STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION

IN THE MATTER OF THE HEARING CALLED BY THE OIL CONSERVATION DIVISION FOR THE PURPOSE OF CONSIDERING:

CASE NO. 10285, 10286, 10300 and 10302

APPLICATION OF AMERICAN HUNTER EXPLORATION, LIMITED, FOR A HIGH ANGLE/HORIZONTAL/DIRECTIONAL DRILLING PILOT PROJECT, SPECIAL OPERATING RULES THEREFOR, AND A NON-STANDARD OIL PRORATION UNIT, RIO ARRIBA COUNTY, NEW MEXICO.

REPORTER'S TRANSCRIPT OF PROCEEDINGS

EXAMINER HEARING

BEFORE: JIM MORROW, Hearing Examiner

May 30, 1991

Santa Fe, New Mexico

This matter came on for hearing before the Oil Conservation Division on May 30, 1991, at 11:10 a.m. at Oil Conservation Division Conference Room, State Land Office Building, 310 Old Santa Fe Trail, Santa Fe, New Mexico, before Freda Donica, RPR, Certified Court Reporter No. 417, for the State of New Mexico.

FOR: OIL CONSERVATION DIVISION

BY: FREDA DONICA, RPR
Certified Court Reporter
CCR No. 417

I N D E X

May 30, 1991
Examiner Hearing
CASE NO. 10285, 10286, 10300 and 10302

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E X H I B I T S

A P P E A R A N C E S

FOR THE DIVISION: ROBERT G. STOVALL, ESQ.
General Counsel
Oil Conservation Commission
State Land Office Building
310 Old Santa Fe Trail
Santa Fe, New Mexico 87501

FOR THE APPLICANT: CAMPBELL & BLACK, P.A.
Attorneys at Law
BY: WILLIAM F. CARR, ESQ.
110 North Guadalupe
Santa Fe, New Mexico 87501

FOR BENSON-MONTIN-GREER: KELLAHIN, KELLAHIN & AUBREY
Attorneys at Law
BY: THOMAS KELLAHIN, ESQ.
117 North Guadalupe
Santa Fe, New Mexico 87501

HEARING EXAMINER: We'll call cases 10285, 286, 300 and 302. These are the application of American Hunter Exploration, Limited, for high angle/horizontal/directional drilling pilot projects and special operating rules and a nonstandard oil proration unit, Rio Arriba County, New Mexico. Does that -- off the record just a minute.

(Off the record discussion.)

HEARING EXAMINER: Call for appearances.

MR. CARR: May it please the Examiner, my name is William F. Carr with the law firm of Campbell & Black, P.A., Santa Fe. I represent American Hunter Exploration, Limited, and I have three witnesses.

HEARING EXAMINER: Are there other appearances in this case?

MR. KELLAHIN: Mr. Examiner, I'm Tom Kellahin of the Santa Fe law firm of Kellahin, Kellahin & Aubrey. I'm appearing on behalf of Benson-Montin-Greer.

HEARING EXAMINER: Any others? Will the witnesses please stand and be sworn?

(Witnesses sworn.)

MR. CARR: May it please the Examiner, before we present our first witness, I would like to request that the portion of case 10286 which relates to development of Section 6 in Township 27 North, Range 1 West, I request that that portion of the case be dismissed. That was filed as a

separate application. It was consolidated for purposes of your legal advertisement, and in agreement with other operators we have agreed to dismiss that application at this time.

HEARING EXAMINER: That's in the part of it that's in Section 6.

MR. CARR: Yes, sir.

HEARING EXAMINER: All right, sir.

JIM LISTER

the witness herein, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. CARR:

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

A. My name is Jim Lister.

Q. And, Mr. Lister, where do you reside?

A. I live in Evergreen, Colorado.

Q. By whom are you employed and in what capacity?

A. I'm the senior exploration geologist for American Hunter Exploration.

Q. Have you previously testified before the New Mexico Oil Conservation Division?

A. No, I have not.

Q. Would you briefly review for Mr. Morrow your

educational background and then summarize your work experience?

