastman representative that handled the directional drilling and control on this particular job?

A Yes.

Q You were the Eastman representative that oriented the Dyna-Drill and made the Dyna-Drill runs?

A Yes.

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1 Q And is a Dyna-Drill another tool, being able to
2 make a well go in a certain direction?

3 A Yes, it is.

4 Q Mr. Vickers, I'm going to direct your attention,
5 after I show this to counsel, this is Exhibit Three at the
6 eleven, nineteen, seventy-five hearing. I will identify it as
7 DN-Four for the purpose of this hearing.

8 MR. DAY: Thank you.

9 Q (Mr. G. Buell continuing.) Mr. Vickers, I am going
10 to hand you an exhibit that you testified from on November 19th,
11 but before I hand it to you though, I'm going to show it to
12 the two Commissioners. It is the only copy we have and I would
13 like for them to have an idea of what it is. It is Amoco's
14 Exhibit Three of November 19th. I've identified it today as
15 Amoco's DN-Four and let me briefly, we have to handle it
16 carefully, it is about to come to pieces. Are you familiar
17 enough with our Exhibit DN-Four that you could briefly state
18 what it is while the Commissioners are looking at it?

19 A I think so.

20 Q Would you try, please?

21 A It is a plat of the proposed directional well that
22 we drew up in our office that contains the direction that the
23 well was to be deflected and the amount of angle required to
24 reach that center point of our target.

25 Q All right, sir.

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1 A I used it as a working plat while drilling the well
2 to plot the pictures.

3 Q Is that the reason it is so soiled and tattered and
4 torn, if I may use that expression?

5 A Yes, sir.

6 Q Mr. Vickers, in directionally deviating and control-
7 ling the direction of a well, is it always necessary that you
8 have a target area so that you will know what the objective is
9 for the bottom-hole location?

10 A Yes, you must have one.

11 Q This is the plat that was given to you for your
12 use in directionally drilling and controlling the Cox well?

13 A Yes, sir.

14 Q And up in the upper left-hand corner, which would be
15 the extreme northwest portion of this forty-acre tract shown
16 on our Exhibit Two over there, it is labeled a target area
17 and it is a hundred feet square?

18 A Yes, sir.

19 Q And right in the middle of that target area is a
20 little circle, what is the significance of the circle that
21 is in the middle of the hundred foot square target area?

22 A Well, that is the proposed target point for the
23 well from the surface location.

24 Q Do you know of your own knowledge who picked the
25 target bottom-hole location or the target area reflected on

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1 Exhibit DN-Four?

2 A No, sir, I do not.

3 Q All right, sir, you do know that this is what was
4 given to you when you went out to the well to kick the well
5 out of the old hole?

6 A Yes, sir.

7 Q All right, I think it is obvious by this wear and
8 tear that this plat has seen considerable usage, did you have
9 it with you at all times that you were out at the Cox well?

10 A Yes, sir.

11 Q Did you have it unfolded and were using it on the
12 floor and in and around the well location?

13 A Yes, sir.

14 Q All right, sir, now I noticed from the kick off
15 point reflected on DN-Four, you have what appears to me to
16 be the trace of a directional survey, it looks quite similar
17 to that plotted on Exhibit DN-Two, just behind you there, and
18 ending up approximately nine feet east of our lease line?

19 MR. DAY: May the Commission please, I'm without
20 the benefit of following the exhibit, may I either join Mr.
21 Guy Buell --

22 MR. G. BUELL: Please, Mr. Day, I realize this is
23 grossly unfair to you but this is the only one we have.

24 MR. DAY: I appreciate that.

25 MR. G. BUELL: I don't think it would stand

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1 reproduction.

2 Q (Mr. G. Buell continuing.) Do you remember the
3 question I asked you?

4 A You asked me what that trace was, I believe.

5 Q Yes, sir, is that the trace of a directional survey
6 that we see on --

7 A That is a plot of the survey pictures as they were
8 taken as the well was drilled.

9 Q All right, sir, now I understand that a single-shot
10 survey was run, is that correct?

11 A Yes, sir.

12 Q Does that mean that a directional shot point was
13 made at each place on Exhibit DN-Four, I see a little round
14 mark, I think they are all identified by footages on our
15 Exhibit DN-Two. Does that represent where a single-shot
16 directional point was taken?

17 A Yes, sir.

18 Q Let me ask you this: Did you run several of those
19 single shot points at once and then get a reading on it, or
20 did you get a reading every time you ran a single-shot point?

21 A Well, we got a reading every time we ran it, yes,
22 we got an additional shot point.

23 Q Mr. Vickers, that was a very awkward question. Let
24 me try again. I notice that these appear to be about every
25 sixty-five feet, a directional shot point?

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1 A Yes, sir.

2 Q My question was meant to be, did you drill, say, four
3 or five hundred feet then run a shot point every sixty-five
4 feet in that newly made hole, or did you, after you had drilled
5 sixty-five feet, take a shot point?

6 A After each period there, whatever it was, sixty or
7 sixty-five feet or whatever.

8 Q Any time along the path of this survey, at any period
9 of time that you ran this single shot, you knew and everybody
10 on the rig floor knew or could have known, the bottom-hole
11 direction that this well was taking?

12 A Yes, sir.

13 Q All right, sir, I know you can't testify as to
14 other people's knowledge, but did you in any way attempt to
15 make a secret of this plat around the well?

16 A No.

17 Q You used it, could a casual observer or a knowledge-
18 able person tell that this was your work tool and the target
19 area was your objective?

20 MR. DAY: I object to that question on that he
21 is testifying as to what other people might know. We answer
22 the questions only within the knowledge of the witness.

23 MR. G. BUELL: I will withdraw the question, Mr.
24 Ramey.

25 Q (Mr. G. Buell continuing.) All right, sir, do you

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1 recall any specific instructions given to you at the well
2 site when you were orienting your Dyna-Drill tool to get out
3 of the old hole?

4 A. Well, to sidetrack the hole in a direction prescribed
5 on this plat.

6 Q All right, sir, from looking at the survey there
7 on that plat, your work plat before the Commission or Amoco's
8 Exhibit DN-Two, it is obvious that you were successful in
9 kicking the well off to the northwest?

10 A. Yes.

11 Q All right, sir, in the interest of time, Mr. Vickers,
12 I'm going to just as quickly as I can, now, we are out of the
13 hole and we're headed to the northwest, did anyone connected
14 with Mr. Cox, by that I mean Mr. Ratts or Mr. Cox or anyone,
15 ever tell you, give you instructions, that the target area had
16 been changed from what we see on your work plat, Amoco's
17 Exhibit DN-Four?

18 A. No, sir.

19 Q After you got out of the hole and were well on your
20 way to the northwest, the Dyna-Drill was run again just
21 below forty-six, seventy-three, almost at a depth of fifty-two,
22 twenty-seven and the last time at a depth of fifty-eight,
23 twenty-three, is that correct?

24 A. That is right.

25 Q Did you make a recommendation to the Cox representative

1 on the well at that time as to the orientation of the Dyna-Drill?

2 A Yes, sir.

3 MR. DAY: If it please the Commissioners, before
4 the witness answers, I don't know all of the testimony Mr. Buell
5 is going into concerning what other people who are not present
6 at this hearing might have said to Mr. Vickers or not said to
7 Mr. Vickers. I'm not objecting to the question or the answer,
8 I'm only pointing out that we may, please, reserve the right
9 to produce the witness in rebuttal if we get into an area
10 which I feel that we need to produce the evidence or testimony
11 showing conflict.

12 MR. RAMEY: Yes, I think that would be in order.

13 MR. DAY: Thank you.

14 MR. G. BUELL: May it please the Commission, I'm
15 trying to do this as legally as I know how from the standpoint
16 of proper evidence procedure, as well as as rapidly as I can.
17 I hope I don't cut too many corners off, I'll try not to.

18 Q (Mr. G. Buell continuing.) All right, I believe I
19 asked you that with respect to the Dyna-Drill run at forty-six,
20 seventy-three. I'll try to ask them in a little more legal
21 and proper way in regard to the Dyna-Drill run at fifty-two,
22 twenty-seven. Did you make a recommendation as to how the
23 Dyna-Drill should be oriented on that Dyna-Drill run?

24 A Yes, sir.

25 Q Did anyone countermand your recommendations or give

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1 you any different instructions?

2 A. No, sir.

3 Q. I'll ask you the same question with regard to the
4 Dyna-Drill run at a depth of approximately fifty-eight, twenty-
5 three?

6 A. The answer would be the same.

7 Q. You made a recommendation and no one in the Cox
8 organization countermanded it or instructed you differently?

9 A. No.

10 Q. All right, sir, at all times that these three
11 Dyna-Drills were run, forty-six, seventy-three; fifty-two,
12 twenty-seven; and fifty-eight, twenty-three, was your sole
13 objective to more nearly hit the center of your target area,
14 as reflected on Amoco's Exhibit DN-Four?

15 A. Yes, sir, it was.

16 Q. And, of course, in more nearly hitting the center
17 of your target area that would also have a visual benefit of
18 keeping the well on the Cox lease?

19 A. Yes, sir.

20 Q. Now, I believe you and I at the previous hearing,
21 we took a straight edge and eyeballed some of these points,
22 that if that direction continued, on the total depth the well
23 could possibly be off the lease?

24 A. Yes, sir.

25 MR. G. BUELL: May it please the Commission, that's

1 all I have by way of Mr. Vickers.

2 MR. RAMEY: Any questions of the witness?

3 MR. G. BUELL: I would like to formally offer
4 Amoco's Exhibit DN-Four, which was Amoco's Exhibit Three at
5 the November 19th, 1975 hearing.

6 MR. RAMEY: Without objection it will be admitted.
7 (THEREUPON, Amoco's Exhibit DN-Four was
8 admitted into evidence.)
9

10 CROSS EXAMINATION

11 BY MR. DAY:

12 Q Mr. Vickers, how long have you been in the directional
13 drilling field?

14 A About twenty-eight years.

15 Q In this area are you familiar that there is a
16 formation drift to the west?

17 A Yes, sir.

18 Q All right. Mr. Vickers, could you explain, if you
19 know, sir, the difference in the estimates of three Dyna-tools
20 made to Mr. Cox, presumably with all of this information
21 that perhaps that you have, and the fact that there were more
22 Dyna-tools used actually in the drilling. The estimate was
23 three and my question is why there were seven?

24 A In order to clarify that I would have to go along
25 here a little bit and explain the terminology, for one thing,

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1 if I may.

2 Q All right.

3 A In our business we consider a turbo-drill run from
4 the time or the depth you begin that run until you run another
5 drilling assembly, other than the Dyna-Drill in the hole.
6 In other words, if it takes three bits to complete a run that
7 still is classified as one Dyna-Drill run in our terminology.
8 So with that in mind, we made five Dyna-Drill runs, two of
9 them required two bits.

10 Q But you charged more?

11 A Well, not necessarily.

12 Q But you did, isn't that correct or do you know?

13 A No, I don't believe we did. We did on one run but
14 on the other, due to the nature of the charge, there is a
15 minimum charge of eight hours actual drilling time on the tool
16 and if you don't exceed that with two bits then there is no
17 additional charge.

18 Q I'm sorry, Mr. Vickers, my question was a comparison
19 between the estimate of the cost that Eastman made before the
20 well commenced and then what was actually charged later. You
21 said more Dyna-tools may be used to accomplish it?

22 A There were two more runs than we estimated.

23 Q And you charged for two more?

24 A Yes, sir.

25 Q How accurate was your drilling, in your opinion,

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1 disregarding the fact of the instructions as to the target area,
2 as to what you actually did?

3 A Well, we would consider it fairly good.

4 Q And how far were you off?

5 A Somewhere between thirty-five and forty feet from
6 the center of the target.

7 Q All right. How good an art, or do you consider a
8 Dyna-tool an art, deviating in drilling an art?

9 A Well, it would be an art as opposed to a science.

10 Q All right, sir, how accurate do you feel that the
11 deviation drilling is that Eastman does?

12 A Very good.

13 Q All right, sir, are you familiar with Gailen B.
14 Marshall? He is a Senior Staff Engineer, Technical Services,
15 serving on the advisory staff of the vice president of
16 marketing, U.S.A. for Sperry-Sun.

17 A No, sir, I'm not.

18 Q What would be your comment concerning the experience
19 you have had in this field, to these statements made by him?

20 (Reading.) Torque lag is the condition when torque
21 is applied to the drilling string at the surface of the bore-
22 hole to achieve a turn of the toolface down hole at the
23 deflection device on top of the mud motor. There have been
24 many observations where the drill pipe was turned one hundred
25 and eighty degrees at the surface and the drill pipe had

1 to be worked up and down as many as fifteen to twenty times
2 before the mud motor turned the complete one hundred and
3 eighty degrees in order to start drilling along the desired
4 course. (End of reading.)

5 Now, do you have any comments on this?

6 MR. G. BUELL: Pardon me. Mr. Vickers, that was a
7 rather long statement, can you recall all of it or would you
8 like to read it for yourself?

9 MR. DAY: It's your option, sir.

10 A Well, I would say that with limitations that is
11 true. It depends on the depth of the well.

12 Q (Mr. Day continuing.) All right, the deeper the
13 bore hole, the greater the torque lag?

14 A Yes, sir.

15 Q (Reading.) The smaller diameter drilling strings
16 that are becoming more and more common due to the high
17 tensile loading of the rigs compound the torque lag problem.
18 The worst case is when a hole is being drilled with small
19 diameter drill pipe and the kick off point is very deep. The
20 torque applied to the drilling string at the surface is very
21 difficult to work down to the relatively short section of
22 drill pipe in the deviated borehole. (End of reading.)

23 A That's true.

24 Q (Reading.) The kick off point acts as a fulcrum
25 which does not allow the torque, introduced at the surface,

1 to be evenly distributed throughout the total drilling
2 string. The mud motor is virtually impossible to control by
3 conventional drilling practices when these borehole conditions
4 exist. (End of reading.)

5 MR. DAY: If the Commission please, I have a copy of
6 this I will leave with the Commission at the conclusion of
7 the hearing for their review if they should be so inclined.

8 I have no other questions.

9 MR. HINKLE: If the Commission please, I have some
10 questions, too.

11
12 CROSS EXAMINATION

13 BY MR. HINKLE:

14 Q Mr. Vickers, did you witness all of the single-shot
15 surveys, yourself?

16 A Yes, sir, I did. I ran those personally.

17 Q How reliable are single-shot surveys as compared
18 to multi-shot surveys?

19 A Well, they are as accurate, the only thing that
20 varies is the method with which they are photographed.

21 Q Now, is there any radius of error in it, whether
22 it is a single-shot or multi-shot survey?

23 A Well, I'm sure there is.

24 Q Have you had any experience as to how much that
25 radius of error might be?

1 A. No, sir, I have not.

2 Q Well, could you say whether it might be ten, fifteen
3 or twenty feet?

4 MR. DAY: If the Commission please, the witness has
5 answered the question and he is now trying to force an answer
6 from him.

7 Q (Mr. Hinkle continuing.) You just don't know?

8 A Yes, sir.

9 Q As to what the radius of error might be, is that
10 correct?

11 A That is correct.

12 Q But you do know that there could be an error in
13 the pinpoint of the bottom hole of the well?

14 A Yes, there could be.

15 MR. HINKLE: That's all.

16 MR. RAMEY: Mr. Stamets?

17
18 CROSS EXAMINATION

19 MR. STAMETS:

20 Q I would like to follow up on what Commissioner
21 Lucero was asking awhile ago. The instrument that you ran
22 in the hole, is that on true north or magnetic north on the
23 setting of this hole?

24 A It is a magnetic compass and each of these pictures
25 is corrected back to due north.

1 Q I'm still confused by your answer.

2 A In other words, you would get a magnetic reading
3 whenever you develop the picture and whatever the declamation
4 is in that area, would be subtracted or added to it to correct
5 it back to a true north reading.

6 Q This is done later in the office so what has been
7 drawn on the exhibit there would be true?

8 A It is a true north representation, yes, sir.

9 MR. STAMETS: Thank you. That's all of the questions.

10 MR. RAMEY: Mr. Vickers, I have heard a lot about
11 the accuracy of directional drilling, is it true that you are
12 able to maybe intercept a borehole of a well that is blowing
13 out by directional drilling?

14 MR. VICKERS: It is possible. I, myself, have
15 never heard of it being done but to answer your question, it
16 is possible to get close enough to the borehole to establish
17 communications and extinguish a wild well.

18 MR. RAMEY: Thank you. Any other questions of
19 the witness? He may be excused.

20 (THEREUPON, the witness was excused.)

21 MR. G. BUELL: May it please the Commission, we
22 would like at this time to call Mr. Coats who is also here
23 under subpoena.
24
25

JAMES B. COATS, JUNIOR

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

DIRECT EXAMINATION

BY MR. G. BUELL:

Q Mr. Coats, how do you spell your last name?

A C-o-a-t-s.

Q No "e" in it?

A No, sir.

Q I've seen it both ways.

Would you please, sir, state your full name, by
whom you are employed and in what capacity and in what
location, please?

A James B. Coats, Junior and I'm a salesman for
Eastman Whipstock in Midland, Texas.

Q All right, are you the Mr. Coats that has been
referred to in prior testimony, that called on Mr. Cox in his
office in Dallas early in June and you called on him as a
salesman for Eastman Whipstock?

A Yes, sir, I am.

MR. G. BUELL: Mr. Ramey, to save me a long walk,
would you mind holding up the Exhibit DN-Four so that Mr.
Coats can see it?

MR. RAMEY: Yes, sir.

1 Q (Mr. G. Buell continuing.) Is that exhibit, the plat
2 portion of that exhibit, identical to a plat that you had
3 prepared in your Midland office and sent to Mr. Cox in his
4 Dallas office?

5 MR. DAY: Does counsel mean with all the curvatures
6 and lines, just what part of the plat, the graph on the left?

7 A If I may, I will use this portion, the solid, you
8 know, the vertical section and horizontal plot without any of
9 the points here.

10 MR. DAY: I'm sorry, Mr. Coats, would you do that
11 again?

12 A This section here, the vertical section and the
13 horizontal plot and the target area.

14 MR. DAY: What about this shaded area here, just
15 the heavy lines you are talking about?

16 A Yes, sir.

17 MR. DAY: Thank you.

18 Q (Mr. G. Buell continuing.) All right, sir, this
19 is critical from my standpoint. The plat that you did send
20 to him, had the target area up in the northwest corner with
21 the bottom-hole target location right in the center of that
22 square target area?

23 A Yes, sir.

24 Q And the target area was a hundred square feet?

25 A Yes, sir.

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1 Q Which made the little hole, the little circle right
2 in the center, fifty from the north line and fifty from the
3 west line?

4 A Yes, sir.

5 Q Mr. Coats, have you had any educational and experience
6 background in the field of petroleum geology?

7 A No, sir, I don't.

8 Q Do you have an educational background or experience
9 background in the field of petroleum engineering?

10 A No, sir, I don't.

11 Q Do you consider yourself technically expert to pick
12 a bottom-hole location target, based on subsurface conditions?

13 A No, sir, I don't.

14 Q Did you yourself, did you pick the bottom-hole target
15 location which is shown on Amoco's Exhibit DN-Four?

16 A No, sir.

17 Q Are you aware of who did pick that bottom-hole
18 target location?

19 A I worked under the assumption that Mr. Cox told me
20 he wanted -- I had the surface location and he wanted the
21 target point at fifty from the north and fifty from the west,
22 and I probably suggested the target area, you know, just
23 because of cost estimates and this kind of thing.

24 Q In other words, it would be cheaper for you all to
25 contract to hit a target area that was a hundred square feet,

1 than it would to hit a precise bottom-hole target location
2 which would be about eight inches in diameter?

3 A Yes, sir.

4 Q So you might have suggested the hundred foot target
5 area that encompasses the bottom-hole target location fifty
6 feet from the north line and fifty feet from the west line?

7 A Yes, sir.

8 MR. G. BUELL: If it please the Commission, that's
9 all I have.

10 MR. RAMEY: Any questions of the witness? Mr. Day?

11
12 CROSS EXAMINATION

13 BY MR. DAY:

14 Q Mr. Coats, Mr. Guy Buell referred to the contract.
15 When you contract you don't contract on a flat fee, do you?

16 A No, sir.

17 Q You drill on a cost basis or a charge basis for
18 your work?

19 A We have to base it on some figure for the customer.

20 Q Like an hour, is it by the hour?

21 A Oh, no.

22 Q Time and use of tools?

23 A We work on the assumption that there is a basis for
24 it and that's the guidelines I follow and as far as any trouble
25 on the well site, the directional man makes the decision out

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1 there that changes my proposal.

2 Q Would it add to the proposal?

3 A Yes, sir.

4 Q Mr. Coats, you have heard mentioned this morning,
5 the estimate that Eastman made before the well commenced. Did
6 you prepare that estimate or did someone else for Eastman
7 prepare it?

8 A I prepared it.

9 Q You prepared it?

10 A Yes, sir.

11 MR. DAY: Thank you. No other questions.

12 MR. RAMEY: Any questions of the witness?

13 Mr. Coats, in making estimates, do you sometimes
14 overestimate?

15 MR. COATS: Yes, sir, it has been known to happen.

16 MR. RAMEY: Thank you.

17 (THEREUPON, the witness was excused.)

18 MR. G. BUELL: May it please the Commission, that
19 is all of the direct evidence we have to present by way of
20 what I have been calling phase one, the circumstances surround-
21 ing the bottoming of this well only nine feet from our lease
22 line.

23 MR. RAMEY: Mr. Hinkle, do you have anything?

24 MR. HINKLE: We have one witness for Atlantic
25 Richfield but it is directed as to whether or not this is a

1 separate reservoir and if there is going to be a motion to
2 continue the case and if it is continued, we would like to
3 wait until after their testimony on the question has been
4 presented before we present ours.

5 MR. RAMEY: Mr. Day?

6 MR. DAY: May it please the Commissioners, we have
7 no further testimony or rebuttal to offer in connection with
8 this part on which we earlier made our premises. We do at
9 this time and on the grounds heretofore stated, respectfully
10 request the Commission to extend time until February 24th
11 under such conditions that it may deem proper and fair to
12 continue this hearing in order for us to produce testimony,
13 expert testimony and so forth, on the communications of the
14 reservoir from which Mr. Cox's well is producing in the
15 Empire-Abo field.

16 MR. RAMEY: Mr. Day, would it be necessary to have
17 Mr. Vickers and Mr. Cox back?

18 MR. DAY: Well, sir, if you please, Mr. Commissioner
19 I cannot at this present time think of any reason. If I do,
20 I will at the most reasonable time immediately notice with
21 the Commission and Mr. Buell and Mr. Hinkle and arrive at a
22 satisfactory situation in that event. Presently I do not
23 intend to do so.

24 MR. RAMEY: In other words, you want Mr. Howard,
25 Mr. Currens, Mr. Ricks and Mr. Meglasson.

1 MR. DAY: May I confer with Mr. Buell?

2 MR. RAMEY: Yes, sir.

3 (THEREUPON, a discussion was held off
4 the record.)

5 MR. DAY: Ricks, Howard and Meglasson.

6 MR. RAMEY: Ricks, Currrens, Howard, I think those
7 are the three?

8 MR. DAY: Mr. Currrens said he would, I believe Mr.
9 Currrens said he would appear anyway?

10 MR. G. BUELL: Yes, Mr. Currrens will appear, absent
11 the subpoena or with the subpoena.

12 MR. DAY: We have no requirement of Mr. Meglasson.
13 He can be excused.

14 MR. RAMEY: How about Mr. Howard and Mr. Ricks?

15 MR. DAY: Mr. Commissioner, we would like to
16 continue the appearances of Mr. Ricks and Mr. Howard, subject
17 to any objections counsel may have.

18 MR. HINKLE: We have no objection to having them
19 return.

20 MR. G. BUELL: May it please the Commission, could
21 I be heard on this one small matter? I do plead with the
22 Commission that we be excused from hauling those heavy
23 samples back out here again. We offer Mr. Cox the opportunity
24 at his convenience. He can examine them at his leisure in our
25 office in Houston. As you all can see, a hearing room is not

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1 the proper place for a geologist to evaluate samples.

2 MR. DAY: No, we have no requirement on the samples.

3 Thank you, Mr. Commissioner.

4 MR. G. BUELL: May I be heard briefly on the
5 motion to continue?

6 MR. RAMEY: Yes, first, Mr. Buell -- as we understand
7 it, Meglasson, Vickers and Coats will be excused unless you
8 notify us otherwise?

9 MR. DAY: Yes, sir.

10 MR. RAMEY: All right, Mr. Buell.

11 MR. G. BUELL: May it please the Commission, I
12 again state to the Commission, we would have no objection at
13 all to postponing the separate reservoir phase of the
14 hearing until February 5th. Again I would like to say, that
15 is over two weeks, we think that is more than a reasonable
16 amount of time with all the data and all the work that Mr.
17 Cox has already done. True, they might not be able to get
18 the petroleum engineer of their choice, he may have other
19 commitments. In regard to that I'm reminded of what happened
20 to me out here one time before the Commission when I attempted
21 to get a continuance on the basis that I would not be available.
22 The remark of the Commission officer was pretty much to the
23 point. He said that Guy Buell was not the only lawyer in the
24 United States. He was as right as he could be and I would like
25 to state that this engineer that they are thinking of, whoever

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1 he might be, is not the only competent, capable consulting
2 reservoir engineer in Southeast New Mexico and we do feel that
3 two weeks, over two weeks, is a reasonable amount of time to
4 get ready.

5 MR. DAY: May it please the Commission, may I reply
6 to Mr. Buell's argument and also sum up the testimony that was
7 heard today? I'm used to giving an opening statment and
8 hearing the argument rebuttal by the other side and then
9 rebuttal here, but however the Commission desires to proceed
10 is fine. Am I allowed to comment on the evidence at this
11 point?

12 MR. RAMEY: Let me ask Mr. Hinkle and get his
13 recommendations on the continuance.

14 MR. HINKLE: We would prefer that it only be
15 continued to the fifth of February. If it is continued beyond
16 that we think the allowable ought to be cut to just enough to
17 save the lease, maybe producing the well one day a month,
18 that's all. This thing has gone on and on and it looks like
19 it is going to go on and on as long as you continue the case
20 and, of course, they are producing a good deal of oil. They
21 have admitted that they have squarely violated the order
22 which was issued. There is no question about that and the
23 well is bottomed eight feet or nine feet from the Empire-Abo
24 pool and there is a grave question as to whether it is just
25 the same as if it were in the Empire-Abo pool, so it is

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1 violating correlative rights every day that thing continues
2 and I think that two weeks is long enough to get a petroleum
3 engineer if they can't get the one that they have requested.

4 MR. RAMEY: All right, Mr. Day.

5 MR. DAY: May it please the Commission, it has been
6 obvious from the outset that Mr. Cox never pretended that he
7 was drilling within the permit. He is not experienced in this
8 matter, he is not experienced with this, he was going to the
9 best of his memory and his testimony but he never willfully
10 violated the Commission's order, never willfully violated
11 the Commission's permit.

12 Regarding the correlative rights, we challenge that
13 any correlative rights are being violated whatsoever. We
14 submit that the well can be found by the Commission to be
15 located on the Cox lease. If there should be a Commission
16 determination of any correlative rights then we submit that
17 these can be adjusted as Mr. Hinkle suggested by a penalty
18 on the production but I urge the Commission in so making
19 this determination to keep in mind that the other two wells
20 that produced on this lease that were shut in for a period
21 of time flooded out. We would respectfully submit to the
22 Commission that some determination be made where some produc-
23 tion could be kept until the date of the continuance. If in
24 its determination the Commission feels that it can make a
25 proper adjustment, then I see no urgency or emergency in

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1 hearing this matter on February the 5th. The Commission has
2 heretofore been submitted the statement from the expert witness
3 that he cannot even commence the study until February 4th. It
4 is a complex case. You have heard the operator testify that
5 he has made diligent effort to attempt to locate an engineer
6 who is familiar with this reservoir.

7 On those grounds we respectfully submit to the
8 Commission in its determination that it take into consideration
9 the fact that this engineer be allowed ample time to study
10 this reservoir. Certainly he will come against witnesses of
11 Amoco and Arco that have lived with this field for a number of
12 years and in all fairness he should be given proper and adequate
13 and reasonable time to prepare his study and so appear and
14 testify and make himself available to cross examination and
15 whatever. Thank you.

16 MR. RAMEY: Mr. Cox, would you, if a continuance
17 is granted to the 24th, would you be willing to shut your
18 well in?

19 MR. COX: Yes, sir. I would rather not but if that
20 is the order of the Commission I will shut the well in.

21 MR. RAMEY: Upon the order of the Commission?

22 MR. COX: Upon the order of the Commission.

23 MR. RAMEY: Did you want to say something, Mr. Buell?

24 MR. G. BUELL: Well, I didn't know whether it was
25 the pleasure of the Commission to hear all closing arguments

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1 on this basis of this phase of the case or wait and have us
2 make our closing arguments on both phases when phase two is
3 over. I was just asking for direction.

4 MR. RAMEY: I would suggest that if you want to make
5 a closing argument on this phase now would be the time to do
6 it.

7 MR. G. BUELL: Well, you know any time the Applicant
8 makes a closing argument I feel that it is only proper that
9 I should.

10 I would like to say this to the Commission. We
11 have not in any way attempted to imply or infer that Mr. Cox
12 tried to hide the true bottom-hole location of his well from
13 the Commission or the injured. As a matter of fact, there
14 is no way in the world that he could because this Commission
15 requires in the case of an essentially deviated well such as
16 this, that one of the conditions preceding and prior to getting
17 an allowable is that you have to file a directional survey
18 with the Commission, showing this Commission where the
19 bottom hole is.

20 I do question in my mind Mr. Day's reference that
21 his violation wasn't willful. I won't use the word willful
22 but I will call to your attention that Mr. Cox had from
23 January 12th to the 8th day of July to get a copy of the
24 Commission order, to replace the copy that was burned in the
25 fire. All in the world it would have taken was a simple phone

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1 call to this Commission or to his attorney here in Santa Fe.
2 He did not do that.

3 Also Mr. Cox knew his solemn sworn testimony to
4 this Commission in May of 1973 was the direct opposite of what
5 he actually did in directionally drilling and controlling this
6 well. I might forgive a geologist for forgetting what is in
7 a Commission order, I might forgive him for not picking up the
8 phone and getting another copy of this, but it is hard for
9 me as a lawyer who practices before this Commission to forgive
10 a man who treats his sworn testimony so lightly.

11 This record clearly and conclusively shows that if
12 Mr. Cox had done what he told this Commission he wanted to do
13 and what your order permitted him to do, he would be four
14 square within the confines of that order. I won't say it's
15 a willful violation, I certainly will say it is a flagrant
16 violation.

17 I will also point out to the Commission that
18 around the periphery of the Empire-Abo field there are many
19 opportunities where an operator, if he could locate a well,
20 down dip, only eight feet from his property line, he can make
21 a well and he will be there producing as long as that
22 reservoir is in existence. We think that is grossly unfair
23 and we don't think that should be permitted by this Commission.

24 We also feel that if Mr. Cox felt he needed
25 assistance from a consulting engineer in establishing his

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1 separate reservoir theory, that he had ample opportunity from
2 July 31 when his well was completed to the hearing on October
3 8th on his own application to have obtained a consulting
4 petroleum engineer and presented his case. Mr. Cox chose not
5 to do that. He chose to present his case himself and apparently
6 now he does feel that he needs back up and we are certainly
7 willing to any reasonable continuance. The reason we ask
8 for a reasonable continuance is that in our opinion and as
9 our incontroverted testimony shows, each day that that well
10 produces our correlative rights are being violated. If the
11 well was not producing our correlative rights would not be
12 violated so I would be hard pressed to object to any kind of
13 a continuance this Commission would want to grant.

14 MR. DAY: In closing, Mr. Commissioners, the drilling
15 permit was obtained two years, two years and one month, if
16 my dates are correct, from the time he secured the permit until
17 the time he commenced the well. This is a long time, he had
18 a fire, he doesn't have a staff of people working for him.
19 His records were destroyed or smoke damaged and his best
20 efforts, within his own confines and ability, being in
21 Hamilton County, on leases that were expiring, on security
22 title matters, he was in danger of losing one of the key
23 leases in that little pool there, to try to comply with the
24 terms of the lease with the USGS or BLM, whatever it is, on
25 this lease. He was hurried and somewhat harassed and

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1 mistakenly trusted what he felt was the true memory of the
2 permit. It was not meant to be a willful or flagrant violation.

3 As to the reservoir, being able to snuggle up close
4 to the reservoir, we will let the record speak for itself
5 at the continuance hearing. As far as the continuance of the
6 hearing, we respectfully urge the Commission to entertain
7 the date of February 24th, against its determination now or
8 in a few days, under what conditions they would make that
9 setting.

10 At this time, if I may, I would like to leave with
11 the Commission as far as review, the article on deviation
12 drilling by Mr. Marshall referred to earlier from the
13 Petroleum Engineer magazine of July 1975, and I will submit
14 copies to other counsel as soon as I get them, which will be
15 as soon as I get back. It is not an exhibit, sir.

16 MR. RAMEY: This is not an exhibit. Do you all have
17 any objection?

18 MR. G. BUELL: I have no idea what it is, so I
19 certainly have no objection, sir. As I understand it, he
20 was formerly offering it as an exhibit and I don't know if I
21 have a right to object.

22 Mr. Hinkle and I both exhausted our expertise in
23 exactly thirty seconds and we have no objection.

24 MR. RAMEY: Mr. Day, as I understand this February
25 24th is a day that you are free from, shall we say court duty?

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1 MR. DAY: I don't know what the exact problems are
2 of the reservoir engineer. I don't understand that he will take
3 a number of days to complete his study. Speaking for myself,
4 I have had the honor to be appointed by the U. S. Magistrate
5 in Dallas to represent a defendant on a criminal charge, which
6 I think I have had three appointments in criminal cases in my
7 entire life and know nothing about it. Nevertheless I have
8 that honor and the schedule being employed, the court has
9 set it on a prior date that would conflict with an earlier
10 appearance. I'm talking about Tuesdays, now, sir. That is
11 my understanding.

12 MR. RAMEY: We're not looking to Tuesdays.

13 MR. DAY: Well, this case then goes to trial on
14 Monday, I would not conclude it by Tuesday.

15 MR. RAMEY: I'm thinking of an earlier date around
16 the seventeenth.

17 MR. DAY: That is the very date that he has set
18 the trial and I realize that this hearing on the reservoir may
19 take as much as two days.

20 MR. LUCERO: On what date is the trial set?

21 MR. DAY: The seventeenth of February.

22 MR. LUCERO: What is the nature of the case, the charge?

23 MR. DAY: This employee is accused of having left
24 the employment of a Schedule D oil company and falsified or
25 secured a P. O. box address under false credentials,

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1 somebody else's driver's license and had printed up statements
2 for completion costs of wells, payment to be made to that
3 P. O. box address and since the statements to customers of
4 the Schedule D company are apparently in states in which
5 they were joined by the FCC from listing.

6 MR. LUCERO: Is this a jury trial or before a
7 committee magistrate, or what?

8 MR. DAY: No, sir, this is a full jury trial in the
9 North District Court, North District of Texas. It's United
10 States of America versus Solley.

11 MR. LUCERO: Do you have an estimate as to possible
12 trial time?

13 MR. DAY: Two days.

14 MR. LUCERO: So that is the seventeen, eighteenth
15 and nineteenth or seventeenth and eighteenth?

16 MR. DAY: Seventeenth and eighteenth, sir, on
17 Thursday, speaking strictly for myself.

18 MR. LUCERO: Our initital conversation was with
19 respect to the twenty-fourth.

20 MR. DAY: Yes, sir.

21 MR. LUCERO: Do you have a conflict then?

22 MR. DAY: No, sir, not on the twenty-fourth, or
23 the twenty-third or the twenty-fifth. I can rearrange
24 matters on the twenty-sixth, sir.

25 MR. RAMEY: The Commission will grant a recess to

1 February 24th.

2 MR. G. BUELL: May it please the Commission, while
3 you are looking at schedules, I have a matter set in Michigan
4 on February 24th, if you are considering that day.

5 MR. DAY: Do you know how long that will take?

6 MR. G. BUELL: Getting up there and back will take
7 longer than the case and it usually is three days. It takes
8 a day to get up, a day for the case and a day to get back.
9 Lansing, Michigan is not easy to get to.

10 MR. DAY: Sir, I have matters on the twenty-sixth
11 and twenty-seventh. I will rearrange them to fit Mr. Buell's
12 schedule or whatever the Commission says.

13 MR. RAMEY: You are going to be out of pocket
14 essentially the whole week of the --

15 MR. DAY: I think he said the twenty-fourth and
16 twenty-fifth.

17 MR. G. BUELL: Probably the twenty-third, twenty-
18 fourth and twenty-fifth, isn't it? I'm advised that we
19 may be able to move that up a week. The application has
20 already been filed and we have asked for that date, but if
21 we can give sufficient notice by moving it up a week from the
22 twenty-fourth.

23 MR. LUCERO: So then that would coincide with
24 the scheduling that he has in Dallas on a criminal trial.

25 MR. G. BUELL: I'm sure I can advance it.

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1 MR. RAMEY: We will take a five minute recess.

2 (THEREUPON, the hearing was in recess.)

3 MR. RAMEY: The hearing will be recessed until
4 February 24th at nine A.M., probably in this room. Either in
5 this room or the Commission's conference room upstairs.

6 Mr. Howard, Mr. Currens and Mr. Ricks should consider
7 themselves under subpoena to be here on the twenty-fourth.

8 The thirty-five barrel allowable for the well will
9 remain in force during this period of adjournment.

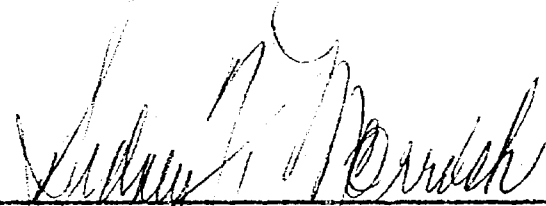
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REPORTER'S CERTIFICATE

I, SIDNEY F. MORRISH, a Certified Shorthand Reporter,
do hereby certify that the foregoing and attached Transcript
of Hearing before the New Mexico Oil Conservation Commission
was reported by me, and the same is a true and correct record
of the said proceedings to the best of my knowledge, skill and
ability.


Sidney F. Morrish, C.S.R.

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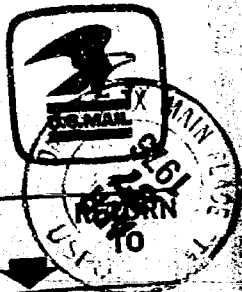
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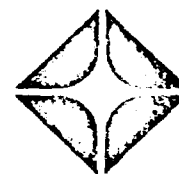
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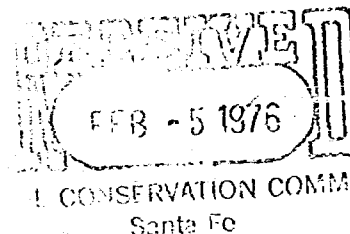
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Permian District
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Midland, Texas 79701
Telephone 915 682 8631



*file - case 5571
note
2/5/76*

February 3, 1976

Mr. Clarence Hinkle
Hinkle, Bendurant, Cox & Eaton
Attorneys-at-Law
Hinkle Building
Roswell, New Mexico



Re: Exchange of Information
Cox et al./Federal EA Lease
Section 12, T-18S, R-27E
Eddy County, New Mexico

Dear Mr. Hinkle:

Attached to this letter is the information requested by Mr. Day for R. G. Cox. This information tabulates TOTCO surveys, at measured depth, on the following wells in the Empire Abo Unit, Eddy County, New Mexico:

M-16; L-16; L-17; L-18; L-19; L-19 (dry hole);
L-20; Amoco Diamond Federal Well

This data was derived from the drillers log and should Mr. R. G. Cox or his representative wish to check the reliability or accuracy of this data, our Midland office is normally open between the hours of 7:45 A. M. and 4:30 P. M.

Atlantic Richfield Company would like Mr. Day's client, R. G. Cox, to furnish us a copy of the logs on the following wells on the above-mentioned lease:

R. G. Cox Federal EA No. 1 (Re-entry)

- 1) IES
- 2) Compensated Density
- 3) Gamma Ray Neutron

R. G. Cox Federal EA No. 2

- 1) Gamma Ray Neutron

A scale of 2-1/2" = 100' would be preferable on the above-mentioned logs.

We would appreciate a response to this prior to February 13, 1976.

Very truly yours,

J. L. Tweed
J. L. Tweed

GES/agp

cc: Mr. Guy Buell, Amoco Production Company, Houston, Tx.
Mr. Joe Ramey, N. M. O. C. C., Santa Fe, New Mexico

EMPIRE ABO UNIT L-16

| DEPTH (FT) | DRIFT INDICATED BY TOTCO (Degrees) |
|------------|---------------------------------------|
| 760 | 1 |
| 1010 | 1/2 |
| 1387 | 1 |
| 1697 | 1 |
| 1935 | 1-1/4 |
| 2072 | 1-3/4 |
| 2232 | 1-1/2 |
| 2504 | 1-1/2 |
| 2906 | 1-1/2 |
| 3205 | 2 |
| 3454 | 2-1/2 |
| 3820 | 2 |
| 3900 | 2-3/4 |
| 3930 | 3 |
| 3993 | 2-3/4 |
| 4040 | 3 |
| 4083 | 3-1/4 |
| 4118 | 3-1/4 |
| 4240 | 3-1/4 |
| 4270 | 3 |
| 4343 | 3 |
| 4406 | 3 |
| 4460 | 3 |
| 4535 | 3 |
| 4576 | 3-3/4 |
| 4620 | 3-3/4 |
| 4665 | 3-3/4 |
| 4680 | 4 |
| 4712 | 4 |
| 4752 | 4 |
| 4770 | 3-3/4 |
| 4795 | 4 |
| 4847 | 3-3/4 |
| 4907 | 3-3/4 |
| 4989 | 3-1/4 |
| 5041 | 3-1/2 |
| 5066 | 4-1/4 |
| 5090 | 4-1/2 |
| 5210 | 4-1/2 |
| 5390 | 4-1/4 |
| 5610 | 4-1/2 |
| 5748 | 4 |
| 5770 | 3-1/2 |
| 6000 | 3 |
| 6080 | 2-1/4 |
| | 2-1/4 |

EMPIRE ABO UNIT L-17

| <u>DEPTH (FT)</u> | <u>DRIFT INDICATED BY TOTCO (Degrees)</u> |
|-------------------|---|
| 170 | 1/2 |
| 400 | 1/2 |
| 610 | 1/2 |
| 1030 | 1-1/4 |
| 1260 | 1-1/2 |
| 1575 | 2 |
| 1700 | 2 |
| 1790 | 1-3/4 |
| 1930 | 1-1/2 |
| 2080 | 1-3/4 |
| 2270 | 1-1/2 |
| 2640 | 1-3/4 |
| 2970 | 2 |
| 3220 | 2 |
| 3470 | 2-1/4 |
| 3790 | 2 |
| 4010 | 2-1/2 |
| 4070 | 2-1/4 |
| 4180 | 2-1/4 |
| 4565 | 2-3/4 |
| 4665 | 2-3/4 |
| 4780 | 2-1/2 |
| 4894 | 2-1/2 |
| 5000 | 2 |
| 5100 | 2 |
| 5160 | 2-3/4 |
| 5325 | 2-1/2 |
| 5400 | 2-1/4 |
| 5560 | 2-1/4 |
| 5630 | 1-1/4 |
| 5680 | 1 |
| 5880 | 3/4 |
| 6060 | 1 |

EMPIRE ABO UNIT L-18

| <u>DEPTH (FT)</u> | <u>DRIFT INDICATED BY TGTCO (Degrees)</u> |
|-------------------|---|
| 153 | 1/2 |
| 400 | 1/2 |
| 605 | 1/2 |
| 850 | 1-1/2 |
| 1150 | 1-1/4 |
| 1550 | 1 |
| 1650 | 1 |
| 1900 | 3/4 |
| 2020 | 1-1/4 |
| 2280 | 1-1/4 |
| 2520 | 1-1/4 |
| 2800 | 1-1/2 |
| 2995 | 1-1/4 |
| 3140 | 1 |
| 3405 | 1-1/2 |
| 3585 | 1 |
| 3825 | 1 |
| 4115 | 1 |
| 4275 | 1 |
| 4400 | 1-1/2 |
| 4790 | 1-3/4 |
| 4840 | 2 |
| 4995 | 1-1/2 |
| 5100 | 1-1/4 |
| 5565 | 2-1/2 |
| 5810 | 3 |
| 5944 | 3-1/2 |
| 6060 | 3-3/4 |

EMPIRE ABO UNIT L-13

| <u>DEPTH (FT)</u> | <u>DRIFT INDICATED BY TOTCO (Degrees)</u> |
|-------------------|---|
| 250 | 1/4 |
| 400 | 1/2 |
| 820 | 1/4 |
| 1535 | 3/4 |
| 1710 | 3/4 |
| 2054 | 1 |
| 2350 | 1 |
| 2700 | 1-1/4 |
| 3130 | 1-3/4 |
| 3400 | 2 |
| 3740 | 2-1/4 |
| 4105 | 2-1/4 |
| 4450 | 2-1/4 |
| 4726 | 2-1/2 |
| 5171 | 2-3/4 |
| 5410 | 4 |
| 5510 | 4-3/4 |
| 5581 | 5-1/2 |
| 5707 | 5-1/4 |
| 5925 | 5 |

EMPIRE ADO UNIT L-19 (DH)

| <u>DEPTH (FT)</u> | <u>DRIFT INDICATED BY TOTCO (Degrees)</u> |
|-------------------|---|
| 475 | 1 |
| 1150 | 1/4 |
| 1540 | 1 |
| 1920 | 2 |
| 2057 | 2 |
| 2232 | 1-1/4 |
| 2430 | 2 |
| 2575 | 2-1/4 |
| 2760 | 2-1/4 |
| 2933 | 2 |
| 3182 | 2-1/2 |
| 3314 | 2-1/2 |
| 3485 | 3 |
| 3700 | 3 |
| 4012 | 3-1/4 |
| 4200 | 2-3/4 |
| 4306 | 3-1/4 |
| 4400 | 3 |
| 4822 | 3 |
| 5116 | 3-1/4 |
| 5235 | 2-3/4 |
| 5365 | 3-1/2 |
| 5500 | 3 |
| 5645 | 3-1/2 |
| 6003 | 2-1/2 |

EMPIRE ABO UNIT L-20

| <u>DEPTH (FT)</u> | <u>DRIPT INDICATED BY TOTCO (Degrees)</u> |
|-------------------|---|
| 535 | 1/8 |
| 1316 | 3/4 |
| 1500 | 3/4 |
| 2000 | 1 |
| 2500 | 3/4 |
| 2999 | 1 |
| 3440 | 1/2 |
| 4500 | 1/2 |
| 4817 | 1/4 |
| 5142 | 1/4 |
| 5592 | 2-3/4 |
| 5805 | 4 |
| 5963 | 4-3/4 |
| 6000 | 5 |
| 6224 | 6 |
| 6230 | 6 |

EMPIRE ABO UNIT M-16

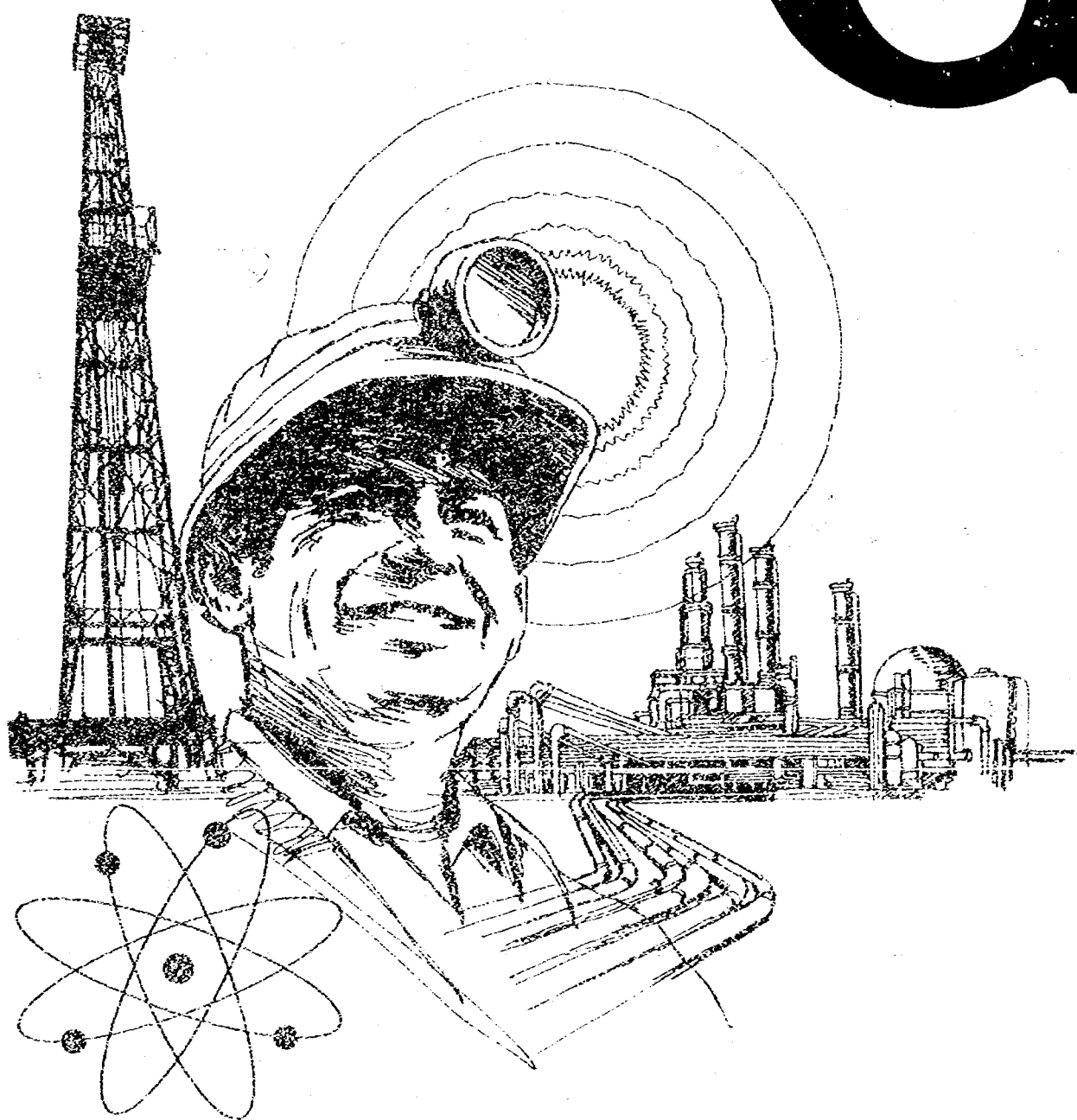
| <u>DEPTH (FT)</u> | <u>DRIFT INDICATED BY TOTCO (Degrees)</u> |
|-------------------|---|
| 125 | 1 |
| 250 | 3/4 |
| 400 | 3/4 |
| 550 | 1 |
| 700 | 1 |
| 850 | 1 |
| 1000 | 1-1/4 |
| 1120 | 1/2 |
| 1250 | 3/4 |
| 1400 | 0 |
| 1630 | 1/2 |
| 1820 | 1/2 |
| 1950 | 1 |
| 2085 | 1 |
| 2205 | 1 |
| 2330 | 1 |
| 2470 | 1 |
| 2765 | 1/2 |
| 2920 | 1/2 |
| 3035 | 1/2 |
| 3270 | 3/4 |
| 3505 | 2 |
| 3715 | 2 |
| 4039 | 2-1/2 |
| 4115 | 3/4 |
| 4200 | 1 |
| 4470 | 1/2 |
| 4540 | 0 |
| 4620 | 1 |
| 4735 | 3/4 |
| 4830 | 1/2 |
| 4915 | 1 |
| 5000 | 1-1/4 |
| 5050 | 3/4 |
| 5135 | 3/4 |
| 5290 | 1-1/2 |
| 5672 | 1-3/4 |
| 5955 | 4 |

AMOCO DIAMOND FEDERAL GAS COM NO. 1

TOTCO SURVEY

| Depth TOTCO Ran | Interval Between TOTCO'S | Drift Indicated By TOTCO |
|-----------------------|--------------------------------|--------------------------------|
| 262' | 262' | 1/2° |
| 550' | 288' | 1/2° |
| 740' | 190' | 1/4° |
| 1120' | 380' | 1/4° |
| 1270' | 150' | 1 1/4° |
| 1437' | 167' | 1/2° |
| 1647' | 210' | 3/4° |
| 1870' | 223' | 0 ° |
| 1990' | 120' | 1/2° |
| 209 | 102' | 3/4° |
| 2359' | 267' | 3/4° |
| 2810' | 451' | 1/4° |
| 3310' | 500' | 1 ° |
| 3645' | 335' | 1/2° |
| 3975' | 330' | 3/4° |
| 4264' | 289' | 1/2° |
| 4610' | 346' | 3/4° |
| 4810' | 200' | 1/2° |
| 4815' | 5' | 1/2° |
| 5105' | 290' | 1 ° |
| 5786' | 681' | 1 ° |
| 6090' | 304' | 2 3/4° |
| 6200' | 110' | 2 1/4° |
| 6395' | 195' | 2 3/4° |
| 6737' | 342' | 3 1/4° |

G



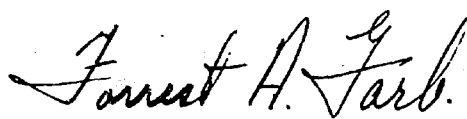
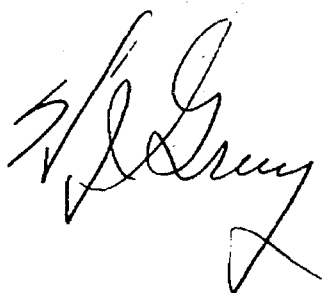
The Gruy Companies

The Gruy Companies are pleased to provide you this latest brochure of our personnel and services. While it is not possible to include every capability in a brochure such as this one, we have attempted to include enough information to demonstrate wide-ranging competence in the energy field.

If you are having energy-related problems, let us discuss them with you.

THE GRUY COMPANIES

H. J. Gruy, Forrest A. Garb, H. C. Wilson



Immediately following completion of this brochure, two distinguished energy authorities joined our organization. We are pleased to include their biographies here to supplement those of our distinguished staff to be found in the brochure.



Mohamed A. M. Selim
Director of Research & Development
H. J. Gruy and Associates, Inc.
Dallas

Dr. Selim received a B.S. Degree in Petroleum Engineering from Cairo University in 1947, an M.S. Degree from The University of Texas in 1952, and a Ph.D. in Petroleum Engineering from the University of California at Berkeley in 1964.

On graduation in 1947, Dr. Selim joined Socony-Vacuum Oil Company in Cairo as a reservoir engineer, rising to acting production department head by 1950.

Following completion of his master's degree in 1952, he taught mathematics for one year at Huston-Tillotson College; he joined Petroleum Research Corporation of Denver in 1954 as a research associate in the Reservoir Mechanics Division.

Concurrently with earning his Ph.D. degree, he served as assistant research engineer in the Institute of Engineering Research at the University of California at Berkeley. Since June of 1964, he has served as senior research engineer and research associate at the Union Research Center.

Dr. Selim joined H. J. Gruy and Associates, Inc. as Director of Research & Development in 1975.

His works in geology, applied mathematics, fluid mechanics, and physics have been widely published.

Dr. Selim is a member of the Society of Petroleum Engineers of AIME, the American Association of Petroleum Geologists, the Mathematical Association of America, the Society of Industrial and Applied Mathematics, the American Geophysical Union, the Society of Exploration Geophysicists, the American Society of Mechanical Engineers, the Institute of Electrical and Electronics Engineers, the Scientific Research Society of America and Sigma Xi. He is a registered professional engineer in the State of Texas.



Loy Charter
Senior Reservoir Engineer
H. J. Gruy and Associates, Inc.
Houston

Mr. Charter received a B.S. Degree in Mechanical Engineering and Business Administration from the University of California at Berkeley in 1938.

On graduation, Mr. Charter joined Shell Oil and Shell Development Companies as a development engineer. From 1941 to 1944, he was responsible for reactivation of development and production of the Coalinga, California field. From 1944 through 1955, he served as reservoir engineer in the Ventura and Los Angeles Basin Divisions of Shell as a secondary recovery engineer for Shell's California properties, and as chief petrophysical engineer for Shell's Pacific Coast Area.

During 1955 and 1956, Mr. Charter was technical liaison with Shell's top management in The Hague, New York, and Houston. In 1957, he returned to California as division petroleum engineer for the company's San Joaquin Division, later serving as chief petrophysical engineer and assistant to the production research director in Houston.

Mr. Charter joined H. J. Gruy and Associates, Inc. in 1975 as senior reservoir engineer. He is a member of Tau Beta Pi honorary Engineering Society and the Society of Petroleum Engineers of AIME.

**Serving
The Energy
Industry**

G

The Gruy Companies

... Since 1950

Featuring:

- World-wide experience
- Over 50 highly qualified professionals
- Nearly 500 man-years of experience
- High industry reputability
- Computer augmentation
- Competence in engineering, geology, energy management and computer programming
- Convenient offices in four cities

The Gruy Companies

Dallas

2501 Cedar Springs Road
Dallas, Texas 75201
Cable: Gruy — Dallas
Telex: 730-833
Answer back: Gruy — Dal
H. J. Gruy and Associates, Inc.
(214) 742-1421
Gruy Management Service Co.
(214) 747-9627

Houston

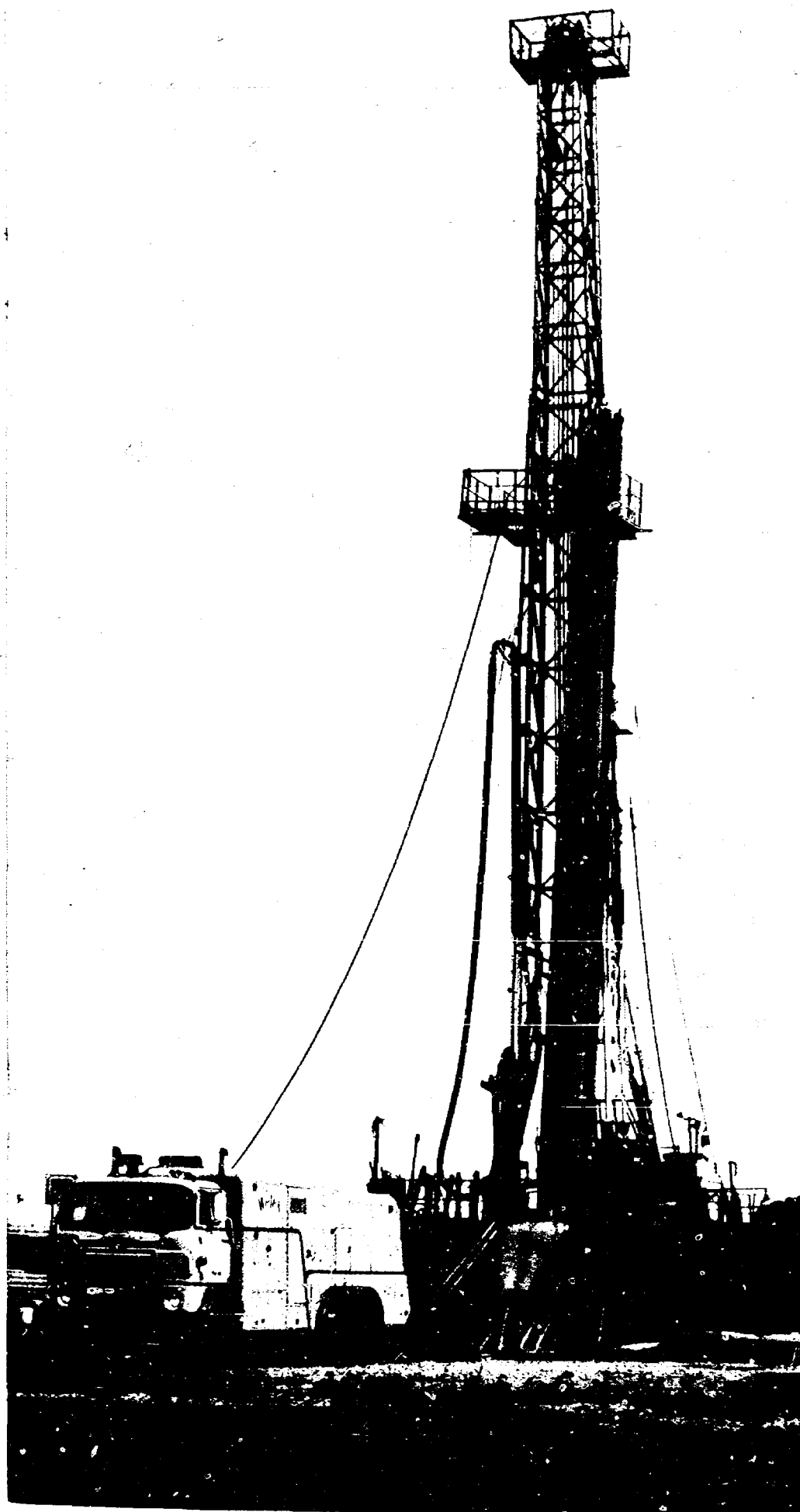
420 Southwest Tower
Houston, Texas 77002
H. J. Gruy and Associates, Inc.
(713) 222-0376
Gruy Management Service Co.
(713) 222-7226

Corpus Christi

603 Wilson Building
Corpus Christi, Texas 78401
Gruy Management Service Co.
(512) 833-2561

New York

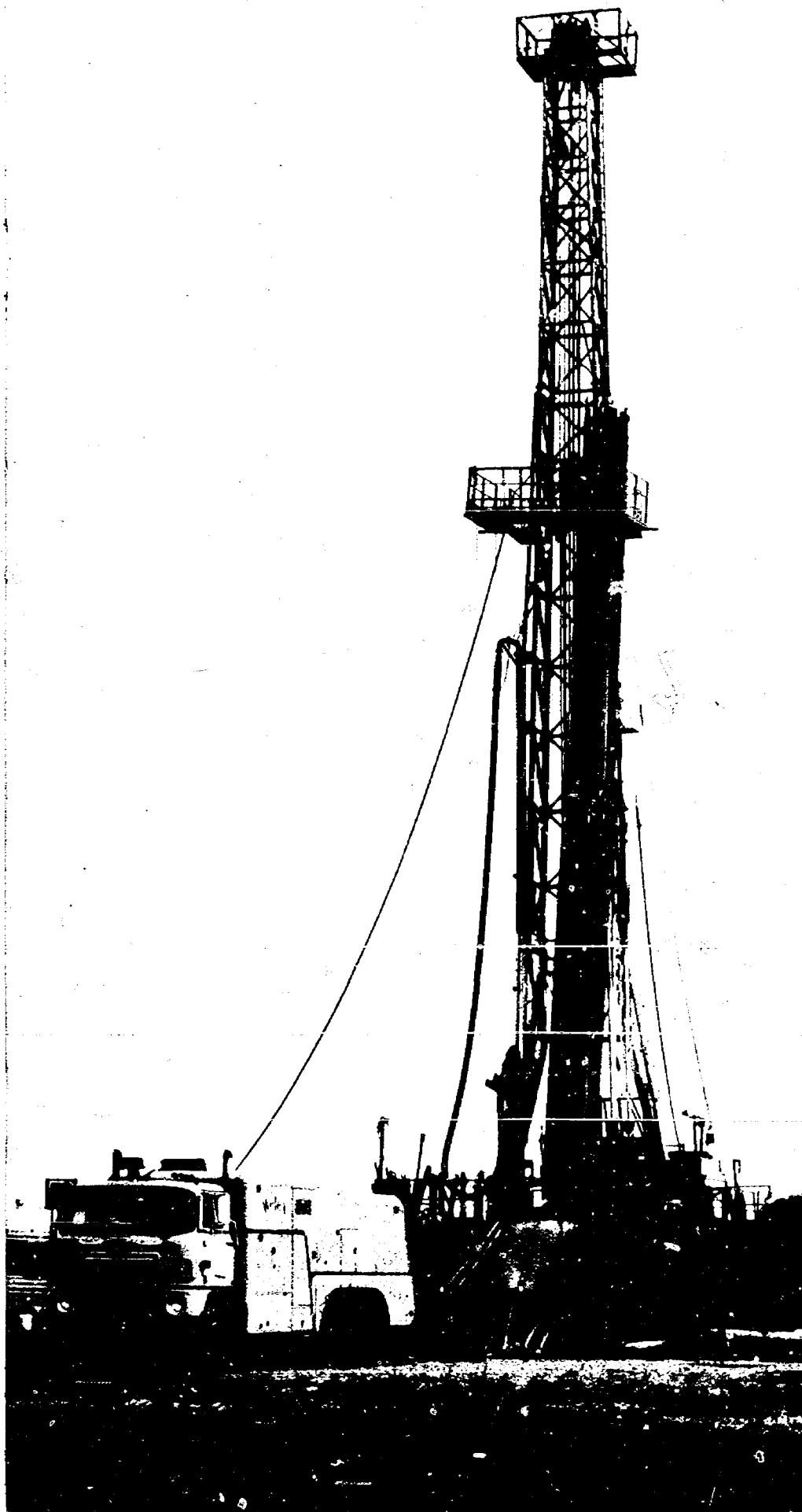
44 West 62nd Street
New York, NY 10023
H. J. Gruy and Associates, Inc.
(212) 757-7242