A. I received a bachelor of science degree in geology from the University of South Carolina and then a master of science degree in geology from the University of Montana. I have 13 years experience as a petroleum geologist, beginning first with Texaco in Denver and then with Champlin Petroleum which later became Union Pacific Resources and then finally with American Hunter Exploration.

Q. Have you testified in other jurisdictions?

A. No, I have not.

Q. Are you a certified petroleum geologist?

A. I'm an AEPG certified petroleum geologist.

Q. Are you familiar with the applications filed in each of these cases by American Hunter Exploration, Limited?

A. Yes, I am.

Q. Are you familiar with the area that is involved in each of these cases and also familiar with the proposed highly deviated directional wells?

A. Yes, I am.

MR. CARR: At this time, Mr. Morrow, we would tender Mr. Lister as an expert witness in petroleum geology.

HEARING EXAMINER: We accept Mr. Lister's qualifications.

Q. (By Mr. Carr) Could you briefly summarize what

American Hunter is seeking with this application?

A. We're seeking approval of four high angle/horizontal/directional drilling pilot projects, and special operating rules for those wells, and also nonstandard oil proration units for certain of those wells.

Q. Have you prepared exhibits for presentation here today?

A. Yes, I have.

Q. Would you refer to what has been marked as American Hunter Exhibit Number 1, identify that exhibit and review it for Mr. Morrow?

A. Exhibit Number 1 is a land map of the proposed project area Rio Arriba County, New Mexico. What's shown on the map is the mineral ownership of the subject acreage and the lease status. And I've colored in yellow on the land map the proposed four locations, surface location and approximate bottom hole location in each of the sections, Section 8 and 6 and 27 North, 1 East, Section 2 and 4 in 27 North, 1 west.

Also shown on the map in the lower right-hand portion is the East Puerto Chiquito Mancos Unit and the production and drilling in that area. To the north and the central portion in 28 North, 1 West is the south end of the Boulder Field. And shown in the western half of 27 North, 1 West is the Florance Unit of the West Puerto Chiquito Mancos

field. The East Puerto Chiquito, Boulder and the Florance Unit all produce from the Mancos formation.

Q. In what pool are the four proposed wells to be located?

A. The wells in Sections 8 and 6 of 27 North, 1 East are to be located within the East Puerto Chiquito Mancos pool. The wells in Section 2 and 4 of 27 North, 1 West are to be located within the West Puerto Chiquito Mancos pool.

Q. It's not shown on this exhibit, but where is the boundary between these two pools?

A. Well, the pool boundary for the West Puerto Chiquito Mancos pool involves 27 North, 1 West, and the northern portion of that pool boundary is at the top of the Township. It would go from the top of Section 6 across to the middle of Section 1 in 27 North, 1 West. And from there the pool boundary trends due south through the middle of the remaining sections in the Township on that east side. And the East Puerto Chiquito Mancos pool would lie in the west half of those Sections 1, 12, 13, 24 and 25, and then the Township shown, 27 North, 1 East, also up to the top of the Township there.

Q. If we go to the western boundary of the East Puerto Chiquito unit shown on this exhibit and we extend that western boundary just due north through the center of those sections, would that be the common boundary between

those two pools?

A. Yes, that's correct.

Q. Are there special pool rules in effect for these pools?

A. Yes, there are.

Q. What are the well location and acreage dedication requirements in each of these pools?

A. For the West Puerto Chiquito Mancos oil pool, it has a 640-acre spacing and 1,650 feet setbacks from the section boundaries. In the East Puerto Chiquito Mancos oil pool, there is a 160-acre spacing rule and 100 wells are to be located within 165 feet of the center of a quarter quarter in that pool.

Q. Now, American Hunter is seeking exceptions to certain provisions in these pools; is that correct?

A. That's correct.

Q. For the wells in Section 6 and 8 in the East Puerto Chiquito Mancos oil pool, what exceptions do we need?

A. Well, in the East Puerto Chiquito area we're asking for exception to spacing and in proration to dedicate the entire section to the wells.

Q. So what you need in terms of spacing, you need to be able to dedicate a 640-acre unit instead of 160 acres?

A. That's correct.

Q. You also need to be able to locate the wells as

you have proposed and directionally drill them?

A. From east to west, that's correct.

Q. And then in addition, you need special provisions that would permit you to, what, have an allowable equal to the allowable that would be assigned to each of the 160s dedicated to each of those wells?

A. That's correct.

Q. We go into the West Puerto Chiquito, what exceptions do you need there?

A. There we're asking for exceptions to well location requirements for the 4-A and the 2-A wells.

Q. What is the ownership of the acreage that is going to be dedicated to each of these four wells?

A. The mineral ownership of the acreage for the four wells is the Jicarilla Apache tribe. They are the mineral owner for each of the sections. American Hunter Exploration is 100 percent working interest party for each one of the subject sections.

Q. What kind of an override does the Jicarilla Apache tribe hold in these tracts?

A. The Jicarilla Apache tribe will retain a 25 percent overriding royalty interest in each of the subject tracts.

Q. Has notice of each of these applications been provided to the other interest owners in the area who will

be affected by this proposal?

A. Yes.

Q. And is the Exhibit Number 2 a copy of an affidavit from Campbell & Black confirming that this notice has been sent?

A. Yes, that's correct.

Q. At this time, Mr. Lister, I'd like you to just generally describe for the Examiner the geologic characteristics of the Mancos formation in this area.

A. The Mancos formation here in this area is approximately 2,000 feet thick. It's principally a shale, but it is divided into about six different members. The Niobrara member of the Mancos shale is the target reservoir. It is a highly calcareous shale with thin, brittle innerbeds of siltstone and very fine grain sandstone. And it's these -- principally these siltstones and sandstones which are fractured and which produce at the fields that I referred to.

Q. Why don't we go to American Hunter Exhibit Number 3? Would you identify that for Mr. Morrow and then review what this exhibit shows?

A. This Exhibit Number 3 is a structure map on the top of the Niobrara A zone. It is on a contour interval of 100 feet and 500 feet. What I've shown on the structure map in addition to the structural contours is on the eastern

side of the map, colored in light green, is the outcrop of the Mancos formation. The darker green corresponds to the approximate producing areas of East Puerto Chiquito field and Boulder field. And then I've also again shown the surface location and the approximate proposed bottom hole location for each of the four wells. And I also have a cross-section A-A' which is a stratigraphic cross-section that goes from the Florance Unit to Boulder field and then down, ending in the East Puerto Chiquito field, and it is a cross-section of the nearest offsetting wells to the proposed drilling program.

Also shows on the structured contour map a steeply dipping rate for the Niobrara A Zone anywhere from 15 degrees dip, bottoming out on the west side to about two to three degrees dip.

Q. What is the significance of structure in terms of the developing -- drilling successful wells in this reservoir?

A. Well, we believe that the structural flexure, the monocline, has result in creating fractures in the reservoir and that these fractures predominantly trend north-south parallel to the monocline and, therefore, we are proposing to drill our wells in an east-west manner in order to intersect these principal fracture directions.

Q. Mr. Lister, let's move to Exhibit Number 4.

Would you identify and review that, please?

A. Exhibit Number 4 is a stratigraphic cross-section of the Niobrara member of the Mancos shale, principally showing the A and the B zones. And as I mentioned before, it goes through the nearest offsetting wells to the proposed project.

And this cross-section is constructed to show that the beds are traceable from west to east across the area with very little variance in stratigraphic thickness. I've indicated on the left and west -- left and right sides the cross-section the bed thicknesses of some of the sandstone-siltstone units. And as you can see, in the A zone 13 feet thick on the west side, 12 feet thick on the east side, very little difference in stratigraphic thickness.