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energy in
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• Convent

Serving The Energy Industry



Featuring:

- World-wide experience
- Over 50 highly qualified professionals
- Nearly 500 man-years of experience
- High industry reputability
- Computer augmentation
- Competence in engineering, geology, energy management and computer programming
- Convenient offices in four cities

Officers

Chairman of the Board and Chief Executive Officer

H. J. GRUY, Houston

President and Chief Operating Officer

F. A. GARB, Dallas

Executive Vice-President

J. W. WOOD, JR., Dallas

Senior Vice-President

G. R. DONALDSON, Houston

Vice-Presidents:

G. L. COX, Dallas

S. B. KURTA, New York

W. G. NOELL, Dallas

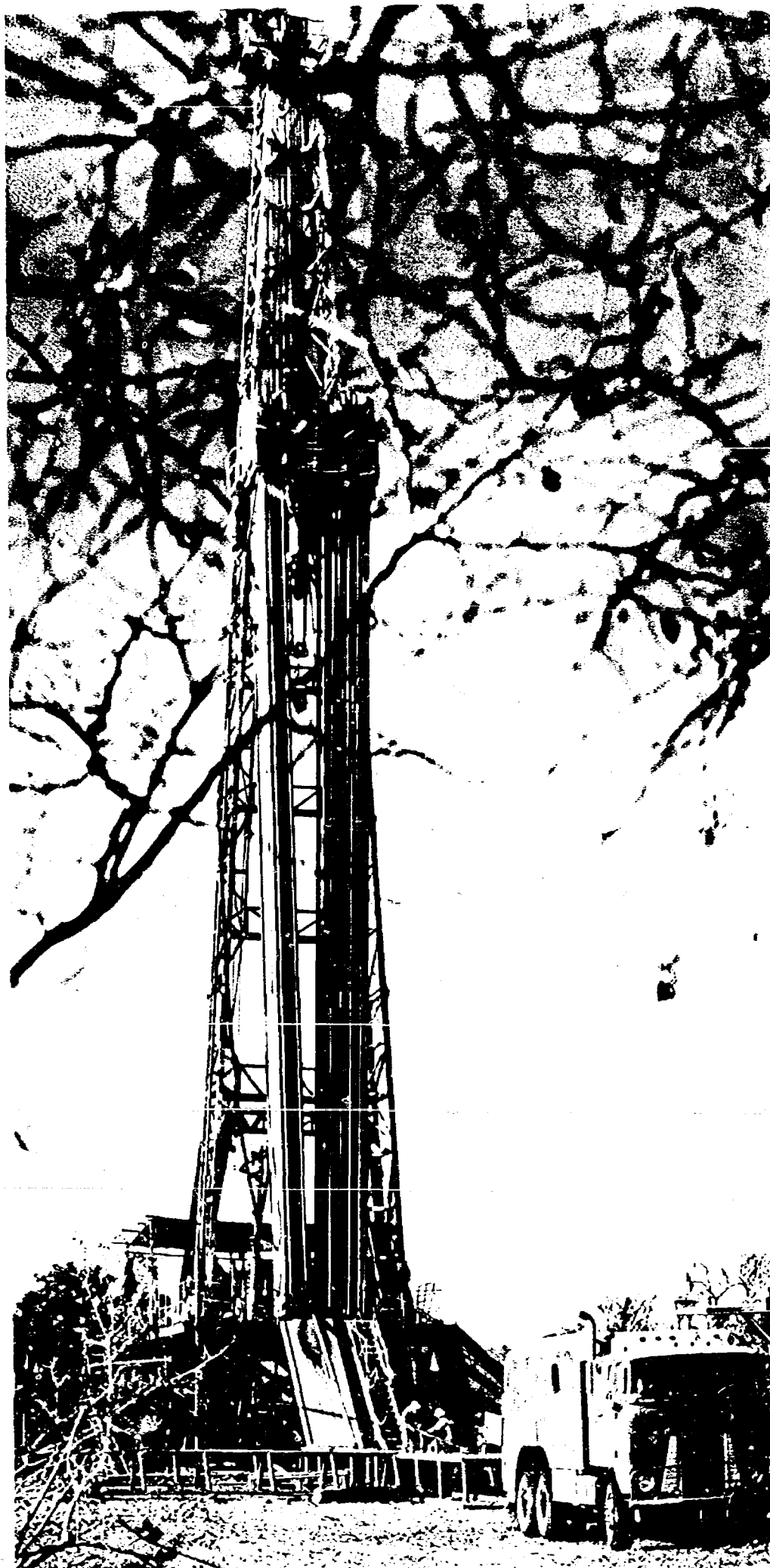
L. T. STANLEY, Dallas

R. E. WATSON, Dallas

L. C. WHITE, Houston

Services:

- Reservoir Engineering Studies
- Secondary and Tertiary Recovery Studies
- Pressure Transient Analyses
- Geologic Studies
- Evaluation Reports
- Market and Economic Analyses
- Investment Analyses
- Reservoir Simulation
- Expert Witness and Representation
- Technical Assistance and Training
- Automation Studies
- Computer Programming and Application
- Industrial Waste Subsurface Storage Studies
- Geothermal Energy Studies



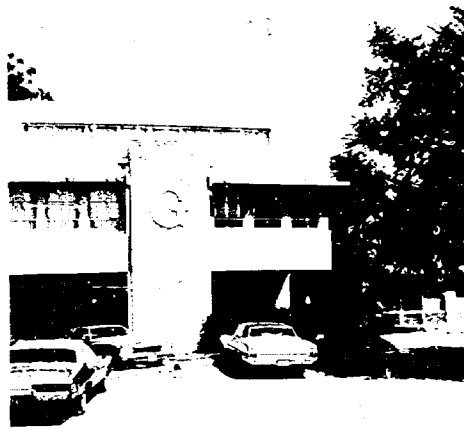
H. J. Gruy and Associates, Inc.



Dallas



H. J. Gruy and Associates, Inc.



Dallas

CAPABILITIES:

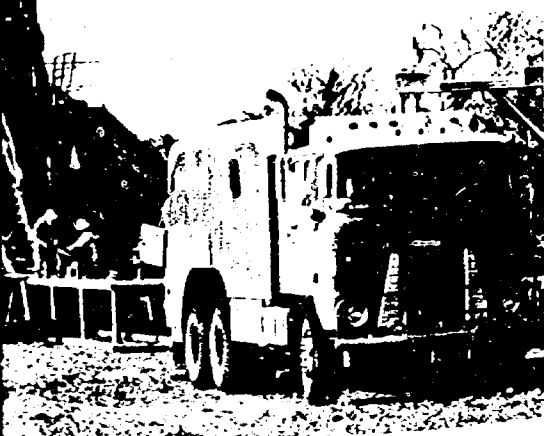
H. J. Gruy and Associates, Inc., is a consulting firm of professional petroleum engineers, geologists, and technical specialists with diversified backgrounds in all phases of the energy industry. Gruy professionals, with several hundred man-years of varied experience, have a working knowledge of all the world's important energy producing areas — the United States, Canada, South America, the Middle East, Turkey, Australia, Indonesia, North Africa, the North Sea, and the Arctic.

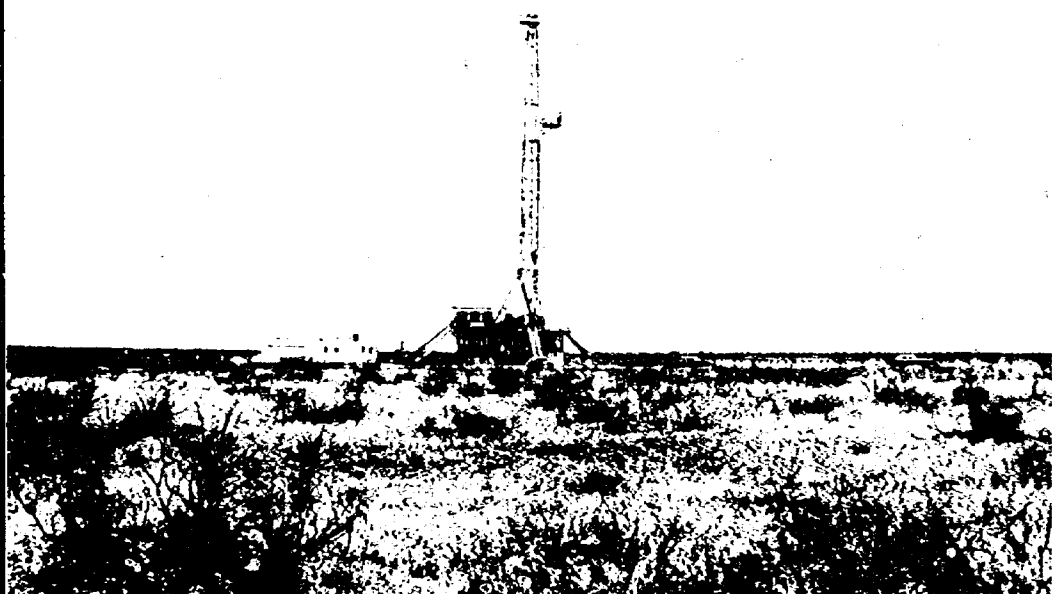
The firm offers a complete range of petroleum engineering and geological services, emphasizing oil and gas property appraisal, reserve estimates, reservoir and geological studies, secondary recovery estimates and unitization studies.

Professional services include a large list of activities ranging from evaluating drilling prospects or planning initial field development, to estimating reserves and forecasting future gas well deliverability and oil production rates, including estimating costs and results of various secondary recovery techniques.

Major financial institutions accept the authority of the organization's studies, particularly reserve estimates and appraisal reports. Gruy studies have been used as the bases for the purchase and sale of both producing and nonproducing properties and for merger negotiations, as well as for the settlement of estates and for submissions to government agencies, including the Securities and Exchange Commission, Federal Energy Administration, the Departments of the Interior and Justice and the Bureau of Mines.

Major and independent oil and gas companies have used H. J. Gruy and Associates' estimates of production rates and gas deliverability in the evaluation and design of plants and oil and gas pipeline systems. Field and well performance studies and geological evaluations have been the bases for technical testimony before the Federal Power Commission, the Se-





Houston

curities and Exchange Commission, state and governmental regulatory agencies, and courts.

H. J. Gruy and Associates has been a leader in applying high-speed digital computers to solving problems and expediting studies in the geological and petroleum engineering fields. To the greatest possible extent, Gruy professionals utilize in-house capabilities for data processing in their analytical solution of problems.

Because of the diversified experience and training of its staff, the Gruy organization frequently performs special studies and analyses for oil and gas producers confronted with unusual problems, or industrial clients concerned with subsurface waste storage, for example.

To keep pace with the dynamic evolution of the energy industry, the Gruy organization is continuing to expand its expertise so that it can meet the needs of clients having problems with other than hydro-carbon fuel production.

The following pages describe briefly some of the consulting services available to clients through the Gruy staff of professional engineers and geologists.



SERVICES INCLUDE:

Reservoir Engineering Studies

Gruy professionals plan and conduct comprehensive studies of oil and gas reservoirs to estimate recoveries and predict future performance under various possible methods of operation; to estimate future oil well productivity and casing-head gas producing rates; to estimate future gas well deliverability and liquid yield; and to recommend optimum secondary recovery programs.

Theoretical reservoir studies are based on the best available techniques including: numerical simulation; conventional material balance calculations; compositional material balance calculations; reservoir productivity and deliverability calculations; reservoir pressure build-up and drawdown test analyses; geological studies; and the various methods that have been developed for predicting the performance of secondary recovery projects. Capabilities include predictions of reservoir production, saturation, and pressure performance considering various producing mechanisms through application of three-dimensional time computer reservoir models.



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Gas Deliverability Projections

Gruy personnel study gas and gas-condensate reservoirs to determine the future deliverability of gas wells. Calculations are based on reservoir rock and fluid data, reservoir pressure and production performance, pressure build-up and drawdown test analyses, well deliverability tests and geologic studies.

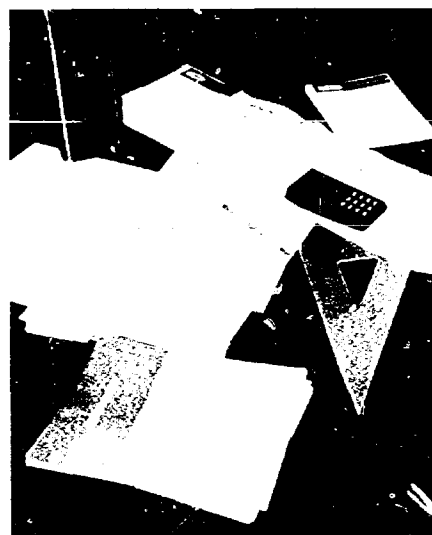
Secondary and Tertiary Recovery Studies

Secondary and tertiary recovery studies performed by Gruy personnel include assessing the effectiveness, costs, and achievable results of such supplemental pressure maintenance and recovery methods as waterflood, gas injection, thermal recovery, solvent flood, polymer flood,

and others. Gruy studies determine the optimum method and procedure and its personnel can design and supervise the installation and operation of process facilities. The company can conduct continuing studies of the program's operation and results.

Pressure Transient Analyses

The Gruy organization uses computer reservoir simulation to design and analyze drill-stem tests, build-up tests, drawdown tests, and interference tests which are used for calculating several parameters. Included are: distance to reservoir limits; skin effect; effectiveness of productivity stimulation methods; average permeability; stabilized shut-in reservoir pressure; stabilized reservoir productivity; reservoir volume; and reservoir configuration.



Pulse Testing

In addition to studying the feasibility of the application of pulse testing, Gruy specialists design and analyze pulse tests to obtain average values of reservoir storage and transmissibility between well pairs. These values, determined for a number of well pairs in multi-well reservoirs, can be used to describe relative communication between wells and oriented fracture systems. These are important data in determining unit participation, optimum injection patterns, and in predicting reservoir performance by computer simulation.

Feasibility Studies

Employing the most advanced techniques available, Gruy professionals study the feasibility of various methods for exploiting oil and gas reservoirs to determine optimum economic recovery by primary or artificial methods.

Geologic Studies

H. J. Gruy and Associates, Inc. conducts geologic studies related to oil and gas exploration and development drilling considering regional structure and stratigraphy based on subsurface correlations, geophysical data, and detailed well log analyses. Methods used in geologic studies are designed to facilitate engineering calculations.

Well Log Analyses

Gruy engineers and geologists perform qualitative and quantitative well log analyses to detect hydrocarbon reservoirs; to recommend zones of completion; to prepare hydrocarbon isopachous maps; to determine average reservoir properties; to

establish vertical and areal distribution of various reservoir properties; and to calculate hydrocarbon volumes beneath tracts in order to determine equity distribution in unitized operations. Staff members have written and compiled a comprehensive, 700-page manual on well log analysis which is used in conjunction with computer programs to analyze well logs.

Reserve Studies

Gruy personnel are experts in the estimation of oil and natural gas reserves.

Evaluation Reports

Future revenues from oil and gas producing properties are projected and values of non-producing interests are estimated by Gruy specialists. At the client's request, fair market values are also estimated.



Unit Participation

Gruy professionals calculate the in-place and recoverable hydrocarbons beneath designated areas for unitized operations, and calculate other parameters that may be used to determine equity distribution and participation.

Market & Economic Analyses

Projections include consideration of future oil allowables in prorating states; future market demand for oil; future demand and prices for natural gas and hydrocarbon liquids in specific markets; future oil and gas reserves to be discovered in specific areas; and future demands for equipment and other oil field services.

Investment Analyses

In addition to economic studies, Gruy personnel analyze investments and prospective investments in oil and gas properties by predicting rate of return and payout based on cash flow and earnings projections. Factors such as depletion, depreciation, income taxes under various treatments, and production loans are considered.

Expert

Gruy professionals calculate the in-place and recoverable hydrocarbons beneath designated areas for unitized operations, and calculate other parameters that may be used to determine equity distribution and participation.

Drilling

A program of drilling operations, including, and future development, interpretation, testing, completion, location, and production of oil and gas wells, is performed by Gruy personnel.



Establish vertical and areal distribution of various reservoir properties; and to calculate hydrocarbon volumes beneath tracts in order to determine equity distribution in unitized operations. Staff members have written and compiled a comprehensive, 100-page manual on well log analysis which is used in conjunction with computer programs to analyze well logs.

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Expert Witness & Representation

Gruy personnel regularly appear on behalf of clients before regulatory agencies and courts as expert witnesses in the fields of petroleum engineering and geology. They also represent clients in unitization and other proceedings, arbitrate disagreements between parties, and perform engineering and geological studies as an objective and unbiased third party for gas sales contract negotiations, unitization, and equity determination.

Drilling & Development Programs

Among the drilling and development programs offered by H. J. Gruy and Associates, Inc. are evaluation of drilling prospects; design of programs for logging, coring, and fluid sampling; analysis of pressure-volume-temperature relationships; interpretation of results of formation tests; design of programs for well completions; and planning of overall field development. Good success in selecting step out locations has resulted from detailed analyses of pressure build-up or drawdown tests performed on existing wells. At the client's request, geologists, engineers, and log analysts can be furnished at the well site.



Design, Operation, & Maintenance of Equipment

H. J. Gruy and Associates, Inc. will provide technical assistance or assume total responsibility for the design, installation, operation, and maintenance of oil and gas fields and associated equipment; supervise the purchase and application of equipment to ensure proper utilization; and advise the client when equipment needs servicing or replacement to achieve optimum economy through preventive maintenance.

Automation Studies

Specialists determine the feasibility for plant, lease, and field automation — including well testing, scheduling and control of production and storage, and control of prime movers. Data organization, telemetering, and alarm system design by Gruy personnel ensure efficient remote operation and data application.

Technical Assistance & Training

To provide or supplement training programs for client personnel, the Gruy organization offers technical assistance in exploration, drilling, production, and management, and will conduct seminars and training schools in fundamental well log analysis, computer technology, and reservoir engineering.

Geothermal Exploration

Gruy geologists and hydrologists have prepared for the energy shortage of the 1970's and beyond. Today, energy sources previously considered peripheral are being explored with greater interest. The Gruy staff is prepared to assist in geothermal exploration by evaluating potential regions, supervising data acquisition, selecting drill sites, and coordinating the overall exploration effort in cooperation with local and regional geologists.

Geophysical Prospecting

Working closely with local professional geophysicists, the Gruy staff conducts geophysical searches for anomalies which indicate prospects for oil or gas reservoirs.

Geochemical Exploration

Selected members of the Gruy staff are trained and experienced in the application of chemistry as an efficient and inexpensive tool in preliminary prospecting and evaluation in energy regions.

Uranium

The Gruy staff maintains a high level of expertise in uranium exploration techniques. Petrophysical properties, log analysis programs, and reserve calculations computed by Gruy's computer are the bases for economic forecasts and property evaluations.

Placer Deposits of Precious Metals

The personnel of H. J. Gruy and Associates, Inc. are experts in the estimation of reserves of precious metals in placer deposits. The staff prepares economic projections, evaluates placer properties and acts as an investment advisor.

Electrical Energy Studies

Because certain of the world's energy needs can be best met through the use of electrical power, optimum methods and fuel sources for electrical generation are being sought continuously. The specialists at H. J. Gruy and Associates, Inc. have prepared long range area market and fuel source studies for the electrical power industry. The Gruy staff has studied the relative merits of fossil fuels versus nu-

clear, geothermal, or hydroelectric sources in power generation for specific applications. Detailed energy-use predictions for electrical service areas are required for studies of this nature and are frequently prepared by the Gruy staff.

Coal

The United States has a large share of known world coal reserves. This fact is increasing in significance in light of projected energy requirements. Gruy professionals study the geologic environment of deposition, postulate favorable areas for coal exploration and compute reserves.

Tar Sands and Oil Shale

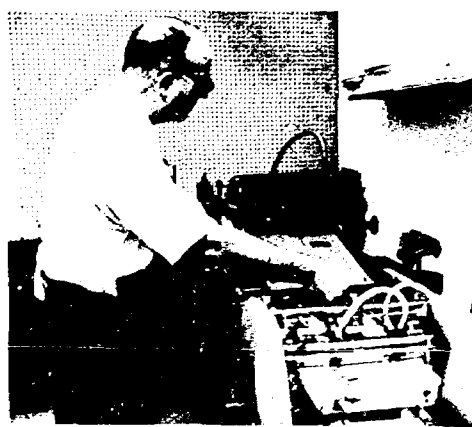
Very large potential reserves of oil are in the tar and shale oil deposits located in Canada and in the U.S. Rocky Mountain region. The geologists and engineers on the Gruy staff maintain a current awareness of the accepted technology for determining reserve tar sand-oil shale volumes and for evaluating recovery techniques from these deposits.

Hydrology

Gruy scientists apply the expertise acquired from detailed work in three-phase flow regimes developed for hydrocarbon reservoirs to the less complicated one-phase flow regimes of hydrology. As the population moves to the more arid Rocky Mountain and Southwestern areas, studies to assure adequate supplies of water will be required. The Gruy organization is prepared with personnel and computer capability to meet the requirements for regional hydrology studies to help alleviate the water problem.

Computer

H. J. Gruy and Associates, Inc. is a sophisticated function through in the entire UNIV. capabilities, enhanced degree of response to requirements. The experienced computer specialists customarily provide a comprehensive library



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Computer Services

H. J. Gruy and Associates, Inc. has the capability to solve and perform highly sophisticated scientific and management functions utilizing its computer facilities. Through an in-house high-speed terminal in the Dallas and Houston offices, the entire Gruy organization has access to a UNIVAC 1108 computer. This impressive capability — supported by a highly experienced group of computer programmers — augments the professional staff to the degree that the Gruy company can respond to the most exacting and unique requirements of its clients.

The Gruy staff has had many years of experience in developing numerous computer systems to solve a broad array of customer problems. At the heart of our ability to respond promptly and comprehensively to client needs is our computer library containing over 100 tested and

proven programs. For example, this library makes possible a complex analysis of reservoir performance using multi-dimensional and multi-phase computer models. Numerous special models have been developed in addition, including coning and gas storage models. Programs are also available which permit: conventional and compositional material balance calculations; gas deliverability calculations; reserve and economic projections; quantitative well log analyses; reservoir pressure test calculations; and investment opportunity evaluations.

In addition to programs responsive to engineering or geological requirements of The Gruy Companies' customers, our computer library also includes programs to assist in the management of oil and gas producing properties. This management system has the ability to perform accounting, joint ownership billing and income distribution and, ultimately, check writing disbursements.

The Gruy computer facilities are available to clients under a variety of arrangements including hourly or block time rental arrangements — with or without consulting personnel. Or, the Gruy programs may be licensed for use in the customer's computer. Brochures describing our computer programs will be provided upon request.



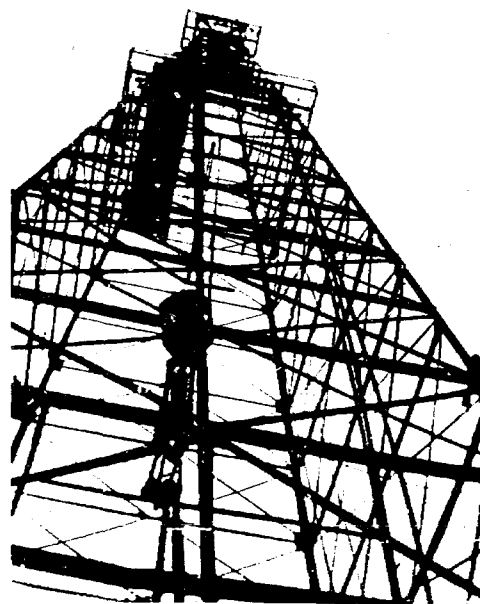
Graphic Arts

Professional drafting and offset printing services are performed in-shop and are available to outside users. In-shop handling provides security for confidential data.

PROFESSIONAL PERSONNEL:

The professional staff of H. J. Gruy and Associates, Inc. is composed of engineers, geologists, and computer specialists who are dedicated to serving their client's needs.

The following pages outline the individual training and experience of staff members. As a group, the Gruy staff represents nearly 500 man-years of specialized experience.



Personnel

H. J. Gruy
Chairman
Executive
H. J. Gruy
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1968.
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Personnel

H. J. Gruy

*Chairman of the Board and Chief Executive Officer
H. J. Gruy and Associates, Inc.
Dallas and Houston*

Mr. Gruy received a B.S. Degree in Petroleum Engineering from Texas A&M University in 1937 and the Professional Degree of Petroleum Engineer by that institution in 1956.

From 1938 until 1942, he was employed by Shell Oil Company as exploitation engineer at various locations in Louisiana, Arkansas, and Texas. In 1942, he became District Engineer for the East Texas District and was the Shell Oil representative for a number of field engineering and geological committees. From 1945 until 1950, he was a petroleum engineer and geologist with the consulting firm of DeGolyer and MacNaughton.

In 1950, Mr. Gruy organized his own firm and has been an independent petroleum consultant since that time.

In addition to drilling and production, his experience includes evaluation of oil and gas producing properties, drilling blocks and non-producing leases. He has been in charge of numerous reservoir and geologic studies throughout the United States, Argentina, Venezuela, Alaska, Australia, Turkey, Africa, the North Sea, and The Arabian Gulf.

His activities have included testifying before the Federal Power Commission on gas reserves and deliverability, before the Securities and Exchange Commission on oil and gas reserves and values, and before regulatory bodies of various states on proration problems; he has been an expert witness in both federal and state courts on behalf of various clients.

Mr. Gruy is a member of the American Association of Petroleum Geologists, the American Petroleum Institute, the Society of Petroleum Engineers of AIME, the Society of Petroleum Evaluation Engineers and the Texas Society of Professional Engineers. He was President of the Society of Petroleum Evaluation Engineers for 1964 and the District Representative for the Dallas District of the American Association of Petroleum Geologists for 1964-66. He served as Treasurer of the Society of Petroleum Engineers of AIME from February, 1965, to February, 1967. Mr. Gruy was installed as President of the Society of Petroleum Engineers of AIME at the annual meeting in New York in 1968. He served a three-year term on the Board of Directors of AIME and SPE as President-Elect of SPE in 1967, President in 1968 and Past President in 1969. He served as Vice-President of AIME for the



year 1969. He was President of the Dallas Petroleum Engineers Club in 1950, President of the Fort Worth Petroleum Engineers Club in 1953 and Chairman of the Fort Worth Section of the American Institute of Mining, Metallurgical and Petroleum Engineers in 1953. He is a member of Tau Beta Pi, honorary engineering society, a Fellow of the Texas Academy of Science, and a registered professional engineer in the State of Texas. In 1965 and 1966, he served as a Distinguished Lecturer for the Society of Petroleum Engineers of AIME.

On February 25, 1966, at the National Engineers Week Banquet in Dallas, Mr. Gruy received an award "In Recognition of Outstanding Achievements in the Field of Petroleum Engineering."

Mr. Gruy was appointed a task force member — along with other experts in government, academia and industry — to conduct a comprehensive National Gas Reserves Study for the Federal Power Commission. This study, begun in 1971 by the Supply-Technical Advisory Task Force, was concluded in 1973.





Forrest A. Garb
President and Chief Operating Officer
H. J. Gruy and Associates, Inc.
Dallas

Mr. Garb received a B.S. Degree and a Professional Degree in Petroleum Engineering from Texas A&M University in 1951 and 1963, respectively.

Upon graduation, Mr. Garb joined Socony Mobil Co. and was assigned to the Magnolia Petroleum Co. operations in Kansas, Texas, and Louisiana. After a two-year tour in the United States Air Force, where he researched foreign propellants and lubricants, he rejoined Socony Mobil Oil Co. in 1954 and was assigned to the offshore drilling program working with drilling fluid control and high-pressure completions.

From 1955 to 1957, he served as a field and reservoir engineer in Socony Mobil's Eastern and Western Venezuela Divisions. During this period, his responsibilities included formation and reservoir evaluation, development and exploration drilling, workover and completion programs, and assignment as company representative on several unitization engineering committees.

Since joining the staff of H. J. Gruy and Associates, Inc. in 1957, Mr. Garb has attended several computer programming schools and the advanced reservoir petroleum engineering course for petroleum industry personnel offered by Texas A&M University. He was elected Vice-President in 1959, Executive Vice-President in 1963, and President in 1973.

Mr. Garb is a member of the Society of Petroleum Engineers of AIME and has served actively on its committees. He is a member of the Society of Petroleum Evaluation Engineers, the Association of Computing Machinery, the Petroleum Engineers Club of Dallas, the Dallas Geological Society and an associate member of the American Association of Petroleum Geologists. He is a registered professional engineer in the State of Texas.



J. W. Wood, Jr.
Executive Vice-President,
H. J. Gruy and Associates, Inc.,
Dallas

Mr. Wood received a B.S. Degree in Petroleum and Natural Gas Engineering from Texas A&I University in 1951 and an M.S. Degree in Petroleum Engineering from Texas A&M University in 1953. During 1960-1962 he completed two years of graduate work in economics at Southern Methodist University.

Upon graduation in 1953, Mr. Wood was employed by the Atlantic Refining Company as a reservoir engineer in the Dallas Eastern Region. In 1955, he joined J. Ray McDermott & Company, Inc. as a petroleum engineer and assistant to the Manager of Operations of the Oil Division. From 1960 to 1963, he was an independent petroleum consultant in Dallas.

In 1963, he joined the Dallas staff of H. J. Gruy and Associates, Inc. as a reservoir engineer. He was elected Vice-President in 1965, Senior Vice-President in 1968, and Executive Vice-President in 1974.

Mr. Wood's experience includes evaluation of oil and gas producing properties and drilling deals, field development programs, oil well workover and production equipment design recommendations, testimony before federal and state regulatory bodies and in the federal court, supervision of field operating personnel, unitization and property acquisition negotiations, and coordination of geological, land, and accounting functions. Much of his recent experience has been in the area of petroleum economics, including studies of crude oil, natural gas and plant products supply, demand and future prices.

Mr. Wood is a member of the Society of Petroleum Engineers of AIME, the American Economic Association, the National Association of Business Economists and the Petroleum Engineers Club of Dallas. He is a registered professional engineer in the State of Texas and a member of the Texas Society of Professional Engineers.



George R. Donaldson
Senior Vice-President and
Houston Office Manager,
H. J. Gruy and Associates, Inc.
Houston

Mr. Donaldson received a B.S. Degree in Petroleum Engineering from the University of Missouri in 1951.

From graduation in 1951 until 1963, Mr. Donaldson was employed as a petroleum engineer by The Atlantic Refining Company in the United States and Venezuela. During his tenure with Atlantic, he served in several petroleum engineering capacities and advanced to supervisor of the petroleum engineering section in Caracas. In this position, his responsibilities included supervision of the reservoir engineering section, production forecasts, and workover recommendations. From 1963 to 1966, he was self-employed, finding and promoting drilling ventures in the Illinois Basin.

In 1966, Mr. Donaldson joined the Houston staff of H. J. Gruy and Associates, Inc. as a petroleum engineer and was elected Vice-President in 1968 and Senior Vice-President in 1972.

Mr. Donaldson is a member of the Society of Petroleum Engineers of AIME and a registered professional engineer in the State of Illinois.



George L. Cox
Vice-President,
H. J. Gruy and Associates, Inc.
Dallas

Mr. Cox received a B.S. Degree in Chemical Engineering from the University of Texas in 1940.

While first employed by Gulf Oil Corporation, Mr. Cox was assigned to the Permian Basin area where his efforts were directed toward well completions, workovers and solution of fluid production problems. As Chairman of the Permian Basin API Committee on Treating, he authored the text used by The University of Texas Extension Division in the course, "Treating Oil Field Emulsions." In 1951, he was transferred to Mene Grande Oil Company, a Gulf subsidiary in Venezuela, where he served as a reservoir engineer and as production superintendent. Mr. Cox also worked as field supervisor in offshore operations for Creole Petroleum Corporation in the Lake Maracaibo area.