And then you can read for yourself the numbers for the B zone. And this is to show continuity of the beds across the area and also to highlight some of the principal targets in the horizontal drilling program. We plan to target the A zone and the B zone in our drilling and largely the sand units that are colored in yellow.

Q. From a geologic point of view, does this reservoir look like a good prospect for horizontal drilling?

A. Yes. We like to see continuity of the beds so that we would have high probability of staying within a unit

or within a zone and successfully drilling through the A and the B.

Q. This cross-section extends from the West Puerto Chiquito into East Puerto Chiquito; is that correct?

A. That's correct.

Q. From a geologic point of view, is there any difference between this reservoir as it is encountered in either of these two pools?

A. Not principally. As you can see, there's continuity of the beds. They were deposited in the same depositional environment. Lithologically they're similar, and in thickness they are similar. The only variance is the dip of the beds across the area from east to west into the basin.

Q. Do you have anything further to add to your testimony?

A. No, I don't.

Q. Were Exhibits 1, 3 and 4 prepared by you?

A. Yes, they were.

Q. And Exhibit Number 2 is the affidavit from Campbell & Black?

A. That's correct.

MR. CARR: Mr. Morrow, at this time we would move the admission of American Hunter Exhibits 1 through 4.

HEARING EXAMINER: Exhibits 1 through 4 are admitted.

MR. CARR: That concludes my direction of Mr. Lister.

HEARING EXAMINER: Mr. Kellahin?

MR. KELLAHIN: No, sir. Thank you.

HEARING EXAMINER: I'm not sure I understood the pool boundary. Bob tried to bring me up to speed. On Exhibit 1, the division between east and west is the center of Section 1 and 12 and 1 and 36; is that correct?

MR. STOVALL: That's 13 down here.

HEARING EXAMINER: 13?

THE WITNESS: Right. If you draw a line from the top center of Section 1 and go straight south with it and divide all those sections in half, that's the common boundary between the two pools.

HEARING EXAMINER: And the top of both pools is that --

THE WITNESS: Top of the Township lines.

HEARING EXAMINER: Now, the rules in the east are 160 acres; is that correct?

THE WITNESS: 160-acre spacing.

HEARING EXAMINER: 150 feet from quarter quarter section?

THE WITNESS: 165 feet, I think it was.

HEARING EXAMINER: How about the west? What are the rules in the west?

THE WITNESS: 640-acre spacing, and 1,650 feet setbacks.

HEARING EXAMINER: So your locations are too close to the north line in the west portion?

THE WITNESS: That's correct. We're asking for exceptions on the locations for those two wells in the West Puerto Chiquito-Mancos pool.

HEARING EXAMINER: Are your surface locations in the east pool, are they standard?

THE WITNESS: Yes, they are.

HEARING EXAMINER: Mr. Carr said you want to delete the portion of one of these cases that applied to Section 6.

THE WITNESS: That's correct.

HEARING EXAMINER: That's not the Section 6 where the well is.

THE WITNESS: No, sir. We had -- there appeared Sections 4 and 6 of 27 North, 1 West, combined on the docket. And 6 is the one to be deleted.

Q. (By Mr. Carr) Two sections west of Section 4, right?

A. That's correct.

HEARING EXAMINER: Would the same horizontal well bore that you're proposing develop both the A and the B portions of the reservoir?

THE WITNESS: Yes, that's correct. And when we show our well bore trajectories later, that will become more apparent.

HEARING EXAMINER: So one well is entitled to 640 acres in the west pool?

THE WITNESS: That's correct.

HEARING EXAMINER: Do you know why they are different? Why the rules are different between the east and the west?

MR. STOVALL: Mr. Morrow, I think just for your information, I explained the background of the -- I think the West Puerto Chiquito field was originally developed on -- I believe it was 640 acres, largely as a result of a unit.

HEARING EXAMINER: The west?

MR. STOVALL: The west. The unit in the Township to the south, the Canados Jitos unit, was, I believe, the basis for those rules, if I'm not mistaken. That's a pressure maintenance unit operated by Benson-Montin-Greer, and there have been numerous cases subsequently involving the West Puerto Chiquito and the Gavilan Mancos pool, which is to the west of the West Puerto Chiquito, that really haven't involved this northern portion a tremendous amount.

I think the eastern portion was originally developed on 160 based upon early testing. There are actually a number of 160-acre oil pools out there that have gotten bigger over time because of the discovery of the fractured nature of the reservoir. Because there hasn't been a lot of activity in the East Puerto Chiquito pool, it

has not been involved in a lot of pool rules and changes that have affected West Puerto Chiquito and Gavilan Mancos.

HEARING EXAMINER: Those that have had to change started on 640 and they're still on 640.

MR. STOVALL: Well, one started on 640. One actually started on 40 and ended up at 640 through a series of rule changes.

THE WITNESS: I think the tendency has been toward larger spacing units.

HEARING EXAMINER: Let me ask you this then. Geologically, do you know of any reason why the rules should be different between the east and the west?

THE WITNESS: No, we do not. And, in fact, I believe that it is one common lithologic unit throughout the area, and the structure is somewhat different from East Puerto Chiquito to Boulder and West Puerto Chiquito. But principally we're dealing with a fractured reservoir here, and that is a common factor among all three reservoirs -- or three fields, I mean.

MR. STOVALL: I hope that helped you.

HEARING EXAMINER: That did.

MR. STOVALL: There's a long history behind this -- trying to summarize it rather briefly.

I do have some questions, just kind of administrative as much as anything.

EXAMINATION

BY MR. STOVALL:

Q. Are you in a position to discuss the -- knowledgeable enough to discuss the relationship between American Hunter and -- I see that Richmond appears -- the property you're developing is property that is controlled by a joint venture between Richmond and the Jicarillas? Do I understand the map legend correctly on that?

A. That's correct. The -- Richmond Petroleum Inc. entered into a joint venture agreement with the Jicarilla Apache tribe, and then American Hunter Exploration came in and has assumed the operatorship of the program. And Richmond Petroleum will have a reversionary 25 percent working interest after payout on the first four wells.

Q. If this is proprietary information, you don't have to answer. But is that out of American Hunter's --

A. Yes.

Q. The Jicarillas are --

A. The Jicarilla Apache tribe interest has remained constant throughout this joint venture agreement. It's simply that we came in and made an agreement directly with Richmond Petroleum.

Q. With respect to the spacing and the permission to drill these, have you had discussions with the Jicarillas with respect to bringing this matter to the Oil Conservation

Division and --

A. Yes, we have. We have met several times with the Jicarilla Apache tribe, both with their minerals committee and with the Jicarilla Apache counsel. And we have made lengthy presentations on our proposed operations, drilling plans and proprietary interpretations of the area. And we have received approval from both the minerals committee and the Jicarilla Apache counsel for this program.

Q. And has the tribe approved also the -- essentially the encroachment, if you will? It appears those wells in the West Puerto Chiquito are, in fact, encroaching 100 percent tribal lands; is that correct?

A. Well, the 100 percent tribal lands surround all of our acreage, as you can see, both north and east and west. And it's a common mineral ownership, and so the tribe is getting an overriding royalty from the sections that we drill on, and the tribe retains the right to drill and develop their odd sections as well. And this has all been reviewed with them.

Q. So they're -- they accept the fact that at least in terms of OCD rules they're not concerned about any drainage impact on their unleased minerals to the north; is that correct?

A. That would be my opinion.

Q. To the extent that you've had discussion -- I

understand you're not speaking for the tribe, but rather based on your discussions with them.

A. That's correct.

MR. STOVALL: I have no further questions.

HEARING EXAMINER: You may be excused, Mr. Lister.