He joined the staff of H. J. Gruy and Associates, Inc. in 1963 and was elected Vice-President in 1968.

Mr. Cox is a member of the Society of Petroleum Engineers of AIME and is a registered professional engineer in the State of Texas.

Stanley B.
Vice-President,
H. J. Gruy
New York

Mr. B. received a B.S. Degree in Chemical Engineering from the University of Texas in 1940. While first employed by Gulf Oil Corporation, Mr. B. was assigned to the Permian Basin area where his efforts were directed toward well completions, workovers and solution of fluid production problems. As Chairman of the Permian Basin API Committee on Treating, he authored the text used by The University of Texas Extension Division in the course, "Treating Oil Field Emulsions." In 1951, he was transferred to Mene Grande Oil Company, a Gulf subsidiary in Venezuela, where he served as a reservoir engineer and as production superintendent. Mr. B. also worked as field supervisor in offshore operations for Creole Petroleum Corporation in the Lake Maracaibo area.

He joined the staff of H. J. Gruy and Associates, Inc. in 1963 and was elected Vice-President in 1968. Mr. B. is a member of the Society of Petroleum Engineers of AIME and is a registered professional engineer in the State of Texas.

After... President



George R. Donaldson
*Senior Vice-President and
 Houston Office Manager,
 H. J. Gruy and Associates, Inc.
 Houston*

Mr. Donaldson received a B.S. Degree in Petroleum Engineering from the University of Missouri in 1951.

From graduation in 1951 until 1963, Mr. Donaldson was employed as a petroleum engineer by The Atlantic Refining Company in the United States and Venezuela. During his tenure with Atlantic, he served in several petroleum engineering capacities and advanced to supervisor of the petroleum engineering section in Caracas. In this position, his responsibilities included supervision of the reservoir engineering section, production forecasts, and workover recommendations. From 1963 to 1966, he was self-employed, finding and promoting drilling ventures in the Illinois Basin.

In 1966, Mr. Donaldson joined the Houston staff of H. J. Gruy and Associates, Inc. as a petroleum engineer and was elected Vice-President in 1968 and Senior Vice-President in 1972.

Mr. Donaldson is a member of the Society of Petroleum Engineers of AIME and a registered professional engineer in the State of Illinois.



George L. Cox
*Vice-President,
 H. J. Gruy and Associates, Inc.
 Dallas*

Mr. Cox received a B.S. Degree in Chemical Engineering from the University of Texas in 1940.

While first employed by Gulf Oil Corporation, Mr. Cox was assigned to the Permian Basin area where his efforts were directed toward well completions, workovers and solution of fluid production problems. As Chairman of the Permian Basin API Committee on Treating, he authored the text used by The University of Texas Extension Division in the course, "Treating Oil Field Emulsions." In 1951, he was transferred to Mene Grande Oil Company, a Gulf subsidiary in Venezuela, where he served as a reservoir engineer and as production superintendent. Mr. Cox also worked as field supervisor in offshore operations for Creole Petroleum Corporation in the Lake Maracaibo area.

He joined the staff of H. J. Gruy and Associates, Inc. in 1963 and was elected Vice-President in 1968.

Mr. Cox is a member of the Society of Petroleum Engineers of AIME and is a registered professional engineer in the State of Texas.



Stanley B. Kurta
*Vice-President,
 H. J. Gruy and Associates, Inc.
 New York*

Mr. Kurta received his A.B. Degree from Brooklyn College in 1947. He attended The Johns Hopkins University from 1948 to 1950 where he completed residence requirements and general examinations for the Ph.D. Degree in Economics and Statistics. He was awarded a Social Science Research Council fellowship in 1950 for research in the behavioral dynamics of corporate systems.

Mr. Kurta joined the U.S. Plywood Corporation in 1951 and became its Manager of Marketing Research in 1953. In 1961 he took a position as managerial economist with The Weyerhaeuser Company. In 1966, he formed Justin Tyme, Inc., consultants in computer-based decision and control systems.

Mr. Kurta has designed and implemented computerized information systems for economic forecasting, inventory control, physical distribution management and transfer pricing. This family of programs rationally and vigorously improved management control of products marketing.

After joining H. J. Gruy and Associates, Inc. in 1973, he was made the marketing representative for the New York area and a consultant in energy economics and forecasting. He was elected a Vice-President in 1974.



W. Glenn Noell
*Vice-President,
 H. J. Gruy and Associates, Inc.
 Dallas*

Mr. Noell graduated from the University of Oklahoma, receiving a B.S. Degree in Geological Engineering, in 1950.

Upon graduation, Mr. Noell was employed by the Panoma Corporation and worked for five years in natural gasoline plant operations. In 1956, he joined the staff of Oil and Gas Property Management, Inc. as a valuation engineer with the principal responsibility of appraising oil and gas properties. He has attended electric log schools offered to industry personnel and is an expert in log analysis.

Mr. Noell joined H. J. Gruy and Associates, Inc. in 1960 as a geological engineer and was elected Vice-President in 1968.

Mr. Noell is a member of the Society of Petroleum Engineers of AIME and the American Association of Petroleum Geologists. He is a registered professional engineer in the State of Texas.



Lyn T. Stanley
Vice-President,
H. J. Gruy and Associates, Inc.
Dallas

Mr. Stanley received a B.S. Degree in Petroleum Engineering from Texas A&M University in 1950.

Upon graduation, Mr. Stanley worked for Tennessee Gas Transmission Company as a field engineer. From 1951 through 1959, he was a production and reservoir engineer for Arabian American Oil Company in Saudi Arabia and New York. During 1960 to 1965, he served as group supervisor of reservoir engineering research for The Pure Oil Company.

Mr. Stanley joined the Dallas staff of H. J. Gruy and Associates, Inc. in 1965 as a petroleum engineer. After serving as manager of computer engineering, he was elevated in 1973 to the position of Vice-President.

He is a member of the Society of Petroleum Engineers of AIME, Society of Professional Well Log Analysts, Tau Beta Pi honorary engineering society and Phi Kappa Phi honorary scholastic society. He is a registered professional engineer in the State of Texas.



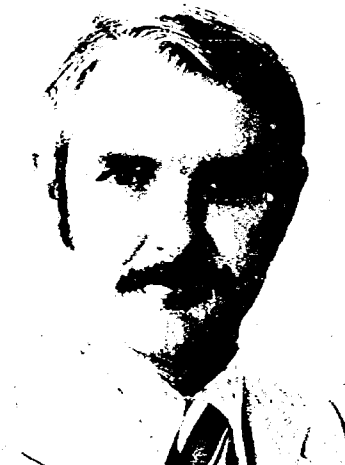
R. E. Watson
Vice-President,
H. J. Gruy and Associates, Inc.
Dallas

Mr. Watson received a B.E. Degree in Civil Engineering from Tulane University in 1927.

His early experience includes service with Cia Mexicana de Petroleo "El Aguila" in Mexico, with H. L. Hunt in Arkansas, with Gulf Oil Corporation and with Clint Murchison in Texas. In 1930, Mr. Watson joined the Humble Oil and Refining Company as a junior engineer and, until 1936, was a district petroleum engineer with responsibilities in New Mexico and Texas. From 1936 to 1941, he served as chief petroleum engineer for Lago Petroleum Corporation in Maracaibo, Venezuela. Upon returning to the United States, he joined the Carter Oil Company as division petroleum engineer for the Louisiana division. From 1944 to 1949, Mr. Watson was Vice-President and Director for the Drilling and Exploration Company in charge of drilling operations in Venezuela, Argentina, and Turkey, and assisted operations in Brazil. In 1949, he became President of Rexray Drilling Company with operations in West-Central Texas. In 1953, he became Manager for Three Brothers Oil Company and for Ray E. Hubbard, an independent oil operator.

Mr. Watson joined the staff of H. J. Gruy and Associates, Inc. in 1962 and was elected Vice-President in 1968.

Mr. Watson is a member of the Society of Petroleum Engineers of AIME and the Petroleum Engineers Club of Dallas.



Leland C. White
Vice-President,
H. J. Gruy and Associates, Inc.
Houston

Mr. White received a B.S. Degree in Petroleum Engineering from Texas A&M University in 1956.

Upon graduation, Mr. White was employed by Shell Oil Company. After a one-year training program and two years of military service, he was assigned to the West Texas area as an exploitation engineer. His work included reservoir engineering, log analysis, and field engineering in the Midland District office. In 1962, Mr. White joined The British-American Oil Producing Company in Dallas as a staff engineer in the Economics and Evaluation Department. His duties included reservoir and petrophysical engineering, estimation of reserves, and appraisals of producing properties.

He joined the staff of H. J. Gruy and Associates, Inc. in 1966, and was elected Vice-President in 1971.

Mr. White is a member of the Society of Petroleum Engineers of AIME and is a registered professional engineer in the State of Texas.

Kent Bruce
Petroleum Engineer,
H. J. Gruy and Associates, Inc.
Houston

During the summers of 1966 through 1968, Mr. Bruce worked as an engineering assistant and roustabout for the Pan Am and Getty Oil Companies.

In 1972, he received a B.S. Degree in Petroleum Engineering from the University of Wyoming.

Early in 1973, he joined the Houston staff of H. J. Gruy and Associates, Inc. as a Petroleum Engineer. Mr. Bruce is a junior member of the Society of Professional Engineers of AIME.



Terence J. Elliott
Geophysicist
H. J. Gruy and Associates, Inc.
Dallas

Mr. Elliott received a B.S. Degree in Geology from the University of Queensland, Australia, in 1963.

Upon graduation, Mr. Elliott was employed by Continental Oil Company from 1963 to 1964 as a geophysical assistant in operations in Australia.

In 1964, he joined WELEX to do well log processing and operations. Mr. Elliott was employed by Continental Oil Company in New York and Louisiana as a geophysicist. He is primarily with mapping North Sea fields. From 1967 to 1971, he was a geophysicist at DELTA Inc. in Houston, working in all phases of seismic processing and interpretation of software packages. He joined H. J. Gruy and Associates, Inc. in 1971 as a geophysicist responsible for client seismic data processing and interpretation. In 1972, he joined McCord and Associates as a consulting geophysicist. He was involved in interpretations for Iran and Australia, and marketing in Europe and the Far East. From 1973 until 1975, he worked with Texas Pacific International in Dallas as Senior Geophysicist responsible for planning, planning, and advising the company on geophysical programs.

Mr. Elliott received a B.S. Degree in Geology from the University of Queensland, Australia, in 1963.

He is a member of the American Association of Petroleum Geologists, the Exploration Geophysical Society, and the Geological Society of America.

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Leland C. White
Vice-President,
H. J. Gruy and Associates, Inc.
Houston

Mr. White received a B.S. Degree in Petroleum Engineering from Texas A&M University in 1956.

Upon graduation, Mr. White was employed by Shell Oil Company. After a one-year training program and two years of military service, he was assigned to the West Texas area as an exploitation engineer. His work included reservoir engineering, log analysis, and field engineering in the Midland District office. In 1962, Mr. White joined The British-American Oil Producing Company in Dallas as a staff engineer in the Economics and Evaluation Department. His duties included reservoir and petro-physical engineering, estimation of reserves, and appraisals of producing properties.

He joined the staff of H. J. Gruy and Associates, Inc. in 1966, and was elected Vice-President in 1971.

Mr. White is a member of the Society of Petroleum Engineers of AIME and is a registered professional engineer in the State of Texas.

Kent Bruce
Petroleum Engineer,
H. J. Gruy and Associates, Inc.
Houston

During the summers of 1966 through 1968, Mr. Bruce worked as an engineering assistant and roustabout for the Pan Am and Getty Oil Companies.

In 1972, he received a B.S. Degree in Petroleum Engineering from the University of Wyoming.

Early in 1973, he joined the Houston staff of H. J. Gruy and Associates, Inc. as a Petroleum Engineer. Mr. Bruce is a junior member of the Society of Professional Engineers of AIME.



Terence J. Elliott
Geophysicist
H. J. Gruy and Associates, Inc.
Dallas

Mr. Elliott graduated in 1963 from the University of Queensland, Australia with a B.S. Degree in Geology.

Upon graduation, Mr. Elliott was employed by Marathon Petroleum Australia, Ltd. from 1963 to 1964 as a geophysical assistant in seismic operations in Australia and New Guinea. In 1964 he joined WELEX to do well logging maintenance and operations. In 1965, Mr. Elliott was employed by Continental Oil Company out of New York and London as a geophysicist. He was involved primarily with interpreting and mapping North Sea seismic data. From 1967 to 1971, Mr. Elliott was a geophysicist for SEISCOM DELTA Inc. in Houston working in all phases of seismic data processing and the development of software packages. Mr. Elliott joined H. J. Gruy and Associates, Inc. in 1971 as a staff geophysicist responsible for handling client seismic data. He left this company in 1972 to join D. R. McCord and Associates in Dallas as a consulting geophysicist. He was involved in geophysical interpretations for major fields in Iran and Australia and consulting and marketing assignments in Europe and the Far East. From 1973 until 1975, Mr. Elliott was with Texas Pacific Oil Co. in Dallas as Senior International Geophysicist responsible for appraising, planning and supervising the company's world-wide geophysical programs.

Mr. Elliott rejoined the staff of H. J. Gruy and Associates, Inc. in 1975 as one of its geophysicists.

He is a member of the American Association of Petroleum Geologists, Society of Exploration Geophysicists, Dallas Geophysical Society and Dallas Geological Society.



Dan M. Jones
Senior Reservoir Engineer,
H. J. Gruy and Associates, Inc.
Dallas

Mr. Jones received a B.S. Degree in Petroleum Engineering from The University of Texas in 1952.

He entered the U.S. Air Force upon graduation and gained experience in Electronics, Communications, and Synthetic Training until 1957. From 1957 to 1962, he was employed by Sinclair Oil and Gas Company as a field engineer in the Texas Panhandle and as a Reservoir Engineer in Tulsa. In 1962, he was assigned as a Reservoir Engineer in Sinclair's Mediterranean Petroleum Co. in Paris until his reassignment in 1964 to West Texas as a Senior Engineer. He was transferred in 1965 to Sinclair's Systems and Computing Department in Tulsa where he was responsible for development and application of technical programs; Mr. Jones did graduate work concurrently at The University of Tulsa in Reservoir Engineering. He joined D. R. McCord and Associates in Dallas in 1969 as an Associate Engineer concerned with development and application of technical programs and simulation studies. He left to become President of Firebird Casing Corporation in 1974.

Mr. Jones joined the Dallas staff of H. J. Gruy and Associates, Inc. in 1974 as a Senior Reservoir Engineer.

Mr. Jones is a member of the Society of Petroleum Engineers of the AIME and the Texas Society of Professional Engineers. He is a registered professional engineer in the State of Texas.



Dickey L. Keith
Petroleum Engineer,
H. J. Gruy and Associates, Inc.
Houston

Mr. Keith received a B.S. Degree in Petroleum Engineering from The University of Missouri in 1968.

Following graduation, he joined the Chevron Oil Company as a reservoir engineer at the Venice Production District in New Orleans. He gained experience in secondary recovery, pressure maintenance, reservoir evaluation, and computer modeling of offshore reservoirs while assigned in the Gulf Coast area.

Mr. Keith joined the Houston staff of H. J. Gruy and Associates, Inc. as a Petroleum Engineer in 1973.



Robert E. Lowry
Senior Geologist,
H. J. Gruy and Associates, Inc.
Houston

Mr. Lowry received a B.S. Degree in Geology in 1949 from the University of Oklahoma where he also did graduate work in geology. In 1964, he received an LL.B. Degree from Jackson School of Law of Mississippi College and obtained a Juris Doctor Degree from Loyola University School of Law in 1970.

From 1949 to 1969, Mr. Lowry was employed by Humble Oil & Refining Company as a geologist. He performed general subsurface geological exploration, well site geological analyses, regional and field mapping, reservoir studies and evaluations and geological studies for workover operations. He also served on geological committees for field unitization and presented geological testimony before the Texas Railroad Commission. His principal areas of experience during this period were the Gulf Coast and the Permian Basins. From 1969 through 1974, Mr. Lowry was a Consulting Geologist and Attorney in Jackson, Mississippi. He prepared extensive oil, gas and mineral leases and practiced law in Mississippi and Louisiana.

In 1975, Mr. Lowry joined H. J. Gruy and Associates, Inc. as a senior geologist in the Houston office.

He is a member of the American Association of Petroleum Geologists, American Institute of Professional Geologists, American Bar Association, and the Mississippi and Louisiana State Bars.



Walter C. Miller
Chief Geologist,
H. J. Gruy and Associates, Inc.
Dallas

Mr. Miller received a B.S. Degree in Geology in 1949 from the University of Wyoming. He also has additional schooling in geology from the University of Wyoming and Tulane University; in computer application and time sharing from Central Wyoming College; and in the uranium industry from the Atomic Energy Commission.

Mr. Miller joined the Carter Oil Company in 1952 as a surface geologist in Wyoming and Colorado. From 1953 to 1962, he was a well site and subsurface geologist in Kansas, Missouri and Oklahoma. In 1962, he was trained as a log analyst by the Humble Research Laboratory in Houston and worked in that capacity in Oklahoma. Later, he was involved with the production geology and stratigraphic groups in the offshore Louisiana area. From 1966 to 1968, Mr. Miller was a consulting geologist and log analyst based in Wyoming. He worked in the Rocky Mountain area, California and Western Canada in both petroleum and mineral exploration. In 1968, he joined the General Nuclear Corporation in Wyoming and was involved in acquisition and evaluation of petroleum properties, uranium claims, prospect development, log analysis, log quality control and in corporate administration as Assistant Secretary. In 1971, Mr. Miller joined Western United Resources, Inc. as Vice-President. He supervised exploration for beryllium, copper, gold, lead-silver and participation in joint ventures of petroleum exploration in Kansas and Colombia.

He joined H. J. Gruy and Associates, Inc. in 1973 as a Senior Chief Geologist. He was appointed Chief Geologist in 1974.

Mr. Miller is a member of the American Association of Petroleum Geologists, the Society of Petroleum Engineers of AIME, the Society of Mining Engineers of AIME, the Society of Professional Well Log Analysts, the Rocky Mountain Association of Geologists, the Wyoming Geological Association and the Dallas Geological Society. Mr. Miller is a Registered Professional Geologist in the State of California.



Robert F. Mitchell
Well Log Analyst - Engineer,
H. J. Gruy and Associates, Inc.
Dallas

Mr. Mitchell obtained his B.S. Degree in Aeronautical Engineering from Texas A&M University in 1951. From 1959 to 1961, he attended the University of Michigan in pursuit of an M.S. Degree in Aeronautical Engineering with specialization in guided missiles. He also attended Service-sponsored courses in personnel management, nuclear systems and computer programs during 1958, 1962 and 1965, respectively.

Mr. Mitchell joined the U.S. Air Force in 1951 where he spent 23 years, primarily in research and development work. His duties have included: performing aircraft structural analyses; testing nuclear weapon effects; developing conventional munitions; conducting studies on advanced space systems; supervising technology exchanges with foreign scientists; and managing long-range planning for the Air Force. He directed the conceptual development of several innovative weapon systems and authored technical papers treating the use of nuclear-powered aircraft in the future.

Mr. Mitchell joined the Dallas staff of H. J. Gruy and Associates, Inc. in 1975 as a well log analyst-engineer.



Yogi R. Patel
Reservoir Engineer,
H. J. Gruy and Associates, Inc.
Dallas

Mr. Patel received a B.S. Degree in Chemistry from The Maharaja Sayajirao University of Baroda, India in 1967. He came to the United States to study chemical engineering at Oklahoma State University. Mr. Patel received an M.S. Degree in Chemical Engineering from the University of Tulsa in 1971. He is now pursuing graduate study in applied mathematics at the University of Texas at Dallas.

In 1971, Mr. Patel was employed by the Sun Production and Research Center in Texas. His assignments included water analyses and the development of treatment programs for corrosive systems.

In 1973, Mr. Patel joined H. J. Gruy and Associates, Inc. as a reservoir engineer with primary responsibilities in pressure transient analysis and reserve estimation.

Mr. Patel is a member of the Society of Petroleum Engineers of AIME.



Raj K. Prasad
Senior Reservoir Engineer,
H. J. Gruy and Associates, Inc.
Dallas

Mr. Prasad received a B.S. Degree in Petroleum Engineering from the Indian School of Mines in 1965.

Upon graduation, Mr. Prasad worked for the Oil & Natural Gas Commission in his home state in India from 1966 to 1968 as Senior Technical Assistant in the production section. He was engaged in various production activities including well testing, crude oil storage and transportation, workover operations and gathering systems.

In 1968, he came to the U.S. and joined the staff of the Tulsa University Drilling Research Project while working toward a M.S. Degree in Petroleum Engineering. The Project was concerned with correlating parameters associated with rotary drilling techniques. His studies concentrated on mathematical modeling and the application of computing to reservoir studies. Mr. Prasad earned an M.S. Degree in Petroleum Engineering in 1970 from the University of Tulsa.

He joined H. J. Gruy and Associates, Inc. in 1970 as a reservoir engineer.

Mr. Prasad is a member of the Society of Petroleum Engineers of AIME.



L. James Rehkemper
Senior Geologist,
H. J. Gruy and Associates, Inc.
Dallas

Dr. Rehkemper received a B.S. Degree in Geology followed by an M.A. in Geology (with a minor in Engineering) from the University of Texas at Austin. He received a Ph.D. Degree in Geology from Rice University in 1969.

Following his graduation in 1956, he was employed by the National Petroleum Company in exploration and production in the Texas and Oklahoma fields. He handled areas and worked on field development, detailed field studies, and secondary operations, and evaluation of producing properties. From 1963 to 1965, he was employed by Mobil Oil Co. in Tripoli where he was principally involved in detailed mapping and stratigraphic correlation. During the 1965-68 period, he was pursuing his doctorate at Rice, his efforts were with the fields of marine stratigraphy and classification. In 1969, Dr. Rehkemper joined the Sun Oil Company in the Project Research Laboratory as Project Leader in Climatology. He worked on the correlation of sedimentary basins from electric logs, geophysical indicators and sedimentary structures. He was also a member of the Basin Evaluation Group and conducted special studies in unexplored and unexploited areas of the world. From 1972, he was assigned to the Reservoir Staff of Sun's Exploration where he worked on projects in the Rocky Mountains and the Anadarko Basin and Oklahoma. During 1974, he was assigned to the Technology Group and involved in new approaches in interpretation of seismic data.

Dr. Rehkemper joined the staff of H. J. Gruy and Associates, Inc. in 1974 as a Senior Geologist.

Dr. Rehkemper is a member of the American Association of Petroleum Geologists, the Society of Economic Mineralogists, the Society of Paleontologists, the Dallas Geological Society, and the American Association of Petroleum Geologists.



Yogi R. Patel
Reservoir Engineer,
H. J. Gruy and Associates, Inc.
Dallas

Mr. Patel received a B.S. Degree in Chemistry from The Maharaja Sayajirao University of Baroda, India in 1967. He came to the United States to study chemical engineering at Oklahoma State University. Mr. Patel received an M.S. Degree in Chemical Engineering from the University of Tulsa in 1971. He is now pursuing graduate study in applied mathematics at the University of Texas at Dallas.

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Mr. Patel is a member of the Society of Petroleum Engineers of AIME.



Raj K. Prasad
Senior Reservoir Engineer,
H. J. Gruy and Associates, Inc.
Dallas

Mr. Prasad received a B.S. Degree in Petroleum Engineering from the Indian School of Mines in 1965.

Upon graduation, Mr. Prasad worked for the Oil & Natural Gas Commission in his home state in India from 1966 to 1968 as Senior Technical Assistant in the production section. He was engaged in various production activities including well testing, crude oil storage and transportation, workover operations and gathering systems.

In 1968, he came to the U.S. and joined the staff of the Tulsa University Drilling Research Project while working toward a M.S. Degree in Petroleum Engineering. The Project was concerned with correlating parameters associated with rotary drilling techniques. His studies concentrated on mathematical modeling and the application of computing to reservoir studies. Mr. Prasad earned an M.S. Degree in Petroleum Engineering in 1970 from the University of Tulsa.

He joined H. J. Gruy and Associates, Inc. in 1970 as a reservoir engineer.

Mr. Prasad is a member of the Society of Petroleum Engineers of AIME.



L. James Rehkemper
Senior Geologist,
H. J. Gruy and Associates, Inc.
Dallas

Dr. Rehkemper received his B.S. Degree in Geology in 1955 followed by an M.A. Degree in Geology (with a minor in Petroleum Engineering) in 1956 from The University of Texas at Austin; a Ph.D. Degree in Geology from Rice University was obtained in 1969.

Following his graduate work in 1956, he was employed by Magnolia Petroleum Company in exploration and production activities in the Texas and Oklahoma Panhandle areas and North Texas. Most of this time was spent in working on field development efforts, detailed field studies for unitization and secondary recovery operations, and evaluations of producing properties for purchase. From 1963 to 1965, he was employed by Mobil Oil of Libya, Ltd. in Tripoli where he was principally involved in detailed field mapping and stratigraphic studies. During the 1965-68 period, while pursuing his doctoral studies at Rice, his efforts were involved with the fields of marine geology, stratigraphy and elastic petrology. In 1969, Dr. Rehkemper joined Sun Oil Company in its Production Research Laboratory as a Project Leader in Clastic Petrology. He worked on the identification of sedimentary environments from electric logs, geochemical indicators and sedimentary structures. He was also a member of the Basin Evaluation Group which conducted special studies of the explored and unexplored basins of the world. From 1972 to 1973, he was assigned to the Regional Geologist's Staff of Sun's Lower 48 Region where he worked on special projects in the Rocky Mountains and the Anadarko Basin of Texas and Oklahoma. During 1973 to 1974, he was assigned to the New Technology Group and was involved in new approaches to the interpretation of seismic data.

Dr. Rehkemper joined the staff of H. J. Gruy and Associates, Inc. in 1974 as a Senior Geologist.

Dr. Rehkemper is a member of the American Association of Petroleum Geologists, The Society of Economic Mineralogists and Paleontologists, Sigma Xi and the Dallas Geological Society.



James G. Rogers
Computer Operations Manager,
H. J. Gruy and Associates, Inc.
Dallas

Mr. Rogers received a B.S. Degree in Education during 1959 from North Texas State University followed by an M.S. Degree in Psychology in 1960 from that University.

From 1956 to 1957, Mr. Rogers was employed as an electronic technician for Geotech Corporation of Dallas; he taught in the Dallas Public Schools from 1960 to 1965.

In 1965, Mr. Rogers joined the Dallas staff of H. J. Gruy and Associates, Inc. as an engineering assistant. In 1968, he became manager of computer operations and presently supervises the Company's in-house computer installations.



Nancy Ann Shepherd
Librarian,
H. J. Gruy and Associates, Inc.
Dallas

Mrs. Shepherd received her B.A. Degree in Liberal Arts (Speech Communication) from North Texas State University in 1972. She did graduate work at North Texas State University and Southern Methodist University and received a Master of Library Science Degree from NTSU in 1975.

Mrs. Shepherd joined H. J. Gruy and Associates, Inc. in 1975 to become librarian in the Dallas staff.

Mrs. Shepherd is a member of American Library Association, Texas Library Association, Southwestern Library Association, and Special Libraries Association. She is also a member of Alpha Lambda Sigma, honorary library society, and Beta Phi Mu, international library science honor society.



C. H. Stewart
Reservoir Engineer,
H. J. Gruy and Associates, Inc.
Houston

Mr. Stewart received a B.S. Degree in Mathematics and Petroleum Engineering from the University of Houston in 1957.

Mr. Stewart served four years in the U.S. Air Force from 1951 to 1955, gaining experience in nuclear weapon and radar technologies during this tour.

He joined Humble Oil and Refining Company in 1957 as a reservoir engineer. He was initially assigned to the computer facilities of Esso Production Research where he held responsibility for oil and gas production including gas engineering, development drilling, workovers, unitization and economic evaluations. He was promoted in 1961 to District Engineer of one of Humble's largest production districts. Mr. Stewart attended Humble's Reservoir Engineering and Management School and did graduate work concurrently in mathematics at Southern Methodist University. From 1963 to 1965, Mr. Stewart was a staff consultant for D. R. McCord and Associates, Inc. and developed mathematical reservoir simulation models for major oil companies. He joined Shell Development Company in 1965 as Senior Research Engineer in charge of research in mathematical techniques for simulating petroleum reservoirs. He also attended the Reservoir Engineering School and the Advanced Engineering Mathematics School given by the Shell Development Company. In 1967, Mr. Stewart entered the independent petroleum consulting field with a specialty for developing reservoir simulation models.

Mr. Stewart joined the Houston staff of H. J. Gruy & Associates, Inc. in 1974 as a reservoir engineer.

He is a member of the Society of Petroleum Engineers of AIME and a member of Tau Beta Pi, honorary engineering society.



William C. Sutherland
Senior Petroleum Engineer
H. J. Gruy and Associates, Inc.,
Dallas

Mr. Sutherland graduated from the University of Oklahoma in 1954 with a B.S. Degree in Petroleum Engineering.

Following a six-year period of practical field experience as a pusher-driller, Mr. Sutherland was employed by Continental Oil Company in 1954 as Drilling Superintendent in the Texas-Oklahoma-New Mexico region. Subsequently, he served as advisor for drilling operations in the offshore Louisiana area. In 1957, he became a consulting engineer in Texas specializing in drilling problems and secondary recovery studies and operations for clients in Texas, Oklahoma, New Mexico, Louisiana and Turkey. During 1965 to 1969, Mr. Sutherland was employed by the Hunt Companies and affiliates as a consultant to management on matters of drilling, completions and unit operations. He gained both onshore and offshore experience in the U.S., Libya, North Sea and Alaska. In 1969, Mr. Sutherland joined D. R. McCord and Associates as a consulting engineer specializing in drilling, completion and remedial work. His experience enabled him to treat drilling and production problems in adverse environments of the U.S., Iran, Algeria and Angola.

Mr. Sutherland joined the Dallas staff of H. J. Gruy and Associates, Inc. in 1975 as Senior Petroleum Engineer. He is a member of the Society of Petroleum Engineers of AIME, and the Petroleum Engineers Club of Dallas. He is also a registered professional engineer in the State of Texas.



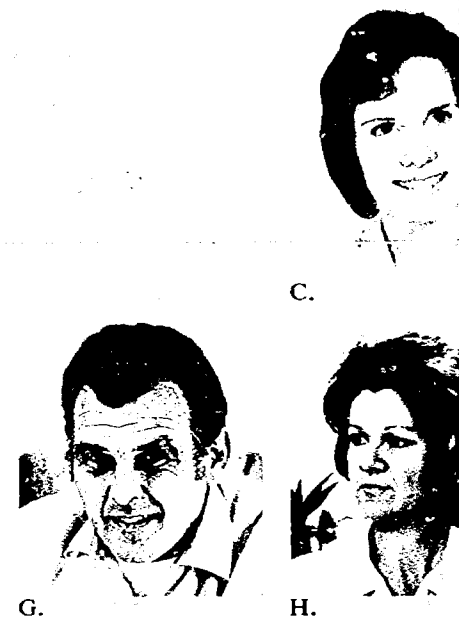
James F. Vincelette
Senior Geologist,
H. J. Gruy and Associates, Inc.
Dallas

Mr. Vincelette received a B.S. Degree in Geological Engineering (with a petroleum option) from the Montana College of Mineral Sciences and Technology in 1966.

Mr. Vincelette was employed by the Sunray DX Oil Company upon graduation where he was involved in field studies, well site geology analyses, regional stratigraphic studies, structural mapping and exploration geology activities. His field experience was gained in the Sacramento and San Joaquin Valleys, the Delaware Basin, North Louisiana, Arkansas and Mississippi. He has worked extensively on the Miocene Trend in South Louisiana and the Jurassic Trend in the Southeastern states.

In 1974, Mr. Vincelette joined the Dallas staff of H. J. Gruy and Associates, Inc. as a Senior Geologist.

He is a member of the American Association of Petroleum Geologists and the Dallas Geological Society.



- A. Julio Castaner, Programmer
- B. Al Cowart, Treasurer and Comptroller
- C. Denise Delahoussaye, Technical Assistant
- D. Theresa Dunklin, Technical Assistant
- E. April Colbert, Receptionist
- F. Kathy Hodge, Executive Secretary
- G. Curtis Hughes, Graphic Illustrator
- H. Doris Jackson, Technical Assistant
- I. Kathy Langford, Key punch Operator
- J. Milton LeSueur, Building Superintendent
- K. Susan LeSueur, Receptionist
- L. Jo Ann Lindsey, Executive Secretary
- M. Fred McGowan, Manager of Graphic Arts
- N. Nancy Plumlee, Key punch Operator
- O. George Stucker, Printer
- P. Betsy Taylor, Technical Assistant
- Q. Irene Wright, Technical Assistant

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- A. Julio Castaner, Programmer
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Officers

President

Executive Vice President

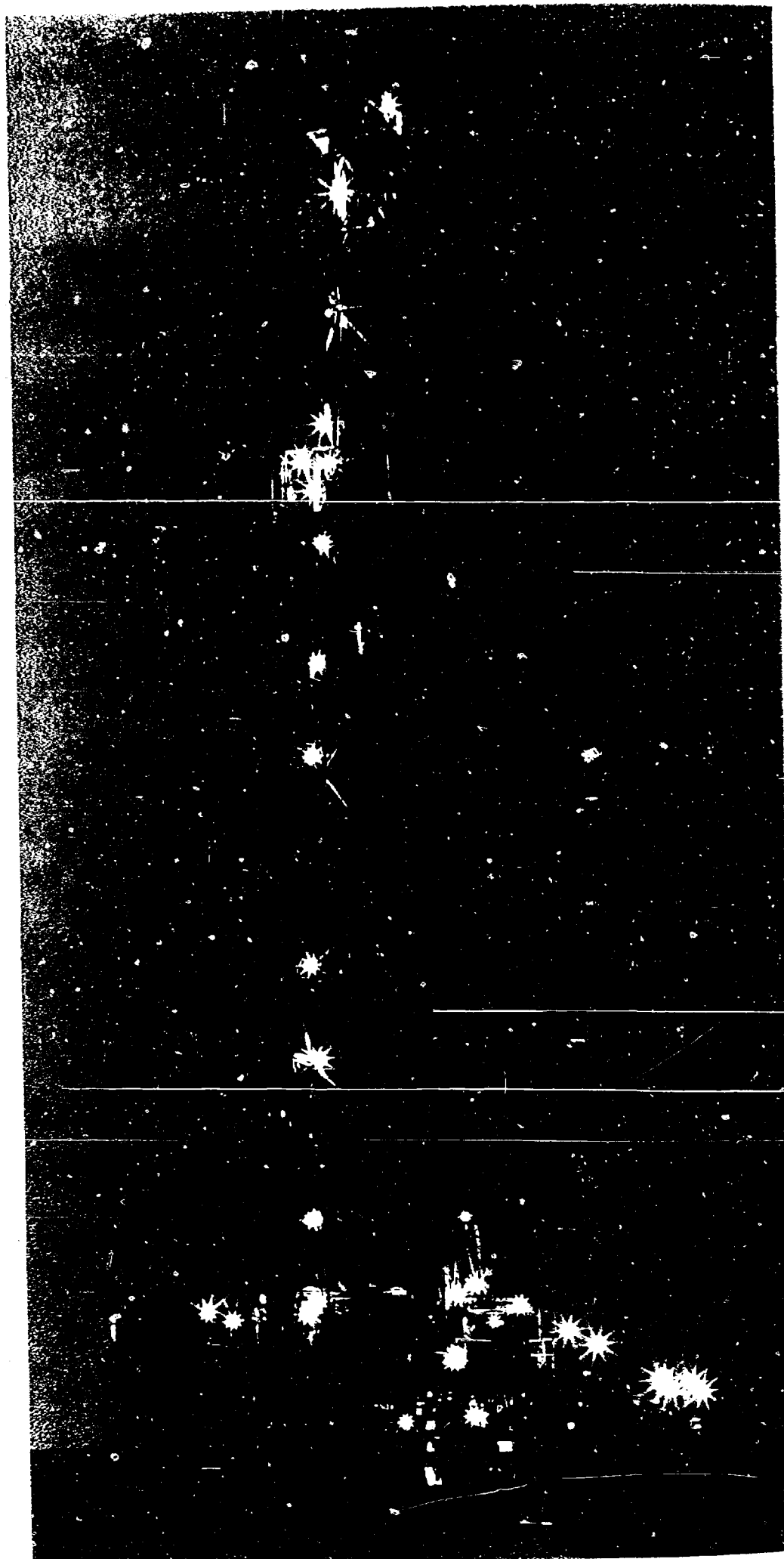
General Manager

Regional Vice President

Regional Vice President

Regional Vice President

Regional Vice President



Gruy Management Service Co.

CAPABILITIES

The Gruy Management Service Company was organized primarily to manage oil and gas producing properties. Personnel devote full time to management of properties. Clients receive additional benefit from the capabilities and experience of the engineers and geologists of H. J. Gruy and Associates, Inc. In-house computing equipment is available for use in preparing income distributions, routine accounts, and joint operating statements.



The GMSCO staff of professional petroleum engineers and accounting, drilling and production specialists provides a broad range of complete petroleum production services at economic and competitive rates. Experienced personnel are available to meet client needs ranging from property management on one hand to providing solutions to special drilling, completion and production problems on the other hand. These services may be secured simply by an operating agreement, agency agreement or letter of instruction. Highlights of these services follow.

Services:

- Property Management
- Drilling and Completion
- Wellbore Operations
- Production Operations
- Separation Equipment
- Distribution Systems
- Accounting
- Auditing
- Engineering
- Geology

Gruy Management Service Co.

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SERVICES INCLUDE:

Property Management

Major area of GMSCO expertise ... Provides economic management of oil and gas producing operations ... Experience and cost consciousness applied ... Close supervision and attention to detail given ... Maximum profit for minimum effort on part of property owner is assured.

Drilling and Completion

Design programs ... Issue AFE's ... Stake locations ... File forms ... Let drilling contracts ... Supervise drilling ... Prepare daily drilling reports ... Supervise completion ... Contract sales of production ... Accounting.

Workovers

Make recommendations ... Design programs ... Let service company contracts ... Supervise workover operations ... Prepare reports ... Accounting.

Production Operations

Oil and gas wells ... Pumping or flowing ... Gas-lift system design, installation and operation ... Other artificial lifting methods ... AFE's ... Gas compression ... Lease surface facilities ... Remedial operations ... Filing regulatory body forms ... Salt water disposal ... Lease and well records ... Automatic lease equipment.

Secondary Recovery

Recommend, design, install and operate waterfloods ... Gas injection ... Steam and fire floods.

Disposal Systems

Design, install and operate storage systems for salt water, plant effluents and other undesirable matter.



The GMSCO staff of professional petroleum engineers and accounting, drilling and production specialists provides a broad range of complete petroleum production services at economic and competitive rates. Experienced personnel are available to meet client needs ranging from property management on one hand to providing solutions to special drilling, completion and production problems on the other hand. These services may be secured simply by an operating agreement, agency agreement or letter of instruction. Highlights of these services follow.



Accounting

Routine accounting ... Monthly joint operating statements ... Monthly income distribution ... Ad valorem and property taxes ... Depreciation ... Depletion ... Division order ... Transfer of ownership ... In-house computing capability.

Gas Compression

Lease compressors by agreement ... Design, install and operate gas-lift systems and compression systems for gas wells and gas injection operations.

Pipeline Systems

Design, install, and maintain pipelines

Consultation

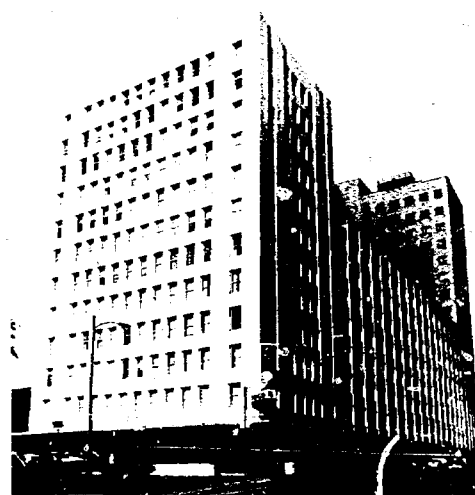
Operating problems ... Design of drilling and workover programs ... Design of lease surface facilities ... Design of secondary recovery programs ... Efficiency studies ... Sale of oil, gas, and plant products ... Auditing AFE's, joint operating statements, and income distribution for non-operator interest owners.

Advantages of GMSCO's Service:

- Maximum profits
- Professional management
- Minimum required operating costs
- Frees owner from attention to continual problems and decisions
- Convenience of dealing with only one management firm for operations in several areas
- Knowledge and experience of drilling and production specialists at a fraction of the full cost

PROFESSIONAL PERSONNEL:

The staff, whose competence is largely responsible for the company's success, is pictured on the following pages.



Corpus Christi

Personnel

H. J. Gruy

*Chairman of the Board and
Chief Executive Officer,
Gruy Management Service Co.
Dallas and Houston*



H. C. W.
President
Gruy M
Dallas

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PROFESSIONAL PERSONNEL:

The staff, whose competence is large-
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featured on the following pages.

Personnel

H. J. Gruy

*Chairman of the Board and
Chief Executive Officer,
Gruy Management Service Co.
Dallas and Houston*



H. C. Wilson

*President and Chief Operating Officer,
Gruy Management Service Co.
Dallas*

Mr. Wilson received a B.S. Degree in Petroleum Engineering from Texas A&M University in 1938.

Upon graduation, Mr. Wilson joined Standard Oil Company of Texas and was assigned to the West Texas-New Mexico Division. He worked in various engineering capacities, including those as District Engineer, Assistant Division Engineer, and District Superintendent until 1948.

From 1942 to 1945, he served as a pilot in the United States Air Force.

In 1948, Mr. Wilson joined Geochemical Surveys, a Dallas based independent oil company, as Production Manager. From 1948 to 1968, he was responsible for the planning, drilling and completion of wells in Texas, New Mexico, California, Montana, North Dakota, Nebraska, Louisiana, Mississippi, Alabama and West Virginia. In addition, he designed, installed and operated several successful waterflood operations in West Texas. In 1968, he was transferred to Dallas as Vice-President of Geochemical Surveys, Inc. In this position, he remained in charge of drilling and production and supervised drilling in the mineral exploration department.

Mr. Wilson joined Gruy Management Service Co. in 1972 as Executive Vice-President and General Manager. He was elected President and Chief Operating Officer in 1973.

Mr. Wilson is a member of the Society of Petroleum Engineers of AIME and the American Petroleum Institute. He is a registered professional engineer in the State of Texas.



Rainer A. Vanoni

*Vice-President and Houston
Area Manager,
Gruy Management Service Co.
Houston*

Mr. Vanoni attended Rice Institute School of Business for two years and received a B.S. Degree in Petroleum Engineering from the University of Houston in 1956. He received an M.S. Degree in Petroleum Engineering from that University in 1959.

Mr. Vanoni was employed by Chevron Oil Company in 1958, where he was responsible for reservoir studies and recommendations for secondary recovery projects including miscible displacement. He has participated in formation of secondary recovery units. He has also supervised and been responsible for drilling, completion, and workover operations along the Gulf Coast, both on land and on offshore or inland barges. Mr. Vanoni has had production experience in most areas of the Gulf Coast including flush primary flowing wells, compressor and gas-lift installations, and waterflood operations.

Mr. Vanoni joined Gruy Management Service Co. in 1968 as the Houston area manager of production. He was elected Vice-President in 1972.



us Christi



David A. Cantwell
District Engineer
Gruy Management Service Co.
Houston

Mr. Cantwell received a B.S. Degree in Petroleum Engineering from The University of Missouri in 1968.

Mr. Cantwell was employed by Gulf Oil Corporation from 1968 to 1974. During this period he was located in the Gulf Coast area of Louisiana where his duties included all phases of petroleum engineering related to offshore operations. His last assignment with Gulf was as Staff Engineer in its Morgan City area office.

Mr. Cantwell joined Gruy Management Service Co. in 1974 as the district engineer for the Company's Houston district.



Harry E. Doty, Jr.
Corpus Christi District Manager,
Gruy Management Service Co.
Corpus Christi

Mr. Doty received a B.S. Degree in Petroleum Engineering from the University of Corpus Christi in 1960.

Mr. Doty has worked for Pan Geo Atlas Corp., Drilling Well Control, Inc., Belco Petroleum Corp. and Integral Petroleum Corp. in various engineering and supervisory capacities. He has had extensive experience in offshore operations, including drilling, completing, and construction of production facilities. He is experienced in the drilling and completing of deep, high pressure wells.

Mr. Doty joined Gruy Management Service Co. in 1974 as an engineer; he became the Corpus Christi District Manager in 1975.



Bob R. O'Dell
Dallas District Manager,
Gruy Management Service Co.,
Dallas

Mr. O'Dell received a B.S. Degree in Petroleum Engineering from The University of Texas in 1961.

After graduation, Mr. O'Dell worked as a field engineer for Dulaney Oil Company in South Texas. In 1963, he joined Tidewater Oil Co. and worked as a production engineer in the Ventura Avenue Field of California. He also helped initiate several thermal stimulation projects in California. During 1965, Mr. O'Dell joined Standard Oil Company of California and worked on reservoir studies, offshore development programs, and thermal stimulation projects in the Santa Barbara area. In 1970, he was transferred to New Orleans where he worked with Chevron Oil Co. as an offshore production engineer in the Main Pass and West Delta areas.

Mr. O'Dell joined Gruy Management Service Co. in 1973 as the Dallas District Manager.



A.



B.



C.



D.



E.



F.



G.

- A. Donna DeCuir, Production Secretary
- B. Gail Garrett, Accountant
- C. Ruth Hans, Production Secretary
- D. Linda Fraley, Receptionist
- E. Pamela Tyer, Production Typist
- F. James P. White, Comptroller
- G. Kathryn Zielski, Production Secretary

Bob R. O'Dell
*Dallas District Manager,
Gruy Management Service Co.,
Dallas*

Mr. O'Dell received a B.S. Degree in Petroleum Engineering from The University of Texas in 1961.

After graduation, Mr. O'Dell worked as a field engineer for Dulaney Oil Company in South Texas. In 1963, he joined Tidewater Oil Co. and worked as a production engineer in the Ventura Avenue Field of California. He also helped initiate several thermal stimulation projects in California. During 1965, Mr. O'Dell joined Standard Oil Company of California and worked on reservoir studies, offshore development programs, and thermal stimulation projects in the Santa Barbara area. In 1970, he was transferred to New Orleans where he worked with Chevron Oil Co. as an offshore production engineer in the Main Pass and West Delta areas.

Mr. O'Dell joined Gruy Management Service Co. in 1973 as the Dallas District Manager.



A Synopsis of The Gruy Companies Publications and Clients

- A. Donna DeCair, Production Secretary**
- B. Gail Garrett, Accountant**
- C. Ruth Hans, Production Secretary**
- D. Linda Fraley, Receptionist**
- E. Pamela Tyer, Production Typist**
- F. James P. White, Comptroller**
- G. Kathryn Zielski, Production Secretary**

Publications:

- "Wartime Regulations of the East Texas Field," *The Petroleum Engineer*, December, 1945, H. J. Gruy.
- "Critical Review of Methods Used in Estimation of Natural Gas Reserves," *Petroleum Development and Technology AIME*, Vol. 179, 1949, H. J. Gruy - Co-Author.
- "Plotting Pressure Drop Against Cumulative Production of Gas Fields on Log-Log Paper," *The Petroleum Engineer*, September, 1950, H. J. Gruy - Co-Author.
- "A Method of Predicting the Future Performance of a Gas Reservoir Using a Digital Computer," *IBM Petrocade Papers*, October, 1959, Forrest A. Garb.
- "Approximation of Gas-Drive Recovery and Front Movement in the Abqaiq Field, Saudi Arabia," *Transactions AIME*, 1960, L. T. Stanley.
- "Curve-Fitting Cuts Material Balance Calculations," *Petroleum Engineer*, August, 1961, L. T. Stanley.
- "A Digital Computer Program for Predicting Reservoir and Individual Well Performance of a Multi-Drive Reservoir," *IBM Petroleum Reservoir Engineering Paper*, March, 1962, Forrest A. Garb - Co-Author.
- "Thirty Years of Proration in the East Texas Field," *Journal of Petroleum Technology*, June, 1962, H. J. Gruy.
- "Just Hours to Field-Evaluate Paraffin Inhibitor," *Petroleum Engineer*, October, 1962, L. T. Stanley - Co-Author.
- "Estimation and Classification of Petroleum Reserves," Seminar on the Economics of Oil and Gas by The Panhandle Association of Petroleum Landmen, Fall, 1964, H. J. Gruy.
- "Practical Application of Digital Computers to Economic Analysis of Producing Properties," *Journal of Petroleum Technology*, February, 1965, H. J. Gruy and Forrest A. Garb.
- "Significance of Oil Company Financial Statements," 1965 Symposium on Petroleum Economics and Evaluation, Dallas Section, March, 1965, H. J. Gruy - Co-Author.
- "Manual of Fundamental Well Log Analysis," Published for Private Distribution, September, 1964, Supplemented August, 1965, H. J. Gruy - Co-Author.
- "A 1966 Critique on Pressure Transient Testing," SPE 1512, Presented 41st Annual Fall Meeting of Society of Petroleum Engineers of AIME, Dallas, Texas, October 2-5, 1966, H. J. Gruy and Forrest A. Garb - Co-Authors.
- "A New Approach to the Two-Dimensional Multiphase Reservoir Simulator," *Society of Petroleum Engineers Journal*, Vol. 6, No. 2, June, 1966, C. H. Stewart.
- "Special Problems in Production Go to Consultant," *Petroleum Management*, February, 1967, H. J. Gruy.
- "Survival of Shale Oil in Underground Retorting by Combustion," 1970 SPE Meeting, Raj Prasad - Co-Author.
- "Effects of Drainage Shape and Well Location on Stabilized Gas Deliverability Calculations," SPE Paper No. 3836 (presented at the Rocky Mountain Regional Meeting of the SPE in Denver, Colorado, April 10-13, 1972) R. K. Prasad - Co-Author.
- "Pressure Transient Analysis in the Presence of Two Intersecting Boundaries," (presented to the 1972 Annual Fall Meeting of the SPE held in San Antonio), R. K. Prasad.
- "Practical Statistics for Petroleum Engineers," The Petroleum Publishing Company, 1973, L. T. Stanley.
- "All We Ever Wanted to Know About Fractured Reservoirs, But Were Afraid To Ask," Presented at Meeting of Southwest Legal Foundation, March 12-13, 1975, Forrest A. Garb - Co-Author.

Clients Have Included:

Ada Oil Exploration Company
The Aerospace Corporation
State of Alaska
American Natural Gas Production Company
American Petrofina, Inc.
Amoco International Oil Company
Amoco U.K. Ltd.
Apco Oil Corporation
Arabian Oil Company, Ltd.
Armco Steel Corporation
Ashland Oil, Inc.
Atlantic Richfield Company
Austral Oil Company, Inc.
Aztec Oil and Gas Company
Bechtel Corporation
Bordon Company
Bradco Oil & Gas Company
R. L. Burns Corporation
Buttes Gas & Oil Company
Cabot Corporation
Cenard Oil & Gas Company
C F Industries, Inc.
Jerry Chambers
Champlin Petroleum Company
Cities Service Company
Cities Service Gas Company
Cities Service Oil Company
Cleary Petroleum Corporation
Clinton Oil Company
Coastal States Gas Company
Colorado Interstate Gas Company
Commonwealth Oil Refining Company, Inc.
Continental Oil Company
Edwin L. Cox
CRA, Inc.
Crown Central Petroleum Corporation
Damson Oil Corporation
Davis Brothers Oil Company
DeCalt International Corporation
Devon Corporation
Diamond Shamrock Oil & Gas Company
Kenneth Dunn
ELF-ERAP
Energy Sources, Inc.
Ethyl Corporation
Falcon Seaboard, Inc.
Five Resources, Inc.
Forest Oil Corporation
Four M Properties, Ltd.
Gas Council of England
Gas and Fuel Corporation of Victoria (Australia)
Gen Oil, Inc.
General American Oil Company of Texas

General
Geochem
General E
Getty Oil
Goodrich
Gulf Oil
Michel
Harding
Highland
John H.
The How
Humble
Hunt Oil
Husky Oil
IAPCO
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King Res
Kirby Pe
LaCoast
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Longhorn
Magellan
McCormi
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Mid-Am
Mitre Co
Mobil Oil
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Signal Oil
Sun Oil C
Tenneco
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Estimation and Classification of Petroleum Reserves," Seminar on the Economics of Oil and Gas by The Panhandle Association of Petroleum Landmen, Fall, 1964, H. J. Gruy.

Practical Application of Digital Computers to Economic Analysis of Producing Properties," *Journal of Petroleum Technology*, February, 1965, H. J. Gruy and Forrest A. Garb.

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Amoco U.K. Ltd.
Apco Oil Corporation
Arabian Oil Company, Ltd.
Armco Steel Corporation
Ashland Oil, Inc.
Atlantic Richfield Company
Austral Oil Company, Inc.
Aztec Oil and Gas Company
Bechtel Corporation
Bordon Company
Bradco Oil & Gas Company
R. L. Burns Corporation
Buttes Gas & Oil Company
Cabot Corporation
Cenard Oil & Gas Company
C F Industries, Inc.
Jerry Chambers
Champlin Petroleum Company
Cities Service Company
Cities Service Gas Company
Cities Service Oil Company
Cleary Petroleum Corporation
Clinton Oil Company
Coastal States Gas Company
Colorado Interstate Gas Company
Commonwealth Oil Refining Company, Inc.
Continental Oil Company
Edwin L. Cox
CRA, Inc.
Crown Central Petroleum Corporation
Damsen Oil Corporation
Davis Brothers Oil Company
DeCalfa International Corporation
Devon Corporation
Diamond Shamrock Oil & Gas Company
Kenneth Dunn
ELF-ERAP
Energy Sources, Inc.
Ethyl Corporation
Falcon Seaboard, Inc.
Five Resources, Inc.
Forest Oil Corporation
Four M Properties, Ltd.
Gas Council of England
Gas and Fuel Corporation of Victoria (Australia)
Gen Oil, Inc.
General American Oil Company of Texas

General Crude Oil Company
Geochemical Surveys, Inc.
General Electric Company
Getty Oil Company
Goodrich Operating Company, Inc.
Gulf Oil Company
Michel T. Halbouty
Harding Oil Co.
Highland Resources, Inc.
John H. Hill
The Howard Corporation
Humble Oil & Refining Company
Hunt Oil Company
Husky Oil Company
IAPCO
L. B. Johnson Estate
Kathol Petroleum Inc.
Kerr-McGee Corporation
Kewanee Oil Company
King Resources Company
Kirby Petroleum Company
LaCoastal Petroleum Corporation
Logue & Patterson, Inc.
Lone Star Producing Company
Longhorn Producing Company
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McCormick Oil & Gas Corporation
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Mitre Corporation
Mobil Oil Corporation
Monsanto Company
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Murphy Oil
Ocean Drilling & Exploration Company
Oilwell Division, U.S. Steel
Oleum, Inc.
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Prudential Funds, Inc.
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Texas Broadcasting Corporation
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Abo Reefing in Southeastern New Mexico

By William J. Le May

Introduction:

The Abo is a transgressive barrier reef which separated lagoonal deposits on the northwest shelf from clastic deposits in the Delaware Basin during lower Leonard (Permian) time. The reef probably grew on a pre-existing platform or hingeline along the rim of the Delaware Basin. The reef grew northward, transgressing the shelf deposits, as well as vertically in the lower Leonard (Abo) section.

Three distinct lithologies, indicative of three different environments of deposition, were the result of the Abo reefing: 1. basin deposits (Bone Spring formation or fore-reef deposits); 2. reef, and 3. shelf deposits, Abo formation, or back-reef deposits.

TREND DEVELOPMENT

The Abo reef was first found to be oil-productive when Skelly Oil Co. deepened a well beneath shallow San Andres production in Lovington field in December 1951. The Abo reef was topped at 8,117 feet and flowed oil on a drill stem test. During the early development of the Lovington Abo field, the rapid facies changes mentioned above were noted traversing the reef from south to north.

It was not until the discovery of Empire Abo field by Pan American Petroleum Corp. and Hondo Oil and Gas Co. in November 1957, and the early development of this field that the Abo reef became a major exploration target. Pay thicknesses in excess of 600 feet were encountered at depths from 5,500 to 5,800 feet. Rapid development followed.

The reef trend was delineated rimming the Delaware Basin by a lithologic study of samples in the lower Leonard section. This caused accelerated acreage acquisition along the reef trend from the Texas line westward across Lea and Eddy counties to the "Huapache structure" in western Eddy County. The degree of well density in various areas governed the width of the reef trend. Strong wild-cating activity along the trend began, continuing at a very rapid pace to the present.

Since December 1959, there have been four Abo reef discoveries between the Empire and Lovington Abo reef fields; Corbin Abo, Turner Abo (or Cedar Lake Abo as it has recently been classified), Wooley Abo and Vac Edge Abo. The last two fields mentioned have not been officially named. The lease names of the discovery have been used to identify them here.

Empire and Lovington Abo fields have separate water tables. All fields are in their early stages of development.

STRATIGRAPHY

Northward, behind the reef, evaporites and lagoonal sediments were being deposited in a restricted environment. These are back-reef shelf

deposits consisting of interbedded green shales and light gray to tan, fine crystalline, anhydritic dolomites. These sediments grade northward into red shales. This shelf deposit has been called "Abo formation." Sedimentation on the fore-reef side consists of black to dark brown, argillaceous and cherty dolomites and limestones interbedded with fine-grained sandstones. These sediments have been called "Bone Spring formation."

The Abo reef is a very clean, white to light tan or gray (commonly anhydritic) dolomite, varying from dense micro- and finely crystalline to coarsely crystalline in texture. The original reef framework probably consisted predominantly of hydro-corals, sponges and algae colonies. Occa-

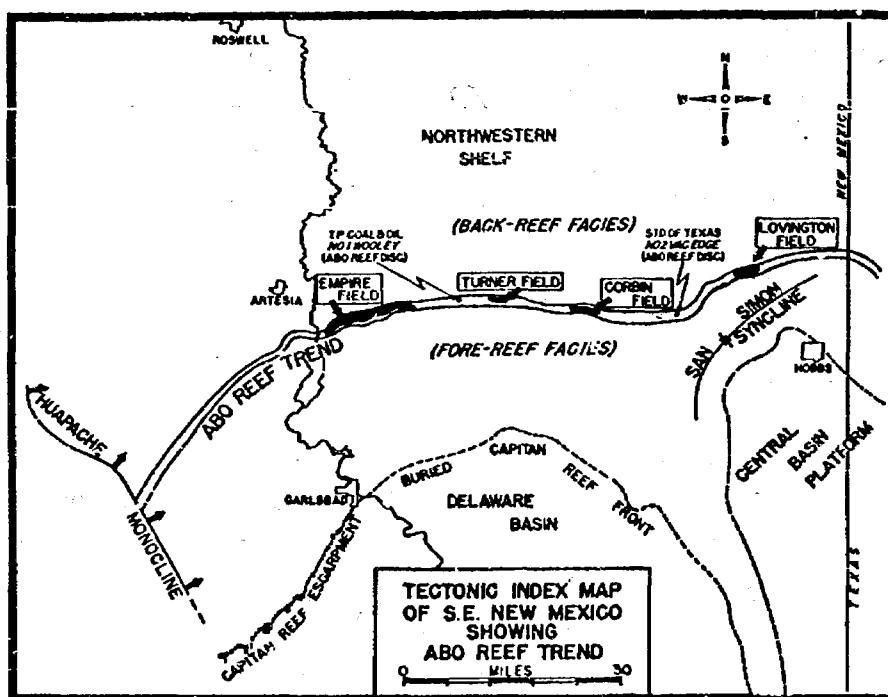


FIGURE 1—Abo reef trend has been established by oil production scattered over a length of at least 60 miles in Eddy and Lea counties, New Mexico from Empire through Lovington fields. Recent discoveries by Texas Pacific Coal and Oil Co. between Empire and Turner Abo fields and by Standard Oil Co. of Texas between Corbin and Lovington provide closer regional control. Abo trend may extend eastward into Gaines and/or Yoakum counties, Texas, and as far west in New Mexico as the Huapache monocline. Although only water has been found in the Abo west of Empire field, Abo prospects may be more favorable toward the extreme west than indicated here.

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1960

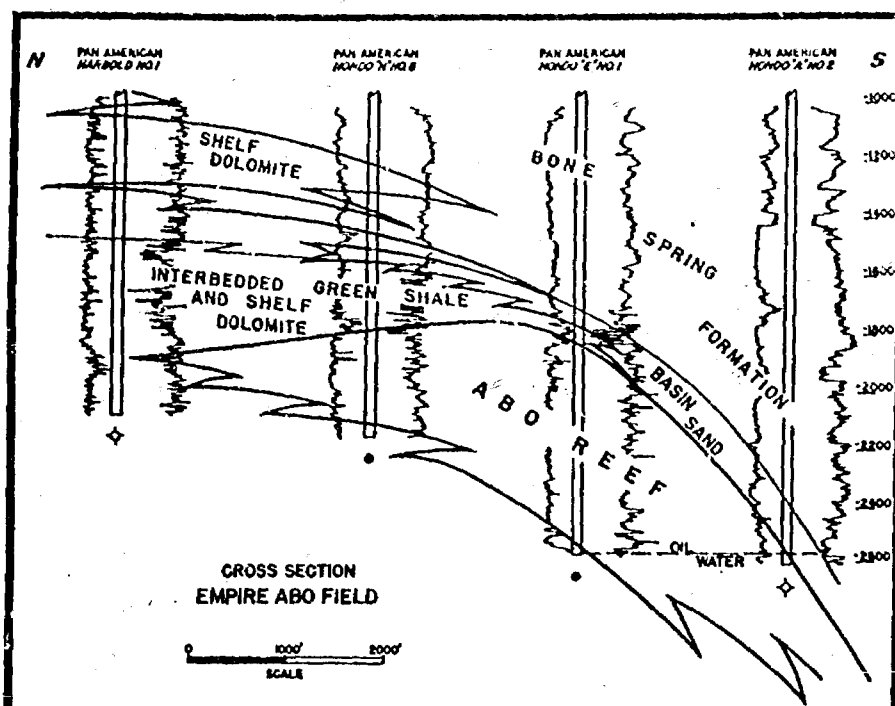


FIGURE 2—Dip cross-section showing reef buildup in the Empire Abo field. Evident are (1) about 700 feet of gross reef pay thickness in best well shown; (2) difficulty in correlating logs via electrical log characteristics alone; (3) distinctive fore-reef and back-reef facies; and (4) steeper fore-reef than back-reef slope.

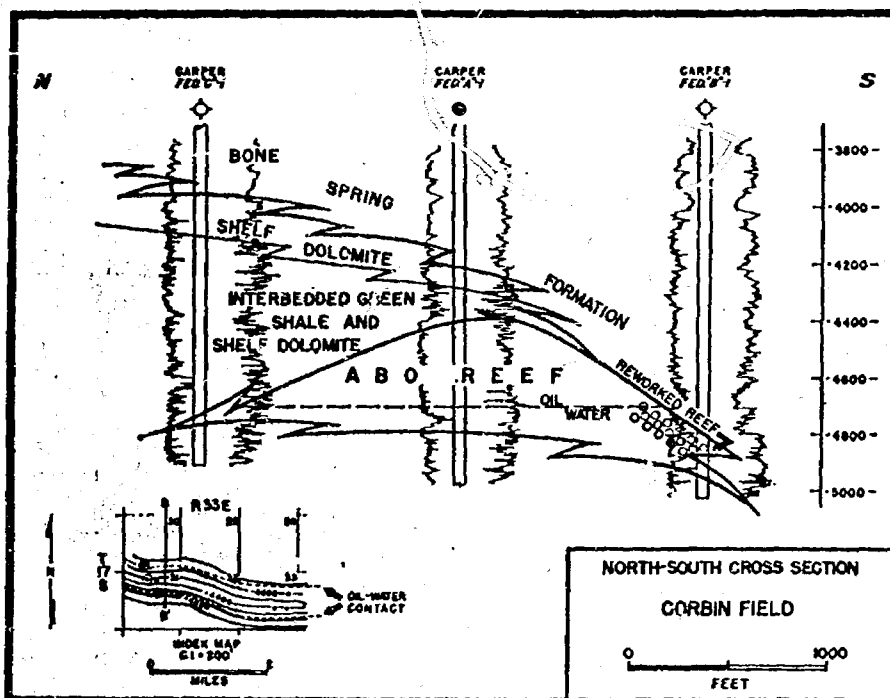


FIGURE 3—Dip cross-section across Corbin Abo reef field indicating: (1) greater transgression of Bone Spring formation northward; (2) size and shape of reef as compared with Empire reef in Figure 2. (Note horizontal scale differences in Figures 2 and 3.)

sional brachiopods, gastropods, and pelecypods have been noted in cores.

The Abo reef is unique in the noticeable absence of fossil remains. Probably in the dolomitization and recrystallization process much of the original fossil assemblages were destroyed. Anhydrite is quite common as a secondary deposit. Anhydrite inclusions a few inches to a few feet in diameter occupy many of the reef fractures and vugs. These inclusions predominate near the base of the reef.

REEF DEVELOPMENT AND DIAGENESIS

Certain conditions concerning reef growth and development can be postulated from observed subsurface stratigraphic relationships. Figures 2 and 3 show cross-sections through the reef in the Empire and Corbin areas. Certain observations are very significant:

In the Corbin area, basin sediments extend farther back-reef than at Empire

The reef at Empire is larger, both vertically and horizontally than at Corbin (note difference in scales in Figures 2 and 3)

The back-reef slope of the Empire reef is more gentle than at Corbin

Both fore-reef slopes are steep.

The reef crest at Corbin is 2,600 feet deeper than at Empire field.

In visualizing the reef growth pattern, it is apparent that variations occur along strike. In such areas as Corbin, reef growth approaches a vertical profile. In other areas, e.g., Empire, growth approaches a horizontal plane. The direction and rate of reef growth were apparently controlled by the rate of subsidence. A stable or slowly rising sea level offers favorable conditions for horizontal reef growth. A more rapidly rising sea level (or subsiding land) results in vertical growth of the reef. There are all gradations of the growth profile between vertical and horizontal. Where the sea level rises too rapidly, reef growth is stopped (Figure 4).

The importance of these variations along strike can not be stressed too heavily. The size and shape of Abo reef fields are dependent upon the growth profile of the reef and its variations in transgression. It has been noted that basin sediments are more transgressive in the Corbin area than at Empire. A structure map will

reveal steeper dip on shallow formations in the Corbin area. These relationships reveal a condition of relatively localized subsidence in the Corbin area. This subsidence probably stopped further reef growth (Figure 4). It is reasonable to assume that this (accelerating) subsidence existed during the latter stages of reef building, producing the vertical type profile of reef growth.

RESERVOIR CHARACTERISTICS

The Abo reef is a good reservoir because of well-developed secondary porosity. Vertical fractures were developed in the reef matrix, possibly due either to post-depositional tilting of the reef in early Tertiary or to compaction of the original reef framework due to overburden.

These fractures acted as channels for solution activity. The original limestone was dolomitized and recrystallized. Vugs were created, especially at the intersection of fractures. This fracture and vug porosity system offers the only effective means of communication within the reef.

Porosity is distributed irregularly within the reef reservoir. Not even offset wells can be correlated in the reef because of this irregular porosity development. Communication in local areas is very poor. This is evidenced by gas trapped in some low structural areas in Empire field. In the west end of Empire there are pockets of abnormally high water. In many cases in which a well has been completed in an anomalously high water zone, the water cut diminishes and oil production increases after the water has been drawn off. Most of these wells have to be pumped, again reflecting locally poor reservoir communication. In many areas, low porosities and permeabilities can be attributed to excessive anhydrite deposition. This condition is prevalent in the western end of Empire Abo field.

The nature of the reservoir drive mechanism in all reef fields but Lovington is questionable. Water drive is active in Lovington Abo field. Production history bears this out.

RESERVES

Empire Abo field is estimated to contain more than 65 million barrels of recoverable oil. It is likely that fields of equal magnitude may be discovered in this trend in the future.

Reserves figures calculated for the Empire Abo field vary from 300,000

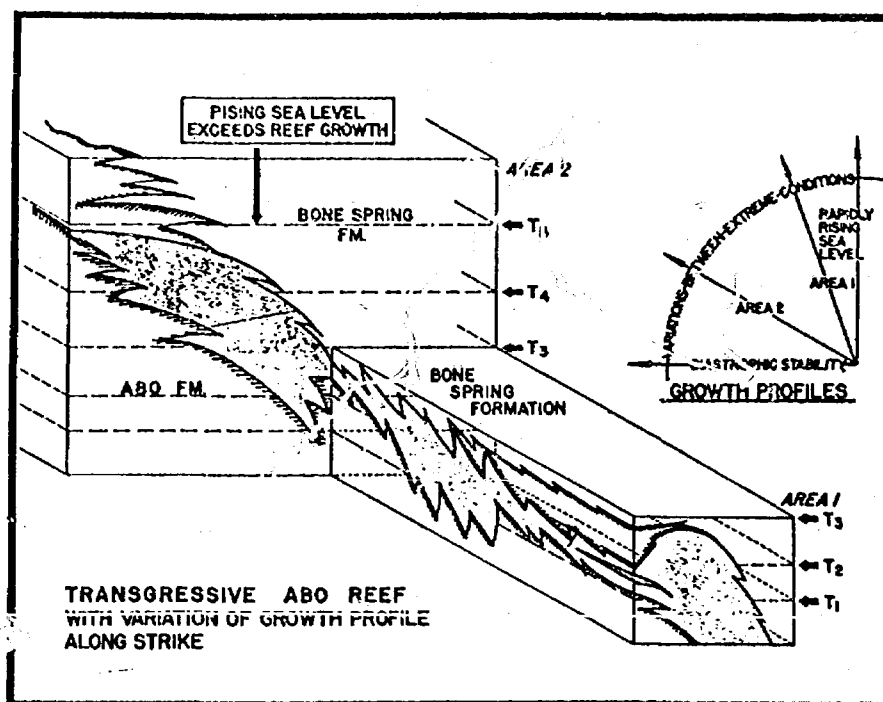


FIGURE 4—Stable or slowly rising sea level encourages horizontal growth of reef. A more rapidly rising sea level causes vertical growth, but if the rise is too fast, reef-building organisms are killed off and reef growth ceases.

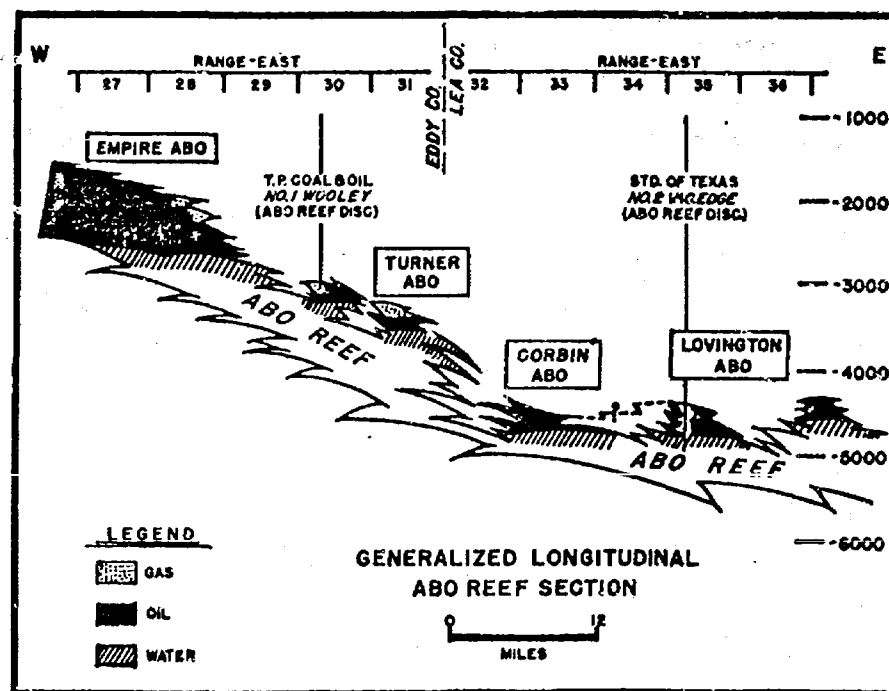


FIGURE 5—This schematic diagram shows general relationship of Abo oil fields to each other and to the main reef.

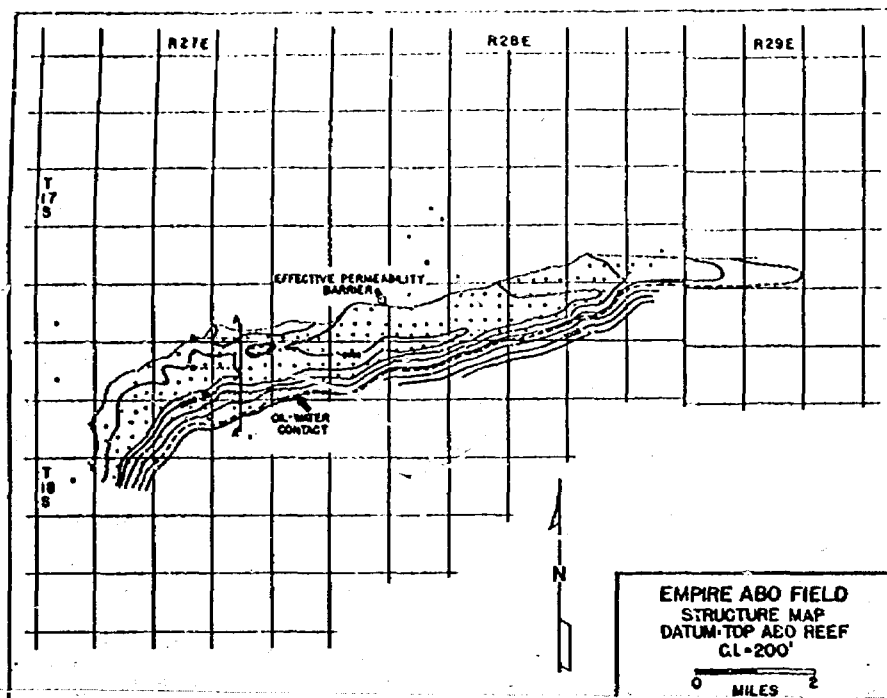


FIGURE 6—Structure on top of Abo reef, Empire field. Steep fore-reef slope is again shown by close contours despite large (200-foot) contour interval.

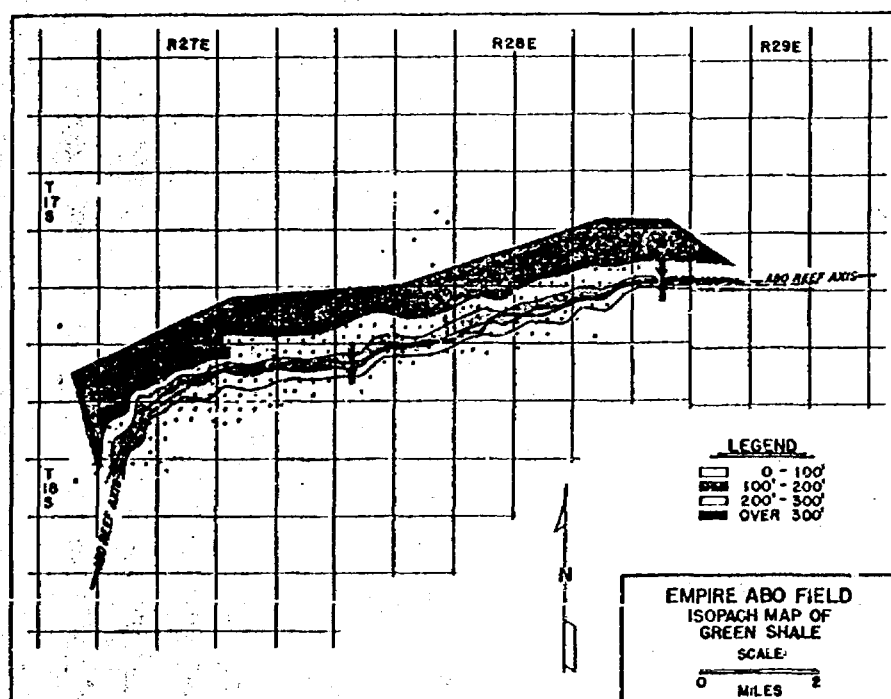


FIGURE 7—Isopach values of green shale section overlying Abo reef in Empire area are almost parallel to the reef axis.

barrels to 1,000,000 barrels per location. A rough approximation for all reef fields might be 500,000 barrels per location. These figures vary with pay thickness, quality of reef pay, and the nature of reservoir drive.

The Abo reef presents a very attractive drilling prospect when one considers the high reserves which can be found at moderate depths. There are some wells in the Empire Abo field with over 600 feet of pay at a depth of 5,600 feet. The Empire Abo field averages approximately 300 feet of pay. Depth to the reef in the Corbin and Lovington areas vary between 8,000 and 8,500 feet. In western Eddy County, the Abo reef is topped between 4,000 feet and 4,500 feet.

ABO REEF TREND EXPLORATION

Hydrocarbons have been trapped where porosity exists in relatively high structural areas along the reef. Figure 5 shows general relationships of Abo oil fields to each other and to the main reef. Three dimensions are needed to visualize the various factors contributing to hydrocarbon entrapment. Fore-reef productive limits are defined by each field's water table. Oil production will be limited back-reef either by the reef reservoir dipping under the field water table (e.g., Corbin Abo field) or, the reef reservoir interfingering with dense shelf dolomites, forming an effective permeability barrier (Empire and Lovington fields). The latter condition usually occurs where the reef has transgressed northward and its slope is gentle back of the crest.

Larger reef fields are of this type because the width of the field has been increased by lateral reef growth. Figure 6 shows structure on top of the reef in the Empire area. The productive area is five to seven locations wide. In contrast, the width of production in the Corbin area (Figure 3) is from one to three locations wide.

In the only completely defined field (Lovington Abo) the east-west productive limits are defined by the reef reservoir dipping under the water level. This type of trap condition seems to be present in other fields along the Abo reef trend. A gentle eastward plunge appears to be carrying the reef under water in the eastern end of the Empire Abo field. Certain evidence points to a different condition in operation in the western extremity of the Empire field:

Reef lithology in the west end of Empire is slightly different than that farther eastward. The dolomite is less porous and permeable, and more finely crystalline. Its color is darker gray. Anhydrite has filled more of the fractures and vugs.

In contrast to other Abo reef fields, the oil column at Empire occupies approximately 70 percent by volume of the total reef reservoir. In other fields, this figure approaches 20 percent.

Along the Abo reef trend west of the Empire field, the reef is encountered higher in the section. Thus far only water has been encountered in the reef. This evidence points to some type of permeability barrier near the western end of the Empire field development.

The first step in any Abo reef exploration program is to delineate the transition zone between lower Leonard basin and shelf facies. This involves a lithologic study of well samples across the general reef trend. Wells which contain 100 percent shelf or 100 percent basin lower Leonard sections present no problem. It is only where interfingering of the two facies occurs that a more detailed study of the area is needed.

Since the Bone Spring formation transgresses the Abo reef in certain areas, it is important to estimate the approximate position of reefing in the section. It can be noted on Figures 2 and 3 that a section of interbedded green shale and shelf dolomite lies directly behind and slightly over the crest of the reef. The top of the green shale constitutes a lithologic top and can be correlated on sample and electric logs. Since the Abo reef acted as a barrier, the top of the green shale and shelf dolomite should be time-equivalent to the top of the reef. Structure maps on top of the green

shale, isopach maps of the green shale section, and cross-sections are useful in exploring for and exploiting Abo reef fields.

Figure 7 is an isopach map of the green shale section overlying the Abo reef in the Empire area. Note that there is a thin section of green shale overlying the reef axis or crest. This is probably the result of Tertiary tilt.

In wildcatting for oil-productive Abo reef, one well is usually not sufficient to test an acreage block adequately. Where a well encounters Bone Spring formation immediately overlying water-bearing Abo reef, an excellent prospect lies to the north or back-reef of that well. Where only a shelf section is penetrated in the lower Leonard series, one would move south or fore-reef for the next location.

The reef is capped by a section of green shale 10 to 50 feet thick along its crest. Therefore, water-bearing reef capped by the above thickness of green shale would discourage further exploration except along the reef strike.

POSSIBLE NEW AREAS

Experience with Abo reefing along the Artesia-Lovington trend in southeastern New Mexico has led to speculation in other areas where similar back-reef—fore-reef conditions exist. Abo reefing has been postulated along the western hingeline of the Central Basin Platform in New Mexico and the Platform's eastern hingeline in Texas. There are strong indications of Abo reefing along the "Huapache structure" in western Eddy County, New Mexico. Barrier reefs of other ages should be examined in light of the success encountered with the Abo reef.

CONCLUSIONS

1. The Abo reef is a transgressive barrier reef which separated shelf

deposits of the Abo formation from basin deposits of the Bone Spring formation.

2. Variations in the size and shape of the reef along its strike can be attributed to a growth profile which was controlled locally by subsidence.

3. Porosity development of the reef is secondary, resulting possibly from Tertiary tilting or compaction due to overburden, fracturing, and solution activity. Subsequent anhydrite deposition has destroyed much of the secondary porosity development.

4. Hydrocarbons are trapped where secondary porosity development has created a reservoir in relatively high structural areas along the reef.

5. Exploration procedure involves a lithologic study of stratigraphic relationships in the lower Leonard section. The upper section of interbedded green shale and shelf dolomite is considered reef equivalent and should be mapped and isopached. A thin section of green shale overlies the crest of the reef, probably a result of Tertiary tilt.

This article is based on a paper presented at the third annual Southwestern Federation of Geological Societies meeting, Abilene, Texas, October 12-14, 1960.

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OIL CONSERVATION DISTRICT NO. 18
 Case No. 5571L R No. DN-3
 Submitted by Amoco
 Hearing Date 1-21-76

Federal Oil Lease
 No. 452

PROSPECTIVE AREA

N

West Lease Line

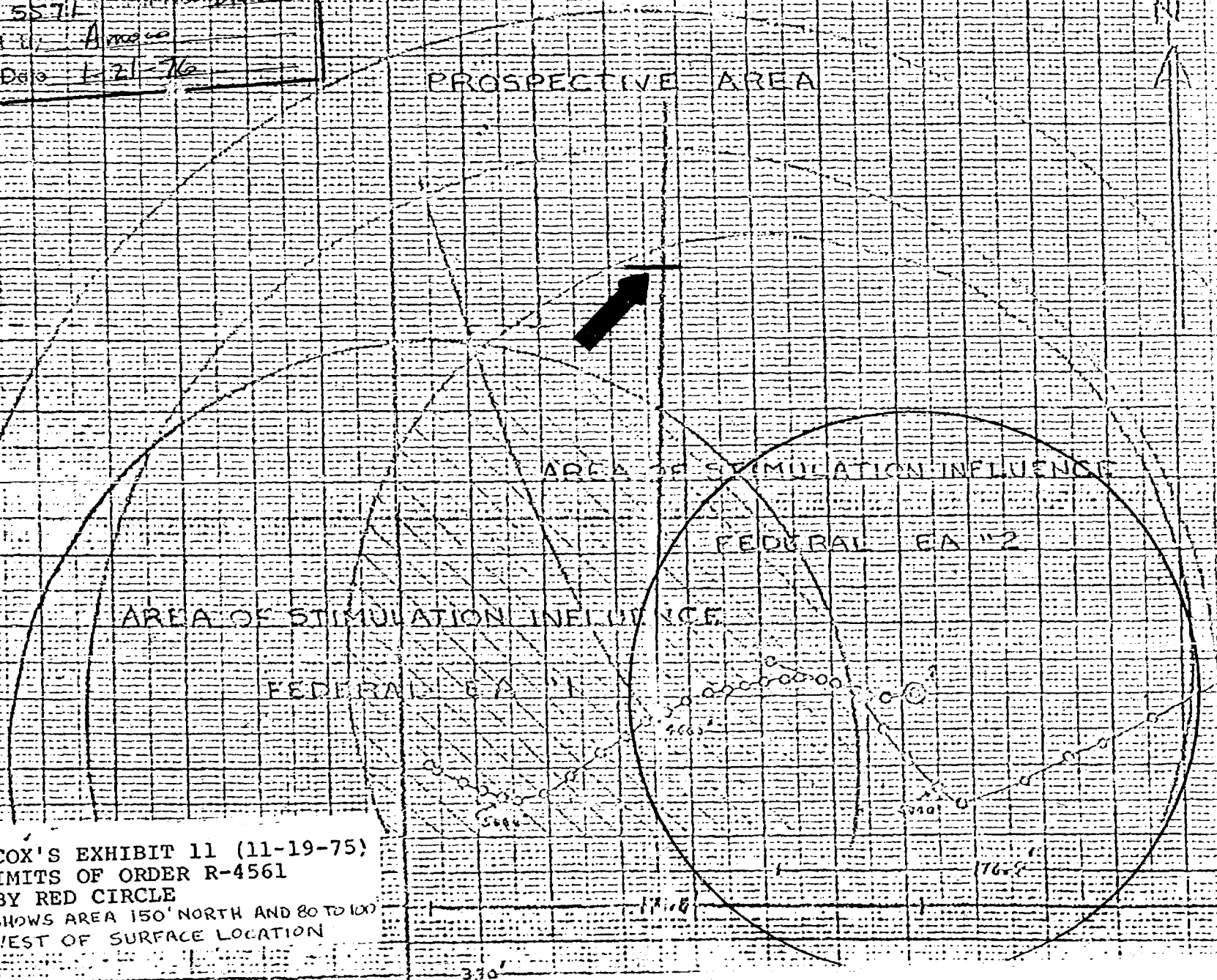
AREA OF STIMULATION INFLUENCE

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AREA OF STIMULATION INFLUENCE

FEDERAL EA "1"

R. G. COX'S EXHIBIT 11 (11-19-75)
 WITH LIMITS OF ORDER R-4561
 SHOWN BY RED CIRCLE
 — SHOWS AREA 150' NORTH AND 80 TO 100'
 WEST OF SURFACE LOCATION



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Destruction Heavy In 5-Alarm Blaze

By LAURA ALLEN
A 5-alarm fire caused
more than \$200,000 damage

and destroyed about 80 per cent of a 1-story office complex at North Central Expressway and Northhaven Saturday evening.

Eighty-five firemen used 20 pieces of major equipment in battling the 2-hour blaze that began at 4:26 p.m. at Park Central Plaza, according to Pete Nunez, fire department public information officer.

Fireman Bobby Galloway was taken to Presbyterian Hospital with a possible leg fracture and another fireman was slightly injured when pieces of sheetrock flew into his eyes. No other injuries were reported.

Fire Chief M. C. Hendrix said the cause of the fire was unknown but it was reported to have started in a snack bar area at the rear of the complex. Nunez said the alarm was called in by someone apparently alone in the building who smelled smoke.

He said a common attic above more than a dozen offices was responsible for the quick spread of the first 5-alarm fire in at least six months. Chemicals in a film



—Dallas News Staff Photo by Larry Reese.

Firemen with hoses find the footing precarious atop a caved-in roof on the Park Central Plaza.

processing company's office backed up as far as I-37 also hampered firefighting efforts. Freeway.

Hundreds of curious spectators crowded around the area, attracted by the thick clouds of black smoke over city. Police department officials said traffic was

Officials were a first concerned that the fire would spread to the nearby Park Central House apartments, but the fire was brought under control and tapped out 6:27 p.m.

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5571
Submitted *April*
Hearing Date *Jan 21, 1976*
DN-1

FIRE DESTRUCTION — One fireman was injured as a five alarm fire raged through an office complex on North Central Expressway late Saturday. A section of the roof collapsed at the height of the blaze. Damage was estimated at more than \$200,000. (Story and more pictures, Page 1-B.)

—Staff Photo by Paul Iverson

Destruction Heavy In 5-Alarm Blaze

By LAURA ALLEN
A 5-alarm fire caused more than \$200,000 damage

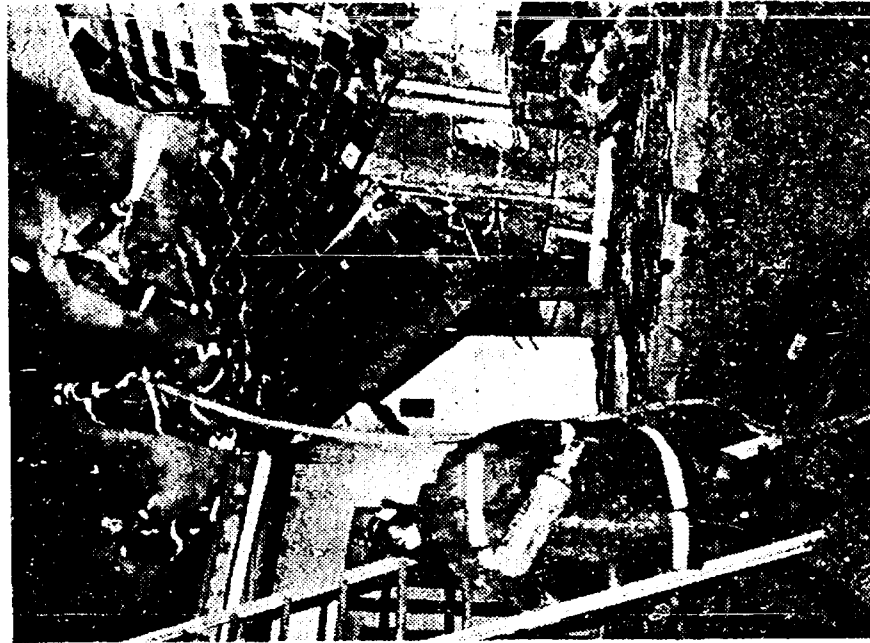
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—Staff Photo by Paul Iverson

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|---------------|----------------------------|
| BEFORE THE | ON CONSERVATION COMMISSION |
| Case No. 5371 | Submittal |
| Jan 21, 1976 | Hearing Date |

Fire guts office complex

Fireman hurt, damages high as blaze roars for 2 hours

By JAN HAMILL
Staff Writer

A five-alarm fire gutted 80 per cent of the Park Central Plaza office building, 11411 N. Central Expressway Saturday, and caused damage in excess of \$200,000, fire department officials estimated.

Some 90 firemen battled the blaze in the one-story brick building two hours before tapping it out at 6:27 p.m. One fireman was injured fighting the blaze.

Fire Chief M. C. Hendrix said the fire was difficult to contain since there were no fire walls and the offices in the complex shared a common attic which allowed the flames to spread.

The collapse of the roof and an overhang on three sides of the building also hampered efforts to reach the flames, concentrated in a central area of the square building.

Fireman Bobby Galloway suffered leg injuries when a section of the roof overhang collapsed. He was treated and released from Presbyterian Hospital.

Investigators still were attempting to determine the cause of the blaze late Saturday. Paul Forsythe, a security

guard at the office complex, said the blaze apparently started in a snack area or a nearby storage room on the west side of the complex.

Salesman Larry Liebman was in his office about 4 p.m. when he smelled smoke and found the flames in the snack area. He went outside, then attempted to re-enter his office, but within five minutes the smoke was too thick, he said.

Flames and pitch-black smoke rose several hundred feet above the building, but the flames did not spread to nearby apartments or a shopping area.

Liebman said workmen recently had shellacked the floor in the western half of the building, owned by Tycher Properties. The area was blocked off Saturday, he said, but he was uncertain whether that contributed to the fire.

Businesses which were destroyed according to Forsythe, included Diversified Consultants Inc., ECI Air Flyte Corp., Electro Rent Corp., Jewish Welfare Federation, Jewish Vocational Counseling Services, Bill R. Jones Insurance Co., Mulberry Square Production and Releasing Co., R. & S. Industries, Remtek, Survey Research Sciences Inc. and Vamp Hosiery.

Other offices suffered smoke or water damage.



—Staff Photo by Paul Iverson

INJURED FIREMAN—Bob Galloway, a fireman injured during a five alarm blaze which swept through a North Central Expressway office building when a section of the roof collapsed, receives oxygen and first aid from fire department ambulance attendants Saturday before being taken to Presbyterian Hospital.

A police dispatch supervisor, Sgt. Don Young said traffic backed up a total of nine miles along the expressway during the fire.

At its worst, the traffic snarl stretched from the intersection of the LBJ Freeway—three miles north—to Mockingbird Lane on the south.



FIREMEN work on the roof of a building in the complex, which was destroyed by fire Saturday at \$200,000 in the two-hour blaze.

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—Staff Photo by Paul Iverson

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—Staff Photo by Paul Iverson

FIREMEN work on the roof of a building in the Park Central Plaza office complex, which was destroyed by fire Saturday. Damage was estimated at \$200,000 in the two-hour blaze.

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ADDRESS 4808 Ridgside
Miss Paige at Cos

ASSIGNED TO _____ ASSIGNED BY Ben
TO BE DONE: # SAP - Call Final

DATE 11/20/75 TIME _____ TOTAL MAN HOURS _____

NOTE: ① Clean on location
5 - 4 Draw File Cabinets
2 - 2 Draw
+ other miscellaneous pcs. - list all
items.

COMMENTS: NOTE: move these to 11311 N. Central
(re-clean vinyl at office) Suite #210

RECEIVED BY CUSTOMER _____ SIGNED BY _____ Employee

YOU ARE RESTORATION SPECIALISTS

SCHEDULE "A" - STATEMENT OF LOSS

| ITEMS OF LOSS | • VALUE | INSURANCE | REPLACEMENT OR REPAIR COST | LESS • DEDUCTIONS | NET CLAIM |
|---|---------|-----------|-------------------------------|----------------------|--------------|
| <u>Office Contents</u> | | | | | |
| <u>Furniture</u> | | | 655.00 | A 163.75 | 491.25 |
| <u>Other than property furniture</u> | | | 6201.36 | | 6201.36 |
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* VALUE

RC-REPLACEMENT COST
ACV-ACTUAL CASH VALUE

* DEDUCTIONS

A-DEPRECIATION
B-SALVAGE

C-DEDUCTIBLE
D-LIMITING CLAUSES

SCHEDULE "B" - APPORTIONMENT

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Unigard Insurance Group

POLICY NUMBER

PX 82-5605

AGENT

Preston Forest

PROOF OF LOSS

AMOUNT OF POLICY

| ISSUED | EXPIRES |
|--------|---------|
| 19__ | 19__ |

By the Above Numbered Policy of Insurance You Insured

Geo-Tech Petroleum Management Corp.

against loss or damage upon the property described under Schedule "A", according to the terms and conditions of the said policy and all forms, endorsements, transfers and assignments attached thereto.

TIME AND ORIGIN: On the 11th day of January 19 75, about the hour of 4:26 p.m., a loss was sustained, which to the best of my knowledge and belief was caused as follows: SMOKE AND WATER DAMAGE from fire in another unit within same building

OCCUPANCY: The building described, or containing the property described, was occupied at the time of the loss as follows, and for no other purpose whatever: office building

TITLE AND INTEREST: At the time of the loss or damage the said property was located at 11411 N. Central Expwy., Dallas, Texas

in the custody of Insured and belonged to Insured

And no other person or persons had any interest therein or encumbrance thereon except None

The interest protected by this policy and for which claim is made is that of Owner
(State whether Owner, Agent, Bailee, Common Carrier, Shipper)

CHANGES: Since the said policy was issued there has been no assignment thereof, or change of ownership, use, occupancy, destination, possession, location or exposure of the real or personal property described, or of your insured's interest therein, except: None

The Actual Cash Value or Replacement Cost, whichever is applicable, of each specific subject thus situated and described by aforesaid policy at the time of loss, and the Actual Loss and Damage to same, as shown by annexed schedule, and for which Claim is Hereby Made, were as follows:

| Item of Policy | CASH VALUE | TOTAL LOSS | TOTAL INSURANCE | AMOUNT NAMED IN THIS POLICY | AMOUNT CLAIMED UNDER THIS POLICY |
|-----------------------|------------|------------|-----------------|-----------------------------|----------------------------------|
| Item of Policy | | | | | 6,692.61 |
| Item of Policy | | | | | |
| Item of Policy | | | | | |
| Other Items of Policy | | | | | |

(For Other Insurance, See Schedule and Apportionment on reverse side) CLAIM UNDER THIS POLICY, \$ 6,692.61

You are hereby requested and authorized to make payment to Geo-Tech Petroleum Management Corp.

and in consideration of such payment the said Company is hereby discharged forever from all further claim by reason of said loss and damage, leaving N/A Dollars (\$ —) only in force under said policy.

IN CONSIDERATION OF the payment of this sum, I/we hereby subrogate the Company, to the amount of such payment, to all my/our rights of recovery for such loss or expense and I/we hereby further agree, upon demand, to execute all documents required of me/us and to cooperate with said company in prosecuting all actions to effect such recovery, and the Company is hereby authorized to commence and prosecute any necessary action or proceedings in my name, or in its own, or in the name of any person or persons to whom it may assign its claim hereunder, for the purpose of effecting collection of the amount above mentioned.

The Insured further agrees to notify the Company in case of any recovery of the property for which claim is being made hereunder, and agrees to turn over to the Company any such recovery which may be made or reimburse the Company to the extent of the payment for such property which may be recovered.

The said loss did not originate by any act, design or procurement on part of Insured, nor on the part of anyone having any interest in the property insured, or in the said Policy of Insurance; nor in consequence of any fraud or evil practice done or suffered by said Insured; that nothing has been done by or with privy; or consent of Insured to violate the conditions of the Policy, or to render it void; and that no articles are mentioned herein or in attached schedules but such as were in the building damaged or destroyed, and belonging to and in the possession of said Insured at the time of said loss; that no property saved has been in any manner concealed, and that no attempt to deceive the said Company as to the extent of said loss or otherwise has in any manner been made. Any other information that may be required will be furnished on call and considered a portion of these proofs.

It is further understood and agreed that all bills, invoices, schedules and statements made by the Insured and attached to this Proof of Loss are to be incorporated into this proof, and are hereby duly sworn to and made a part hereof.

It is hereby agreed that neither the furnishing of this blank and the filling out of the same by the adjuster, or any agent of said Company, nor the action taken by said Insurance Company to investigate the amount of loss and damage, nor the acceptance of this statement by the said Insurance Company on showing made as of date hereof, as above stated, shall be claimed to be any waiver of the provisions of this sworn statement or of the conditions of said Policy, which are hereby reaffirmed as conditions precedent to the payment of the loss; and, further, that there can be no waiver of the provisions of this agreement or of the conditions of said Policy otherwise than in writing, signed by a duly authorized agent of said Insurance Company.

Dated at Dallas this 11 day of January 19 75

County of Dallas

State of Texas

Subscribed and sworn to before me this 11 day of January 19 75 Geo-Tech Pet. Mgt. Corp. President

Notary Public

4080 BLACK GOLD DR. W DALLAS, TEXAS 75247
(214) 637-2260

All items on this inventory are considered to be damaged by handling, fire, water, moving or other damage caused by the event for which Restoration Specialists has been engaged. Restoration Specialists are authorized to make any and all repairs deemed necessary by them considering the nature of the loss. The inventory will be cleaned, deodorized, repaired and restored, and charges will be made in accordance with the inventory sheet total.

| Item | Quantity | Unit Price | Total Price |
|---|----------|------------|-------------|
| Office # 1 | | | |
| 1 desk | 1 | 36 00 | 36 00 |
| 2 desk chair | 1 | 16 00 | 16 00 |
| 3 end table | 1 | 8 00 | 8 00 |
| 4 book case | 1 | 12 00 | 12 00 |
| 5 uph chair | 1 | 12 00 | 12 00 |
| Lobby | | | |
| 7 couch to be determine | 1 | | |
| 8 end table | 1 | 8 00 | 8 00 |
| 9 lamp | 1 | 4 00 | 4 00 |
| 10 sec desk | 1 | 48 00 | 48 00 |
| 12 Sec chair | 1 | 12 00 | 12 00 |
| 14-15 wood shelves | 1 | 24 00 | 24 00 |
| Office # 2 | | | |
| 16 credenza | 1 | 36 00 | 36 00 |
| 17 exec desk | 1 | 156 00 | 156 00 |
| 18 office chair | 1 | 12 00 | 12 00 |
| 19 typewriter table | 1 | 4 00 | 4 00 |
| 20 (21) upholstered chair | 1 | 24 00 | 24 00 |
| Office # 3 | | | |
| 22 metal office chair | 1 | 24 00 | 24 00 |
| 23 drafting table top replace cover and clean | 1 | 24 00 | 24 00 |
| 24 drafting table base | 1 | 16 00 | 16 00 |
| 25 drafting table glass | 1 | 8 00 | 8 00 |
| 26 5' metal table | 1 | 16 00 | 16 00 |
| 27 wood office desk | 1 | 12 00 | 12 00 |
| 28 metal table | 1 | 12 00 | 12 00 |
| 29 light box | 1 | 12 00 | 12 00 |
| 30 light box glass | 1 | 12 00 | 12 00 |
| 31 metal filing cabinet | 1 | 12 00 | 12 00 |
| 32 Record | 1 | 12 00 | 12 00 |
| 33 base and glass | 1 | 12 00 | 12 00 |

NAME OF PURCHASER Carl L. R. H. Mgt. Co. HOME PHONE _____ BUS. PHONE _____ ☐ MR. ☐ MRS.
ADDRESS _____ APT. # _____ CITY _____ STATE _____ ZIP _____

☐ SHIP TO
☐ DIRECTIONS
☐ ENTRY PROBLEMS
☐ FORMER ADDRESS
☐ KEY
☐ DELIVER WITH INV

☐ THIS IS A SPECIAL ORDER
NOT TO BE CANCELLED OR RE-
TURNED. ESTIMATED DELIVERY
IN ABOUT TO WEEKS

☐ "AS-IS" MERCHANDISE
IF THIS BOX IS CHECKED, THE MER-
CHANDISE PURCHASED IS NOT SUB-
JECT TO RETURN OR EXCHANGE.

☐ TAKE-WITH
☐ WILL-CALL, STORE } DATE _____
☐ WILL-CALL, WHSE. } TIME _____
☐ LAY-BY UNTIL _____
☐ MAIL DIRECT _____
☐ DELIVERY DATE _____

M T W T H F S

☐ DELIVER WHEN RECEIVED

[illegible]

If this purchase has been charged to your Gabriels Credit account, you may pay for the merchandise by making monthly minimum payments of 5% of the "new balance" of your account or \$10, whichever is larger. Such payments include **FINANCE CHARGES** computed by applying periodic rates of 1 1/2% per month (**1 1/2% ANNUAL PERCENTAGE RATE**) to the first \$500 of your "adjusted balance" (the "previous balance" less all payments and credits during the month) and 1% per month (**12% ANNUAL PERCENTAGE RATE**) to that portion of your adjusted balance in excess of \$500. A minimum **FINANCE CHARGE** of 50¢ is applied to any adjusted balance totaling less than \$33. To avoid incurring a **FINANCE CHARGE**, pay the full amount of the new balance shown on your monthly statement before the end of the month following the billing date of such statement.



| | | | | |
|--------|----------------------|------|------|----------|
| RTG | RETURN MOSE REC'D BY | | MGR. | APPROVED |
| CREDIT | PERSON | DATE | | |

THIS INVOICE HAS NOT BEEN AUDITED AND IS SUBJECT TO CORRECTION.
THIS INVOICE AND THE SALES AND SECURITY AGREEMENT SET FORTH ON
THE REVERSE SIDE HEREOF CONSTITUTE AN AGREEMENT BETWEEN PUR-
CHASER AND SELLER WHICH SHALL BE BINDING UPON THEM AND THEIR
RESPECTIVE REPRESENTATIVES, SUCCESSORS AND ASSIGNS.

X *[Signature]* THANK YOU!

RECEIVED BY _____
WILL CALL DELIVERED BY _____ DATE _____

| | | |
|-----------|--|----|
| SUB. TOT. | | |
| SALES TAX | | |
| TOTAL \$ | | 42 |

| | |
|------------------|-----------|
| PAYMENT RECEIVED | |
| \$ | C. R. NO. |

C.O.D. \$ _____

| | |
|---------|-----|
| SOLD BY | NO. |
|---------|-----|

| | |
|------------|-----|
| SHP. | |
| WRITTEN BY | NO. |

Gabberto

13342 MIDWAY ROAD, DALLAS, TEXAS 75240
PHONE (214) 233-3232

1005 SLASHING:

NO. 68021 CUSTOMER

DATE 27 / Feb / 75 ACCT. #☐ NEW ACCT.R Geo-Tech Petroleum Co.

HOME PHONE

BUS. PHONE 287-3365☐ MR. ☐ MRS.ADDRESS 4130 LBT FwyAPT. # 409CITY DALSTATE TxZIP 75234

ADDITIONAL INSTRUCTIONS

- ☐ SHIP TO
☐ DIRECTIONS
☐ ENTRY PROBLEMS
☐ FORMER ADDRESS
☐ KEY
☐ DELIVER WITH INVOICE #

☐ THIS IS A STOCK ORDER
 MERCHANDISE IS ON ORDER, IT IS
 ESTIMATED TO ARRIVE ABOUT

☐ THIS IS A SPECIAL ORDER
 NOT TO BE CANCELLED OR RE-
 TURNED. ESTIMATED DELIVERY
 IN ABOUT TO WEEKS.

☐ "AS-IS" MERCHANDISE
 IF THIS BOX IS CHECKED, THE MER-
 CHANDISE PURCHASED IS NOT SUB-
 JECT TO RETURN OR EXCHANGE.

- ☐ TAKE-WITH
☐ WILL-CALL, STORE } DATE
☐ WILL-CALL, WHSE. } TIME
☐ LAY-BY UNTIL
☐ MAIL DIRECT
☐ DELIVERY DATE
 M T W T H F S
☐ DELIVER WHEN RECEIVED

| LOC | QTY | DEPT | MFR. | MODEL # | DESCRIPTION | COLOR-FABRIC-FINISH | MFR'S SUGGESTED | PRICE EA. | AMOUNT |
|---|-----|------|------|----------|----------------|---------------------|-----------------|-----------|--------|
| | 1 | 01 | 230 | 975 SBWL | Summit T.H. Ch | Khaki Brown | 539 | | 329 |
| | 2 | 01 | 130 | 970WB | Chair | 20090/Wht | 195 | 69 | 138 |
| | 1 | 01 | 301 | 3229-08 | Green Chair | N-357/WH | 347 | 125 | 125 |
| | 1 | 01 | 130 | 55-002 | ARM CHAIR | BA 39 Green | 165 | 87 | 87 |
| <p>Make Check to Gabberto dated Febr. 27th 1975</p> | | | | | | | | | |

CREDIT ACCOUNT TERMS

If this purchase has been charged to your Gabberts Credit account, you may pay for the merchandise by making monthly minimum payments of 5% of the "new balance" of your account or \$10, whichever is larger. Such payments include FINANCE CHARGES computed by applying periodic rates of 1 1/4% per month (18% ANNUAL PERCENTAGE RATE) to the first \$500 of your "adjusted balance" (the "previous balance" less all payments and credits during the month) and 1% per month (12% ANNUAL PERCENTAGE RATE) to the portion of your adjusted balance in excess of \$500. A minimum FINANCE CHARGE of 50¢ is applied to any adjusted balance totaling less than \$33. To avoid incurring a FINANCE CHARGE, pay the full amount of the new balance shown on your monthly statement before the end of the month following the billing date of such statement.



| RTG | RETURN MOSE REC'D BY | | MGR. | APPROVED |
|--------|----------------------|------|------|----------|
| CREDIT | PERSON | DATE | | |

THIS INVOICE HAS NOT BEEN AUDITED AND IS SUBJECT TO CORRECTION.
 THIS INVOICE AND THE SALES AND SECURITY AGREEMENT SET FORTH ON THE REVERSE SIDE HEREOF CONSTITUTE AN AGREEMENT BETWEEN PURCHASER AND SELLER WHICH SHALL BE BINDING UPON THEM AND THEIR RESPECTIVE REPRESENTATIVES, SUCCESSORS AND ASSIGNS.

X Mark J. Gabberto THANK YOU!

RECEIVED BY:

PAID FEB 27 1975

WILL CALL DELIVERED BY _____ DATE _____

← 2906

SUB. TOT. 558
 SALES TAX 27.80
 TOTAL \$ 583.80

PAYMENT RECEIVED
 C.R. NO. _____

C.O.D. \$ 583.80

SOLD BY REINOLD NO. 112

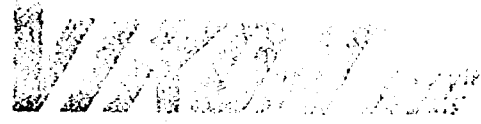
SHR. 1
 WRITTEN BY _____ NO. _____

GABBERTS 2001

Gabberto

13342 MIDWAY ROAD, DALLAS, TEXAS 75240
 PHONE (214) 233-3232

Save this copy. It shows the details of your purchase. Your monthly statement will also refer to this invoice.



P. O. BOX 2442 • GARLAND, TEXAS 75041
VIKON INC. (214) 271-2455 • TWX 910-860-5160
HUTCHINGS OFFICE PRODUCTS DIVISION (214) 278-1315
D-U-N-S-05-739-9016 METRO 265-6244

Invoice **Nº 8862**

Invoice Date **1-30-75**

Invoice Page of

Customer No. **11817**

Please refer to this invoice number on all remittances and inquiries.

TERMS: Net 10 days from invoice date unless otherwise stated below.

PAST DUE charges are subject to 1% per month handling charges. non-waivable.

SOLD TO:
Geo Tech Petroleum
11311 N. Central
Dallas, TX

SHIP TO:

| DATE SHIPPED | | SHIPPED VIA | TERMS | SALESMAN | ORDER NO. |
|----------------------|------------------|--|--------|-------------|------------------------------------|
| 1-21-75 | | | Net 10 | 110--Wright | |
| QUANTITY ORDERED | QUANTITY SHIPPED | DESCRIPTION / PRODUCT NUMBER | | | TOTAL |
| | | Paint job on RBC Paint Labor 2 hours | | | 18.50hr 10.00 37.00 47.00 |
| | | <i>Approved: [signature] 2/6/75</i> | | | |
| RECEIVED JAN 31 1975 | | SUB TOTAL | | SALES TAX | FREIGHT |
| | | 47.00 | | .50 | |
| | | TOTAL | | 47.50 | |

Thank You—

CUSTOMER (RETAIN)

PAID FEB 27 1975 #2805

PLEASE PAY THIS AMOUNT

P. O. BOX 2442 • GARLAND, TEXAS 75041
 VIKON INC. (214) 271-2455 • TWX 910-860-5160
 HUTCHINGS OFFICE PRODUCTS DIVISION (214) 278-1315
 D-U-N-S-05-739-9016 METRO 265-6244

Invoice **Nº 8607**

Invoice Date **1-17-75**

Invoice Page **1** of **1**

Customer No. **11817**

Please refer to this invoice number on all remittances and inquiries.

TERMS: Net 10 days from invoice date unless otherwise stated below.

PAST DUE charges are subject to 1% per month handling charges, non-waivable.

SOLD TO: **Geo-Tech Petroleum**
11411 N. Central Expr., Suite 130
Dallas, Texas 75231

SHIP TO:

| DATE SHIPPED 1-17-75 | | SHIPPED VIA | TERMS Net 10 | SALESMAN 110--Wright | ORDER NO. | |
|--------------------------------|------------------|--|------------------------|--------------------------------|------------|---------------|
| QUANTITY ORDERED | QUANTITY SHIPPED | DESCRIPTION / PRODUCT NUMBER | | | UNIT PRICE | TOTAL |
| | | Clean-up of Savin 220, S/N 64347 from smoke and water damage | | | | 50.00 |
| | | Clean-up of Litton RBC copier, S/N 2160200 from smoke and water damage | | | | 50.00 |
| | | | | | | <u>100.00</u> |
| | | SUB TOTAL | SALES TAX | FREIGHT | TOTAL | |
| | | 100.00 | | | 100.00 | |

Thank You —

No. **2244**
 4K 455 Rediforme

Authorized By _____

CUSTOMER SALES FILE

PLEASE PAY
 THIS ACCOUNT

SPECIALIZING IN FIRE, WATER AND SMOKE DAMAGE

FURNITURE REFINISHING AND UPHOLSTERING

STATEMENT

Restoration Specialists

4030 BLACK GOLD DR. ■ DALLAS, TEXAS 75247
(214) 637-2200

TO

DATE

Geo Tech Corporation
11311 N Central Expressway S/210
Dallas Texas 75200

2-10-1975

Restoration of fire damaged goods

\$1,756.05

Thank you

R R Coleman

PAID FEB 27 1975

✓ 2953

NORTEX

ELECTRONIC CALCULATORS, INC.
 1383 STEAKMONS SUITE 212 DALLAS, TEXAS 75247
 214/631-0387

INVOICE
No. 020283

| TR | TC | ST | SM | LOC |
|----|-----|----|----|-------|
| 01 | 700 | | 13 | 07 34 |



JST. NO. 019166

DATE 01/29/75

SOLD TO

GEO - TECH & PERROLEM
 11311 N. CENTRAL EXPRESSWAY
 SUITE 210
 DALLAS, TEX 75231

SHIP TO

| | | | | | |
|------------------|----------|------------------|----------------------------|----------|--------|
| OUR ORDER NUMBER | | OUR ORDER NUMBER | | SALESMAN | |
| ----- | | 6771 | | AGENCY | |
| DATE SHIPPED | | SHIPPED VIA | | F.O.B. | |
| 1/28/75 | | NOTEX | | DALLAS | |
| PRODUCT | QUANTITY | | STOCK NUMBER / DESCRIPTION | TERMS | |
| | ORDERED | SHIPPED | | NET 10 | |
| 1/9710 | 1 | 1 | TI SR 10 - 823615 | PRICE | AMOUNT |
| | | | | 54.95 | 54.95 |
| G.TOTAL SALES | | | SALES TAX | FREIGHT | MISC. |
| 54.95 | | | 2.75 | | |
| | | | | TOTAL | 57.70 |

ORIGINAL

PAID FEB 27 1975
 #2811

NORTEX

ELECTRONIC CALCULATORS, INC.
383 STEMMONS SUITE 212 DALLAS, TEXAS 75247
214/631-0387

INVOICE
No. 020161

| TR | TC | ST | SM | LOC |
|----|-----|----|----|-----|
| 2 | 700 | | 13 | 17 |
| | | | | 32 |



ST. NO. 019166

DATE 01/27/75

SOLD TO

GEO - TEXH PETROLEUM
11311 N. CENTRAL
SUITE 210
DALLAS, TEX

SHIP TO

| OUR ORDER NUMBER BAL PAIGE | | OUR ORDER NUMBER 6489 | | SALESMAN AGENCY | |
|-------------------------------|----------|--------------------------|----------------------------|----------------------|--------|
| E SHIPPED 21/75 | | SHIPPED VIA NORTEX | | TERMS NET INVOICE | |
| PRODUCT | QUANTITY | | STOCK NUMBER / DESCRIPTION | PRICE | AMOUNT |
| | ORDERED | SHIPPED | | | |
| 79720 | 1 | 1 | TI SR 20 - 53043 | 109.95 | 109.95 |
| TOTAL SALES | | | SALES TAX | FREIGHT | MISC. |
| 109.95 | | | 5.49 | | |
| TOTAL | | | | 115.44 | |

ORIGINAL

PAID FEB 27 1975
2891

FURNITURE
ACCESSORIESGIFTS & RUGS
CANDLES

Adele Hunt's

HOME FURNISHINGS - INTERIORS

7015 SNIDER PLAZA

DALLAS, TEXAS 75205

363-2528

DATE 27 FEB - 1975Sold To ROBERT L. COO HOME PHONE 387-3385Address GED-TECH COMPANY BUSINESS PHONECity 4330 LBS (AT HIGHWAY) State SO. 409Del. Info. (NORTH TOWN PLAZA)

SALESMAN CASH CHO. ON DEL. MOSE. RETD. TERMS

| QUANTITY | FACTORY | NUMBER | DESCRIPTION | PRICE |
|----------------------------|---------|---------|----------------------|---------|
| 1 | 11 | | SOFA | |
| 1 | 14 | 5301 | PARADE LAMP TBL | |
| 1 | 5 | 09.1333 | BRONZE LAMP | |
| 1 | | 5206-A | BRASS CHAIRMAN LAMP | |
| 1 | 415 | 888-848 | SOFA - COO TOLCOY 21 | |
| 1 | 54 | 344-409 | NITE STAND | 1000 00 |
| | | | Tax | 50 00 |
| TASD, ALL CASH ON DELIVERY | | | | 1050 00 |

this order in

NAME MONA V. V. V.\$ 1050 00 PAID FEB 27 1975**Budget Furniture Shop** # 28016721 PRESTON PH. 522-8850
DALLAS, TEXAS 75205

CONDITIONAL CONTRACT OF SALE - The undersigned acknowledges receipt of above articles and agrees to pay in 30 days from date unless otherwise agreed in writing. Title to above property shall remain with seller until paid for in full. Undersigned further agrees that if he fails to pay any payments when due, then all the sum remaining unpaid shall immediately become due and payable and the seller may enforce payment of the entire sum then unpaid with interest at 6% or may, if he so elect, rescind this executory contract and take possession of the above article without legal process, and retain for use thereof money theretofore paid.

No. **14807** Received By: _____

DELIVERY COPY

DELIVERY DATE:

MARCH 11
1965
A.M. P.M.

Adele Hunt's

HOME FURNISHINGS
7015 SNIDER PLAZA • 363-2528
DALLAS, TEXAS 75205

"Where Dallas Shops With Confidence"

INSPECTOR:

LOADED BY:

DELIVERED
BY:

DELIVER TO: ROBERT L. Cox (LAD-TECH Co.) PHONE: 387-3385
STREET: 4230 LBJ, Suite # 409 CITY: TOWN NORTH DALLAS
SOLD BY: JS TICKET NO. 14807 TICKET DATE: 2-27-75
SPECIAL INSTRUCTIONS: AFTER 1:00 PM - PLEASE

| CK | QUANTITY | ITEM NO. | LOCATION | DESCRIPTION |
|----|-------------------|------------|----------|---------------------------------|
| | 1 | 11 | PR | Sofa - (Holman Str. Co.) |
| | 1 | 46-1301 | PR | CONSOLE LAMP TABLE |
| | 1 | 5-04-1233 | PR | BRONZE LAMP - short on delivery |
| | 1 | 5206-A | PR | CLIMAX - PERS LAMP |
| | 1 | 45-585-848 | PR | Sofa - COU. 70404-21 |
| | 1 | 54-341-409 | PR | NITE STAND |
| | CASH ON DELIVERY | | | |
| | this order is for | | | |
| | 1,050.00 | | | |
| | | | | |
| | | | | |

Budget Furniture Shop

6721 PRESTON PH. 522-8850
DALLAS, TEXAS 75205

grosses that
taken around
am Red
Shake

Please Note: Acknowledgment of receipt of this
expressly recognizes and implies that title to
the remains with seller, Adele Hunt, Inc. until
been paid for in full.

WE HOPE YOU ENJOY YOUR NEW PURCHASE!

REC'D.
BY:

ALLEN BUSINESS MACHINES

SALES - RENTALS - REPAIRS - SUPPLIES

1012 WEST DAVIS

PHONE 948-3709

MAIL ADDRESS: P. O. BOX 21174

DALLAS, TEXAS 75211

Customer's
Order No.

Date

Name

Address

City

State

SOLD BY

CASH

C. O. D.

CHARGE

ON ACCT.

MOSE. RETD.

PAID OUT

QUAN.

DESCRIPTION

PRICE

AMOUNT

1 Royal Elec adda

29.50

Top

4.00

90 Min labor

\$83.50

1 gear parts & oil

PAID FEB 27 1975

2883

THANK YOU Please keep this copy for reference

TOTAL

All claims and returned goods MUST be accompanied by this bill.

No. 24461

Rec'd By

ORIGINAL



LOCAL MOVING - STORAGE ORDER

821-9936
363-9452

6850 TWIN HILLS

P. O. Box 31778
DALLAS, TEXAS 75231

On the Move—Day and Night

Time: _____ M. DAY: 2-23-75 19_____
NAME: Geotech Management TEL.: 3635795
FROM: 11311 N. Central TO: 4230 LBJ #409
FROM: _____ TO: _____
REC'D. BY: _____ / VANS 2 MEN @ \$ 18.00 PER HR.
INSTRUCTIONS: _____

| Van No. | Driver | Helper | Helper | Helper | Started | Time Out | Finished |
|---------|--------------|--------|--------|--------|---------|----------|----------|
| B-2 | Emmett Price | | | | 12:30 | | 5:00 |

TERMS AND CONDITIONS

The company specifically reserves the right to accept or refuse any order for moving, packing, crating, storing, etc.

Terms: All charges shall be paid in full in Cash, Money Order, Cashier's or Certified Check, to the Van Driver in charge, upon completion of the services ordered. Personal checks are acceptable only when prior arrangement has been made with the company.

The company agrees to exercise all reasonable and customary care in handling and transporting the articles to be moved. No responsibility is assumed by the company 1) for loss or damage to articles caused by fire, rust, deterioration, the elements, vehicle accidents, Acts of God or other causes beyond its control; nor 2) for items packed in boxes, barrels, cartons, chests, trunks, drawers, etc., by the owner, nor 3) for the mechanical non-operation after moving of refrigerators, stoves, radios, clocks, television sets, barometers, washing machines and/or other similar articles, nor 4) for labor strikes, riots, insurrections, acts of war, etc., nor 5) for the handling and moving of plants, flowers, animals or birds in or out of cages, fish in bowls or aquariums and similar items.

The responsibility of the company for articles lost or damaged is hereby specifically limited to 30c per pound per article and not to exceed the total amount of \$20.00 for any one article, piece, package, etc., including contents, regardless of weight. Additional protection by specific insurance coverage is available to the customer through the company upon request. Damage to floors, carpets, linoleum, and walls is limited to \$50.00.

Any claim for damaged or lost articles must be filed with the company in writing within 5 days after completion of this move. The company shall have full right and free access to examine damaged articles and 30 days after receipt of claim to accept or deny responsibility.

The services of the company do not include installing and/or connecting gas, electric or other types of fixtures and appliances, the taking down or putting up of antennas, air conditioners, etc., the taking up or relaying of fastened carpets or rugs, the rehanging of pictures, mirrors, etc.

I certify the services set forth hereon, subject to the terms and conditions above, were duly ordered by me and have been fully and properly rendered and that all articles received by the company have been delivered to me at destination in good and acceptable condition, except as specifically noted in writing on the reverse side hereof.

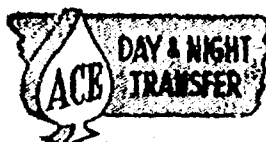
SIGN
HERE

INVOICE N° 4113

INVOICE

| | | | |
|--|---------------|--|----------|
| DRAYAGE | 4 1/2 HRS. | | \$ 81 00 |
| EXTRA LABOR | HRS. | | |
| PACKING SERVICES | | | |
| DELIVERY FEE + 30 min. driving | | | 9 00 |
| PAPER | | | |
| TAPE | | | |
| BBLs. | @ | | |
| CARTONS | @ | | |
| CARTONS | @ | | |
| CARTONS | @ | | |
| WARDROBES | @ | | |
| WAREHOUSE HANDLING | LBS. @ | | |
| STORAGE | LBS. @ | | |
| INSURANCE | | | |
| TRANSIT | @ per \$1,000 | | |
| STORAGE | @ per \$1,000 | | |
| PLEASE PAY DRIVER | | | 90 00 |
| PAYMENT RECEIVED BY: <u>Emmett Price</u> | | | |

LOCAL MOVING - STORAGE ORDER



821-9936

2825 GREENVILLE AVENUE

DALLAS, TEXAS 75206

On the Move—Day and Night

Time: _____ M. DAY: _____

4-25-1974

NAME: Geo-Tech Petroleum Inc.

TEL: 642-313-5775

FROM: 622 N Central

TO: 11811 N Central

REC'D. BY: _____ \$ _____ INS. 1 VANS 2 MEN @ \$ 18.00 PER HR.

INSTRUCTIONS: _____

3 offices

| Van No. | Driver | Helper | Helper | Helper | Started | Time Out | Finished |
|---------|--------|--------|--------|--------|---------|----------|----------|
| B-2 | Emmett | Steve | | | 1:00 | | 4:30 |

TERMS AND CONDITIONS

The company specifically reserves the right to accept or refuse any order for moving, packing, crating, storing, etc.

Terms: All charges shall be paid in full in Cash, Money Order, Cashier's or Certified Check to the Van Driver in charge, upon completion of the services ordered. Personal checks are acceptable only when prior arrangement has been made with the company.

The company agrees to exercise all reasonable and customary care in handling and transporting the articles to be moved. No responsibility assumed by the company 1) for loss or damage to articles caused by fire, rust, deterioration, the elements, vehicle accidents, Acts of God or other causes beyond its control, nor 2) for items packed in boxes, barrels, cartons, chests, trunks, drawers, etc., by the owner, nor 3) for the mechanical non-operation after moving of refrigerators, stoves, radios, clocks, television sets, barometers, washing machines and/or other similar articles, nor 4) for labor strikes, riots, insurrections, acts of war, etc., nor 5) for the handling and moving of plants, flowers, animals or birds in or out of cages, fish in bowls or aquariums and similar items.

The responsibility of the company for articles lost or damaged is hereby specifically limited to 30c per pound per article and not to exceed the total amount of \$20.00 for any one article, piece, package, etc., including contents, regardless of weight. Additional protection by specific insurance coverage is available to the customer through the company upon request.

Any claim for damaged or lost articles must be filed with the company in writing within 5 days after completion of this move. The company shall have full right and free access to examine damaged articles and 30 days after receipt of claim to accept or deny responsibility.

The services of the company do not include installing and/or connecting gas, electric or other types of fixtures and appliances, the taking down or putting up of antennas, air conditioners, etc., the taking up or relaying of fastened carpets or rugs, the rehanging of pictures, mirrors, etc.

I certify the services set forth herein, subject to the terms and conditions above, were duly ordered by me and have been fully and properly rendered and that all articles received by the company have been delivered to me at destination in good and acceptable condition, except as specifically noted in writing on the reverse side hereof.

Sign Here

[Signature]

INVOICE N° 2376

INVOICE

| | | | |
|---|----------------|---------|-------------|
| DRAYAGE | 3 1/2 HRS. | 18.00 | \$ 63.00 |
| EXTRA LABOR | HRS. | | |
| LABOR | 30 min Driving | | 9.00 |
| PACKING SERVICES | | | |
| PACKING MATERIALS | | | |
| BBLs. | @ | | |
| CARTONS | @ | | |
| CARTONS | @ | | |
| WARDROBES | @ | | |
| WAREHOUSE HANDLING | | | |
| STORAGE | LBS. @ | | |
| INSURANCE | | | 2089 |
| TRANSIT | @ PER \$1,000 | 930-016 | |
| STORAGE | @ PER \$1,000 | | |
| 4 HRS | | | |
| PLEASE PAY DRIVER | | | EST \$72.00 |
| PAYMENT RECEIVED BY: <i>[Signature]</i> | | | |

HOWARD'S DRAFTING SERVICE
501 NOEL PAGE
DALLAS, TEX. 75201

May 5, 1975

Geo-Tech Petroleum Management
Suite 409
4230 LBJ Freeway
Dallas, TX 75234

Attn: Mr. Robert Cox

Based on maps rendered for restoration and clean-up, I
estimate the costs to be as follows:

| | |
|---|----------------|
| 1. Replacement of damaged maps | \$240.00 |
| 2. Reproduction and scaling of maps to original size | 720.00 |
| 3. Labor | <u>2000.00</u> |
| Total | \$2960.00 |


Howard M. Wess
Howard's Drafting Service

GEO-TECH PETROLEUM
MANAGEMENT CORPORATION
11411 NORTH CENTRAL EXPRESSWAY
DALLAS, TEXAS 75231
PHONE 363-5795

GEO-TECH PETROLEUM
MANAGEMENT CORPORATION
11411 NORTH CENTRAL EXPRESSWAY
DALLAS, TEXAS 75231
PHONE 363-5795

1-A

National Bank of Commerce

National Bank of Commerce of Dallas, Dallas, Texas 75201

Date January 27 19 75

2786

Pay to the Order of Business Machines of Texas

\$187.50

One Hundred Eighty Seven and 50/100 Dollars

This check is in full settlement as shown here. Acceptance by endorsement constitutes receipt in full.

Repair on IBM typewriter
per invoice
agreement

GEO-TECH PETROLEUM
MANAGEMENT CORPORATION

Robert H. Cox

⑆1110⑈0004⑆

05⑈885⑈9⑈

⑈0000018750⑈

1-B

National Bank of Commerce

National Bank of Commerce of Dallas, Dallas, Texas 75201

Date February 4 19 75

2823

Pay to the Order of Business Machines of Texas

\$ 172.50

One Hundred Seventy Two and 50/100 Dollars

This check is in full settlement as shown here. Acceptance by endorsement constitutes receipt in full.

#1272
Friden repair

GEO-TECH PETROLEUM
MANAGEMENT CORPORATION

Robert H. Cox

⑆1110⑈0004⑆

05⑈885⑈9⑈

⑈0000017250⑈

D-U-N-S No. 02-627-7277

(72)

INVOICE

Nº 5216

NELLE'S OFFICE MACHINES

4019 Maple

DALLAS, TEXAS 75219

526-8781

Name Geo Tech Petroleum Management Mr. R. L. Cox.

Address 4230 LBJ Suite 1409 Tower North Plaza

Dallas Texas 75234

Date 5-9-78

| MACHINE NO. | DESCRIPTION | | |
|-------------|------------------------------|-----------|--------|
| 737163 | One Versa. L. & S. Steno. M. | | |
| | Portable Dictating Machine | | 114.50 |
| | One Pen Microphone | | 27.50 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | SALES TAX | 7.10 |
| | | TOTAL | 149.10 |

Purchase Order No. _____ Signed by _____

GEO-TECH PETROLEUM
MANAGEMENT CORPORATION
11411 NORTH CENTRAL EXPRESSWAY
PHONE 363-5795 DALLAS, TEXAS 75231

3

2907

National Bank of Commerce
National Bank of Commerce of Dallas, Dallas, Texas 75201

COUNTRY CLUB CLENNERS

Pay to the Order of COUNTRY CLUB CLENNERS

Date Feb 27 19 75

\$ 11 ⁹⁵/₁₀₀

Eleven & 95/100 MAR 4 1975 Dollars

This check is in full settlement as shown here. Acceptance by and on behalf of payee constitutes receipt in full.

| | |
|--|-------------------|
| | Smoke damaged |
| | Gloves & 11/11 |
| | No central repair |

**GEO-TECH PETROLEUM
MANAGEMENT CORPORATION**

Robert G. Cox

⑆1110⑈0004⑆ 05⑈885⑈9⑈ ⑈0000001195⑈



SINCE 1912

INVOICE

No. 15041

OFFICE SUPPLY COMPANY
DALLAS, TEXAS 75202

STATIONERY • OFFICE EQUIPMENT • A. B. DICK DUPLICATING PRODUCTS

GENERAL OFFICES 400 S. AUSTIN AT WOOD ST. PHONE 747-8581
STATIONERY STORE 1523 COMMERCE ST. PHONE 747-8581
FURNITURE DISPLAY 401 S. LAMAR AT WOOD ST. PHONE 747-8581
A. B. DICK DUPLICATING / COPYING PRODUCTS 1440 PRUDENTIAL DR. PHONE 634-9310

SHIP TO . MRS PAIGE
SUITE 409

SOLD TO . GEO-TECH PETROLEUM
4230 LBJ FREEWAY
DALLAS, TEXAS

C C 2182

6-A

INVOICE DATE . 3/5/75
YOUR ORDER NO. .
SHIPPED VIA .
SALESMAN . PHONE 3

DUNS 00-894-7541

TERMS NET MONTHLY: ALL ACCOUNTS DUE ON THE TENTH OF MONTH FOLLOWING DATE OF PURCHASE. NO DISCOUNT ALLOWED. PAYABLE IN DALLAS, TEXAS.

| QUANTITY | DESCRIPTION | PRICE UNIT | EXTENSION | TOTAL |
|----------|-------------------|------------|-----------|-------|
| 1 EA | #P-2 POSTAL SCALE | C | 6.50 | |

TAX .33
6.83

SPECIAL

PAID FEB 27 1975

22955

ADDRESS ALL COMMUNICATIONS AND REMITTANCES TO 400 S. AUSTIN ST., DALLAS, TEXAS



SINCE 1912

INVOICE

No. 92598

OFFICE SUPPLY COMPANY

DALLAS, TEXAS 75202

STATIONERY • OFFICE EQUIPMENT • A. B. DICK DUPLICATING PRODUCTS

| | | |
|---|---------------------------|----------------|
| GENERAL OFFICES | 400 S. AUSTIN AT WOOD ST. | PHONE 747-858 |
| STATIONERY STORE | 1523 COMMERCE ST. | PHONE 747-858 |
| FURNITURE DISPLAY | 401 S. LAMAR AT WOOD ST. | PHONE 747-858 |
| A. B. DICK DUPLICATING / COPYING PRODUCTS | 1440 PRUDENTIAL DR. | PHONE 634-9311 |

SHIP
TO

6-B

SOLD
TOGEO--TEAM. PETROLEUM
11311 NO. CENTRAL - SUITE 210
DALLAS, TEXAS

A T 832

INVOICE DATE 1/23/75

YOUR ORDER NO.

SHIPPED VIA

SALESMAN 9 STORE

D-U-N-S 00-894-7541

TERMS NET MONTHLY: ALL ACCOUNTS DUE ON THE TENTH OF MONTH FOLLOWING DATE OF PURCHASE. NO DISCOUNT ALLOWED. PAYABLE IN DALLAS, TEXAS.

| QUANTITY | DESCRIPTION | PRICE UNIT | EXTENSION | TOTAL |
|----------|-----------------------|------------|-----------|-------|
| 12 EA | 5068 LEGAL PADS | B | 6.97 | |
| 1 EA | 1017 PENCIL SHARPENER | B | 8.06 | |
| | | | 15.03 | |
| | | | TAX .75 | |
| | | | 15.78 | |

PAID FEB 27 1975 # 2893

ADDRESS ALL COMMUNICATIONS AND REMITTANCES TO 400 S. AUSTIN ST., DALLAS, TEXAS



P. O. Box 5577 / Midland, Texas 79701 / (915) 563-0511
TWX 910-881-5066 / Cable: EASTCO

June 12, 1975

GEO TECH PETROLEUM, INC.
FEDERAL EA #1
EDDY COUNTY, NEW MEXICO

COST ESTIMATE

| | |
|---|--------------------|
| 1-1st Day | \$515.00 |
| 11-Additional Days @ \$255.00 Per Day | 2,805.00 |
| 30-Hrs Down Hole Motor | 3,600.00 |
| 3-W-7 Type Sealed Brg. Bits 7 7/8" | 2,100.00 |
| 1-Single Shot "R" Instrument 12/days | 465.00 |
| 1-5 1/2"x30' Monel Drill Collar 12/days | 792.00 |
| 3-Roller Reamer Body | 225.00 |
| 6-Sets Cutters @ \$305.00 ea. | 1,830.00 |
| Misc. Trucking, Cost of Living, Etc. | 500.00 |
| TOTAL | \$12,832.00 |

\$ 12,832.00

BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 557 Exhibit No. DN-2
Submitted by Cox
Hearing Date 1-21-76

Directional Drillers / Sub-Surface Surveyors / Instrument & Tool Rentals / Sales / Worldwide



ORIGINAL INVOICE

PAGE 1 OF 2

NO. c 9222

DATE

August 13, 1975

YOUR ORDER NO.

TICKET NO.

WT 775 D55

LOCATION:

Federal EA #1

RECEIVED AUG 21 1975

MAIL PAYMENTS TO
EASTMAN WHIPSTOCK, INC.
P.O. BOX 14609
HOUSTON, TEXAS 77021 U.S.A.

CHARGE
TO

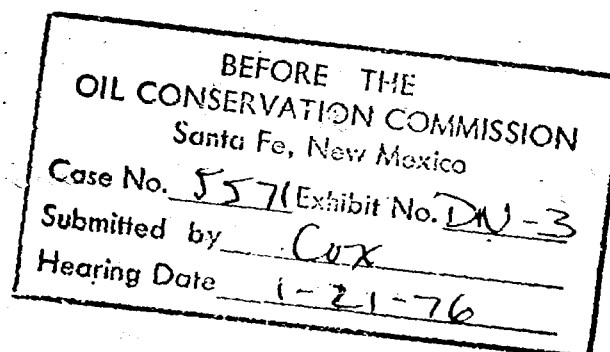
Geo Tech Petroleum Management Corporation
4230 LBJ Freeway #409
Dallas, TX 75234

TERMS: NET 10th PROX.

SERVICE CHARGE WILL BE MADE ON ALL
PAST DUE INVOICES, AS OUTLINED IN OUR
GENERAL TERMS AND CONDITIONS.

| 5340 8-43 | SERVICE RENDERED | AMOUNT |
|-----------|--|----------|
| | For services and rental of equipment to directionally drill your Federal EA #1 as follows: | |
| | <u>SERVICE CHARGES:</u> | |
| 1 | First day of service - 7/9/75 | 515.00 |
| 21 | Additional days of service @ 255.00 per day - 7/10/75, 7/12/75 - 7/31/75 | 5,355.00 |
| 2 | Standby days @ 165.00 per day - 7/8/75 & 7/11/75 | 330.00 |
| | <u>TRANSPORTATION CHARGES:</u> | |
| | EW car mileage: 360 miles @ .40 per mile | 144.00 |
| | Trucking as per Meyer Inv. #C7-276 (attached) | 110.60 |
| | Trucking as per Meyer Inv. #C7-275 (attached) | 110.60 |
| | Trucking as per Hall Inv. #H-201 (attached) | 231.42 |
| | <u>INSPECTION CHARGES:</u> | |
| | For 8 tool joints @ 3.50 per joint | 28.00 |
| | <u>RENTAL EQUIPMENT:</u> | |
| 1 | EW 6 1/2" X 30' Non-Mag. Drill Collar, #817 - 24 days @ 63.00 per day | 1,512.00 |
| 1 | 5" Straight Directional Dyna-Drill, as per Dyna-Drill ticket #0478 (attached) | 6,996.80 |
| 2 | 7 7/8" Near Bit Roller Reamers, #18275, #17666, as per Grant Inv. | 310.00 |
| 1 | 7 7/8" String Roller Reamer, #19455, as per Grant Inv. | 155.00 |
| 1 | EW 2° Bent Sub, #EW 4981 - 4 days @ 15 day min. | 90.00 |

FORM D-1097





NO. C 9222

DATE
August 13, 1975
YOUR ORDER NO.

MAIL PAYMENTS TO
EASTMAN WHIPSTOCK, INC.
P.O. BOX 14609
HOUSTON, TEXAS 77021 U.S.A.

TICKET NO.
WT 775 D55
LOCATION:

CHARGE TO
Geo Tech Petroleum Management Corporation
(cont'd.)

Federal EA #1
TERMS: NET 10th PROX.
SERVICE CHARGE WILL BE MADE ON ALL
PAST DUE INVOICES, AS OUTLINED IN OUR
GENERAL TERMS AND CONDITIONS.

| 5340 8-43 | SERVICE RENDERED | AMOUNT |
|--|---|--------------|
| 1 | EW 4 1/2" Reg. Box X 4 1/2" Reg. Pin Sub, #6008 - 7 days @ 3.85 per day | 26.95 |
| 1 | EW 4 1/2" Reg. Box X 3 1/2" Reg. Pin Sub, #EW 5920 - 4 days @ 5 day min. | 19.25 |
| 1 | EW Type "R" Single Shot Instrument complete with field equipment, as per RA #1121 (attached) | 744.00 |
| <u>SALES ITEMS:</u> | | |
| 3 | Sets of 3 Chert Cutters for Reamers, as per Grant Inv. | 900.00 |
| 2 | 7 7/8" Sealed Bearing Bits M44N, as per Dresser Inv. #67330-A (attached) | 1,110.12 |
| 1 | EW 4 1/2" Reg. Baffle Plate | 13.25 |
| Sub Total | | \$ 18,701.99 |
| 4% New Mexico State Tax on 2,023.37 | | 80.93 |
| TOTAL AMOUNT DUE | | \$ 18,782.92 |

New Mexico
Vickers

rlw

EMPIRE ABO POOL
I. GAS-OIL RATIO COMPARISONS
Gas-Oil Ratios (MCF/BO)

BEFORE THE 7
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 5571 Exhibit No. DN-2
Submitted by ARCO
Hearing Date 2-24-76

| WELL | JULY 1975 | AUGUST 1975 | SEPT. 1975 | OCT. 1975 | NOV. 1975 | DEC. 1975 |
|---|-----------|-------------|--------------|-----------|-----------|-----------|
| L-16 | 1.109 | 1.323 | 1.067 | 1.161 | 1.106 | 1.113 ✓ |
| L-17 | .818 | 1.031 | .775 | .868 | .814 | .821 |
| L-18 | .842 | 1.056 | .800 | .893 | .839 | .846 |
| M-16 | 1.068 | 1.281 | 1.025 | 1.118 | 1.064 | 1.071 |
| *Avg. of Above Wells | .937 | 1.151 | .896 | .991 | .936 | .943 |
| R. G. Cox EA Fed #1 | ---- | ---- | GOR- .857 | .862 | .863 | .861 |
| **Average Daily Oil Rate (BOPD) | | | 23.3 | 38.5 | 34.7 | 34.6 |
| ***Avg. Daily Oil Rate per Actual Producing Day (BOPD) | | | 35.0 | 38.5 | 37.1 | 41.3 |
| Number of actual producing days | | | 20 | 31 | 28 | 26 |

*Avg. = Total gas produced for the four wells divided by total oil produced.

** = Total monthly production divided by the number of days in the month.

*** = Total monthly production divided by the number of actual producing days.

II. Oil API Gravity Comparison

A. Empire Abo Unit, nearest batteries to Cox E.A. Fed. No. 1:

| | <u>Oil Gravity, °API</u> |
|--------------|--------------------------|
| Battery M-14 | 43.5* |
| Battery K-18 | 43.8* |

(*Representative gravity for September 1975)

B. Cox E.A. Fed. No. 1

| | |
|-----------------|------|
| E.A. Fed. No. 1 | 43** |
|-----------------|------|

(**Data from USGS, "Well Completion or Recompletion Report and Log," Test date 9/15/75)

OIL CONSERVATION COMMISSION

P. O. BOX 2088

SANTA FE NEW MEXICO 87501

November 12, 1975

C
Sumner G. Buell, Esq.
Attorney at Law
P. O. Box 2307
Santa Fe, New Mexico 87501

Re: Application of Robert G. Cox
Oil Conservation Commission
Case 5571

O
Dear Sumner:

P
Enclosed are copies of the Subpoenas issued by the Oil Conservation Commission this date pursuant to your request of November 11, 1975. Both Atlantic Richfield Company and Amoco Production Company have agreed to accept service by mail and, therefore, we anticipate no problems in having the appearances and information you seek at the hearing on November 19, 1975.

Y
I have also enclosed, for your files, copies of the Subpoenas previously issued at the request of Clarence Hinkle and Guy Buell.

It is the Commission's desire that all necessary data be present at the November 19 hearing so that we may resolve this controversy. Therefore, if we can be of further assistance, please advise.

Very truly yours,

WILLIAM F. CARR
General Counsel

WFC/dr
Enc.

OIL CONSERVATION COMMISSION

P. O. BOX 2088

SANTA FE NEW MEXICO 87501

November 12, 1975

CERTIFIED - RETURN
RECEIPT REQUESTED

Mr. Guy Buell
Amoco Production Company
P. O. Box 3092
Houston, Texas 77001

Re: Case No. 5571, Application of
Robert G. Cox to Amend Order
No. R-4561

Dear Guy:

Enclosed herewith you will find a Subpoena commanding
the appearance of Dan Currens before the Commission
on November 19, 1975.

It is my understanding that this should be directed
to your attention and that Amoco Production Company
will accept service by mail.

If you have any questions, please advise.

Best regards.

Very truly yours,

WILLIAM F. CARR
General Counsel

WFC/dr
enc.

C
O
P
Y

J. O. SETH (1863-1963)

A. K. MONTGOMERY
WM. FEDERICI
FRANK ANDREWS
FRED C. HANNAHS
SUMNER G. BUELL
SETH D. MONTGOMERY
FRANK ANDREWS III
OWEN M. LOPEZ

JEFFREY R. BRANNEN
JOHN BENNETT POUND
GARY R. KILPATRICK

MONTGOMERY, FEDERICI, ANDREWS, HANNAHS & BUELL

ATTORNEYS AND COUNSELORS AT LAW
350 EAST PALACE AVENUE
SANTA FE, NEW MEXICO 87501

POST OFFICE BOX 2307
AREA CODE 505
TELEPHONE 982-3875

October 31, 1975

OIL CONSERVATION COM.

SANTA FE

Guy Buell, Esq.
Amoco Production Company
Post Office Box 3092
Houston, Texas 77001

Re: Case No. 5571, Application of Robert G. Cox
To Amend Order No. R-4561

Dear Guy:

I am returning to you copies of the two logs of Amoco's Diamond-Federal Gas Com. No. 1 Well to the base of the Abo. In light of the confused state of the present discovery in this case, and the subpoenas that have been issued, I cannot give you the assurance that I can deliver to Mr. Richard Stamets the entire Eastman file on the Cox Federal EA No. 1.

Neither my clients, nor any agent on their behalf, have examined the logs you gave me, and when I am able to assure you that I can live up to our part of the agreement, or make some other arrangements, we may again request the logs and probably additional information.

Thank you for your courtesies in this matter, and if you have any questions, please contact me.

Best regards.

Sincerely,

s/SUMNER G. BUELL

SGB/vt
#5086-75-7

cc: Mr. Richard L. Stamets
cc: Mr. William F. Carr

C
O
P
Y

OIL CONSERVATION COMMISSION

STATE OF NEW MEXICO
P. O. BOX 2088 - SANTA FE
87501



DIRECTOR
JOE D. RAMEY

LAND COMMISSIONER
PHIL R. LUCERO

STATE GEOLOGIST
EMERY C. ARNOLD

October 31, 1975

Eastman Whipstock, Inc.
P. O. Box 4609
Houston, Texas 77021

Attention: Mr. John Wilson

Dear Mr. Wilson:

On October 28, 1975, the New Mexico Oil Conservation Commission issued subpoenas duce tecum to Mr. Edgar G. Meglasson and Mr. R. B. Vickers of Eastman Whipstock, Inc. ordering them to appear before the Commission on November 19, 1975. The subpoenas direct these individuals to bring with them and produce at the hearing all files and other data in their possession which relates to the directional drilling of the Robert G. Cox Federal "EA" Well No. 1 located in Section 12, Township 18 South, Range 27 East, Eddy County, New Mexico. Mr. Cox was also subpoenaed.

The Commission issued these subpoenas pursuant to requests by Atlantic Richfield Company and Amoco Production Company. I discussed the costs which Eastman would incur with Mr. Clarence Hinkle, attorney for Atlantic Richfield, and he asked that I have you discuss this matter with Mr. Hugh Christianson in Atlantic Richfield's Midland office.

If you have questions, feel free to call me at any time.

Very truly yours,

WILLIAM F. CARR
General Counsel

WFC/dr

OIL CONSERVATION COMMISSION

P. O. BOX 2088
SANTA FE NEW MEXICO 87501

October 28, 1975

Clarence Hinkle, Esq.
P. O. Box 10
Roswell, New Mexico 88201

Dear Mr. Hinkle:

Pursuant to your request for Atlantic Richfield Company and a similar request from Mr. Guy Buell for Amoco Production Company, the Commission has issued subpoenas duce tecum to Mr. Edgar G. Meglasson and Mr. R. B. Vickers of Eastman Whipstock, Inc. and to Mr. Robert G. Cox ordering them to appear before the Commission on November 19, 1975. The subpoenas direct these individuals to bring with them and produce at the hearing all files and other data in their possession which relates to the directional drilling of the Robert G. Cox Federal "EA" Well No. 1.

Eastman Whipstock, Inc., has raised certain questions concerning expenses they may incur in appearing at this hearing. I have referred them to Mr. Hugh Christianson with Atlantic Richfield in Midland.

If I may be of further assistance, please advise.

Very truly yours,

WILLIAM F. CARR
General Counsel

WFC/ax

cc: Mr. Guy Buell
Mr. Sumner Buell

October 28, 1975

C
O
P
Y
Sheriff of Midland County Texas
P. O. Box 2355
Midland, Texas 79701

Dear Sir:

Enclosed are two subpoenas which the New Mexico Oil Conservation Commission needs to have served on employees of Eastman Whipstock, Inc. at their office on West Highway 80 in Midland. Two copies of each are provided; one for service and one for return.

The charges for serving these subpoenas should be billed to the Commission and we will promptly remit.

Very truly yours,

WILLIAM F. CARR
Assistant Attorney General

WFC/dr
enc.

NEW MEXICO
OIL CONSERVATION COMMISSION

FIELD TRIP REPORT

DATE 10-20-75

Name of Employee W. A. Gressett

Time of Departure 9:00 A. M. Time of Return 11:00 A. M.

Miles Travelled _____

In the space below please indicate purpose of trip and duties performed, listing wells or leases visited.

FIELD TRIP:

Accompanied Mr. L. C. Hudry with Atlantic Richfield Company and Don Gordon with the U. S. G. S. to witness re-surveying the surface location on the Robert G. Cox Federal EA #1-D, 12-18-27.

Said well located 331/N & 330/W of 12-18-27.

W. A. Gressett
Employee's Signature
District #11

44°59'
330'
331'
Federal EA No. 1
Elev. 3605.5



12

DATE CHECKED: October 20, 1975
WEATHER: Clear, Warm
P.C.: M. Webb
CHAIN: B. Attaway
J. Boling

WITNESS: W. A. Gressett
District Supervisor
N.M.O.C.C.
Artesia, New Mexico

WITNESS: L. C. Hudry
Senior Operations Engineer
Atlantic Richfield
Hobbs, New Mexico

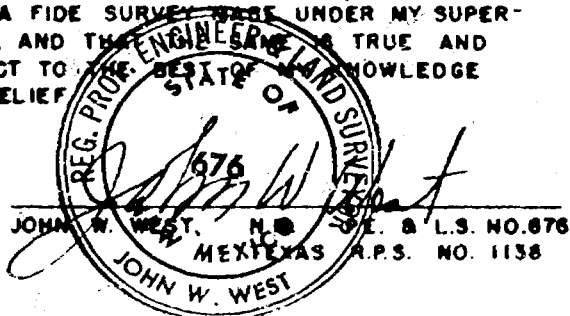
WITNESS: D. Gordon
Petroleum Engineering Technician
U.S.G.S.
Artesia, New Mexico

RECEIVED

OCT 21 1975

O. C. C.
ARTESIA. OFFICE

I HEREBY CERTIFY THAT THIS PLAT WAS
MADE FROM NOTES TAKEN IN THE FIELD IN
A BONA FIDE SURVEY MADE UNDER MY SUPER-
VISION, AND THAT THE SAME IS TRUE AND
CORRECT TO THE BEST OF MY KNOWLEDGE
AND BELIEF.



ATLANTIC RICHFIELD COMPANY

Check made on Robert Cox, Federal EA Well No. 1
located 330 feet from the west line and 331 feet from
the north line of Section 12, Township 18 South,
Range 27 East, N.M.P.M., Eddy County, New Mex.

JOHN W WEST ENGINEERING COMPANY
CONSULTING ENGINEERS HOBBS, NEW MEXICO

| | |
|-----------------------|---------------------|
| Scale 1"=1000' | Drawn by Beverly |
| Date October 20, 1975 | Sheet 1 of 1 Sheets |



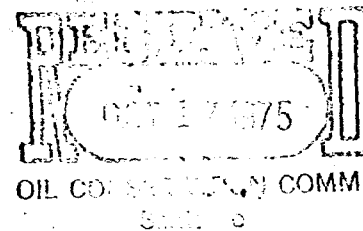
Amoco Production Company

500 Jefferson Building
P.O. Box 3092
Houston, Texas 77001

Guy Buell
Attorney

October 14, 1975

Mr. Sumner Buell
Attorney at Law
350 East Palace Street
Santa Fe, NM 87501



Re: Case No. 5571, Application of
Robert G. Cox to Amend
Order No. R-4561

Dear Mr. Buell:

During the course of argument over the continuance of the above case, it was agreed that if Amoco would furnish your client with a copy of the log of Amoco's Diamond-Federal Gas Com. No. 1 well--to the base of the Abo--your client would authorize Eastman to release their file on the directional drilling of the Cox Federal 'EA' No. 1 to Mr. Richard Stamets of the New Mexico Oil Conservation Commission.

Pursuant to that agreement you will find enclosed a copy of the log requested by your client. (Actually copies of two logs, a dual lateral and a C&L-FDC) Would you please advise Eastman--with a copy of the letter to me--that they may furnish their file to Mr. Stamets.

Very truly yours,

Original signed by

Guy T. Buell

JTB:rh
Enclosures

cc: Mr. Richard Stamets

J. O. SETH (1883-1963)

A. K. MONTGOMERY
WM. R. FEDERICI
FRANK ANDREWS
FRED C. HANNAHS
SUMNER G. BUELL
SETH D. MONTGOMERY
FRANK ANDREWS III
OWEN M. LOPEZ

JEFFREY R. BRANNEN
JOHN BENNETT POUND
GARY R. KILPATRICK

MONTGOMERY, FEDERICI, ANDREWS, HANNAHS & BUELL

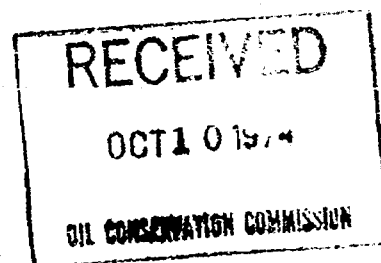
ATTORNEYS AND COUNSELORS AT LAW

350 EAST PALACE AVENUE
SANTA FE, NEW MEXICO 87501

POST OFFICE BOX 2307
AREA CODE 505
TELEPHONE 982-3875

October 10, 1975

Mr. Joe D. Ramey
Executive Director
New Mexico Oil Conservation Commission
State Land Office Building
Santa Fe, New Mexico



Re: Application No. 5571
Application of Robert G. Cox--directional drilling

Dear Mr. Ramey:

As you probably know, Applicant's testimony in this case was heard on October 8, 1975, before Mr. Stamets as the Examiner. At the close of Applicant's presentation, Aamco, represented by Mr. Guy Buell, asked that the matter be continued until the November 19th hearing. Because this is a well presently pumping for test purposes with a limited allowable, we opposed Mr. Guy Buell's request. After a short recess, Mr. Stamets announced that the matter would be continued and that he would recommend to the Commission that the No. 1 Federal EA Well be given a temporary allowable pending a decision of thirty-five (35) barrels per day.

Because this well is presently pumping for test purposes and additional testing is necessary to determine the capability of the well and hopefully additional reservoir characteristics, we respectfully request that the Commission grant us a temporary allowable of between 45 and 50 barrels per day. This additional allowable, over and above Mr. Stamets' recommendation, would give us a good deal of flexibility and hopefully, would provide additional information valuable to all persons concerned. If I can supply you with any additional information, please advise.

Very truly yours,

A handwritten signature in cursive script, appearing to read "Sumner G. Buell".

SGB/vt
#5086-75-6

cc: Mr. Richard L. Stamets
cc: Legal Division, New Mexico
Oil Conservation Commission

HAND DELIVERED

J. O. SETH (1883-1963)

A. K. MONTGOMERY
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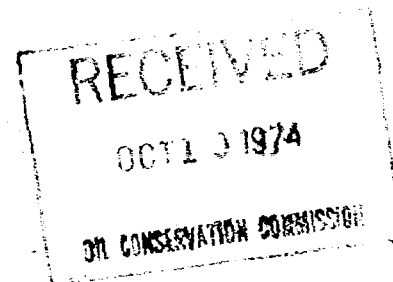
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cc: Legal Division, New Mexico
Oil Conservation Commission

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J. O. SETH (1883-1963)

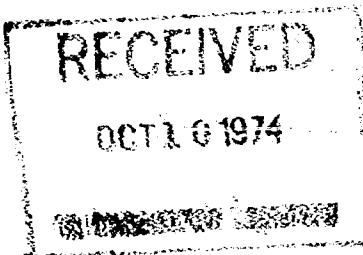
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October 10, 1975



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Executive Director
New Mexico Oil Conservation Commission
State Land Office Building
Santa Fe, New Mexico

Re: Application No. 5571
Application of Robert G. Cox--directional drilling

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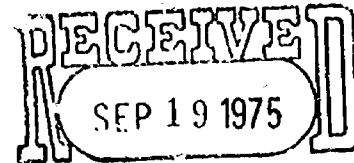
Very truly yours,

SGB/vt
#5086-75-6

cc: Mr. Richard L. Stamets
cc: Legal Division, New Mexico
Oil Conservation Commission

HAND DELIVERED

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BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

OIL CONSERVATION COMM.
Santa Fe

APPLICATION OF ROBERT G. COX
FOR THE AMENDMENT OF ORDER

NO. R-4561

Case No. 5571

APPLICATION

COMES NOW ROBERT G. COX, by and through his attorneys, and applies to the Commission for an Order amending Order No. R-4561, and in support of the Application, states:

1. Applicant is the authorized operator of the Federal "EA" Well No. 1, located 330 feet from the North Line and 330 feet from the West Line of Section 12, Township 18 South, Range 27 East, N.M.P.M., in the Empire-Abo field, in Eddy County, New Mexico.

2. On June 25, 1973, the Commission entered its Order No. R-4561 permitting the applicant to directionally drill its well and as a condition thereof the well was to be bottomed in the Empire-Abo pool at a point within 100 feet of the surface location of the well.

3. A further condition of the said Order was that a continuous multi-shot directional survey be made of the well from total depth to the whipstock point, with shots not more than 100 feet apart.

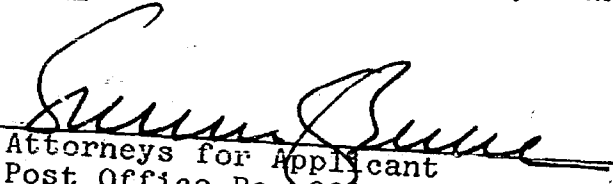
4. To require a continuous multi-shot directional survey at this time of the well is apt to endanger the producing capabilities of the well with a resulting loss of hydrocarbons.

5. That the well is presently bottomed within the exterior boundaries of the NW-1/4 of the NW-1/4 of Section 12, Township 18 South, Range 27 East, N.M.P.M. which is the acreage dedicated to this well.

WHEREFORE, Applicant asks that this matter be set before the Commission or one of its designated examiners, as the Commission may desire, and that Order R-4561 be amended to eliminate the requirement of a continuous multi-shot directional survey, and to permit the bottoming of the well at approximately 8 feet from the West Line and approximately 58 feet from the North Line of Section 12, Township 18 North, Range 27 East, N.M.P.M., Eddy County, New Mexico.

Respectfully submitted,

MONTGOMERY, FEDERICI, ANDREWS, HANNAHS
& BUELL

By 
Attorneys for Applicant
Post Office Box 2307
Santa Fe, New Mexico 87501

DOCKET MAILED

Date 1/12/76

DOCKET MAILED

Date 9/26/75

DOCKET MAILED

Date 11/10/75

ATWOOD, MALONE, MANN & COOTER
LAWYERS

JEFF D. ATWOOD [1883-1960]
ROSS L. MALONE [1910-1974]

RECEIVED
OCT 3 - 1975

OIL CONSERVATION COMM.
Santa Fe

P. O. DRAWER 700
SECURITY NATIONAL BANK BUILDING
ROSWELL, NEW MEXICO 88201
[505] 622-6221

October 2, 1975

CHARLES F. MALONE
RUSSELL D. MANN
PAUL A. COOTER
BOB F. TURNER
ROBERT A. JOHNSON
JOHN W. BASSETT
ROBERT E. SABIN
RUFUS E. THOMPSON
RALPH D. SHAMAS

Mr. Joe Ramey
Oil Conservation Commission
State Land Office Building
Santa Fe, New Mexico 87501

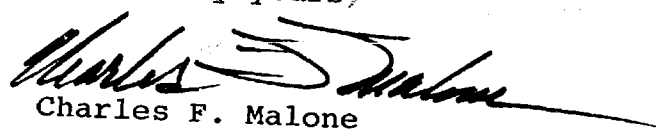
RE: Examiner Hearing - October 8, 1975

Dear Mr. Ramey:

Please file the enclosed Entry of Appearance for
Amoco Production Company in Case No. 5571.

Thank you and with regards, I am,

Very truly yours,


Charles F. Malone

CFM:sgs
Enclosure



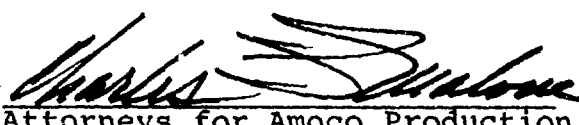
BEFORE THE OIL CONSERVATION COMMISSION
STATE OF NEW MEXICO

IN THE MATTER OF THE APPLICATION)
OF R. G. COX FOR AN AMENDMENT TO)
ORDER NO. R-4561, EMPIRE-ABO POOL,)
EDDY COUNTY, NEW MEXICO.) Case No. 5571

ENTRY OF APPEARANCE

The undersigned Atwood, Malone, Mann & Cooter of
Roswell, New Mexico, hereby enter their appearance herein
for the Applicant, Amoco Production Company, with Guy Buell,
Esquire, of Houston, Texas.

ATWOOD, MALONE, MANN & COOTER

By 
Attorneys for Amoco Production
Company
Post Office Drawer 700
Roswell, New Mexico 88201