MR. CARR: At this time we call Mr. Bondarchuk.

ALEX BONDARCHUK

the witness herein, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. CARR:

Q. Will you state your name for the record, please?

A. My name is Alex Bondarchuk.

Q. Where do you reside?

A. Calgary, Alberta, Canada.

Q. By whom are you employed and in what capacity?

A. I'm a senior drilling engineer with American Hunter Exploration.

Q. Have you previously testified before this division?

A. No, I have not.

Q. Would you review for Mr. Morrow your educational background and then summarize your work experience?

A. I graduated in 1981 with a bachelor of science in chemical engineering from University of Waterloo in

Waterloo, Canada. Worked for seven years as a drilling engineer for Shell Canada. And then for the last three years I've worked for American Hunter Exploration as a senior drilling engineer.

Q. Your employment since graduation, you've been employed as an engineer?

A. Yes, I have.

Q. Are you a registered petroleum engineer?

A. I'm a professional engineer in the provinces of Alberta, Canada.

Q. Have you had prior experience with horizontally drilling wells?

A. Yes. I was the drilling engineer for a ten-well horizontal program drilled within the Bachman formation in the Williston Basin in North Dakota.

Q. Are you familiar with the applications filed in each of these cases for American Hunter?

A. Yes, I am.

Q. Are you familiar with the proposed drilling plans in the subject area?

A. Yes, I am.

MR. CARR: We tender Mr. Bondarchuk as an expert witness in -- or an expert drilling engineer.

HEARING EXAMINER: We accept Mr. Bondarchuk's qualifications.

Q. (By Mr. Carr) Have you prepared certain exhibits for presentation here today?

A. Yes, I've prepared two.

Q. Would you refer to what has been marked as American Hunter Exhibit Number 5, identify that and review it for the Examiner?

A. Okay. The -- this first exhibit is a package of plots showing the surface location and subsurface target area for the four proposed wells. I refer to -- actually, first of all, also surface locations for the four wells are in the east half of the section, as we plan to drill downdip in a westerly direction.

The wells will be located within a 2,900 foot by 1,500 foot drilling window. These dimensions were selected to allow us some flexibility with respect to the bottom hole location, due to the lack of well control in the area. We plan to drill a vertical pilot hole in each well. And then based on the cuttings and the logs and some down hole test results, we will then determine the optimum direction to drill in order to not intersect the maximum number of fractures. For example, I've referenced the 8I-1 well. The surface location, as shown, is 2,000 feet from the south line and 500 feet from the east line, Section 8. And as shown, there's a 2,900 by 1,500 foot drilling window.

Q. So you're going to drill a straight hole; then

with the data you acquire at that time, you'll pick the exact location for the well within this block as indicated on this exhibit.

A. That is correct.

Q. What are the subsequent pages in Exhibit Number 5?

A. The subsequent pages are the three other locations that we are proposing at this time. The 6A-1 well, the 2A-1 well and finally the 4A-1 well. They are all, as I've mentioned earlier, similar as far as surface locations, being at least half of each section.

Q. Let's move to American Hunter Exhibit Number 6. I think what I'd ask you to do is identify this and then, referring to Exhibit Number 6, explain to Mr. Morrow exactly how you propose to go about drilling each of these wells.

A. These diagrams show the well design that we propose to use in the high angle section. The -- what I'll do is reference the first well, the 8I-1. We plan to spud this well from the surface location previously shown in Exhibit 5. A twelve-and-a-quarter-inch hole will be drilled to approximately 1,450 feet. And 95 eighths intermediate casing will be set. This casing point, it's approximately 100 feet above the primary kickoff point. An eight and three-quarter inch vertical pilot hole will then be drilled to an approximate total measured depth of 2,550 feet.

At that time the well will be evaluated, and based on the samples, logs and tests, down hole test results, we will confirm and/or revise our preliminary estimates of formation tops and dips, plus also the fracture limitation. The well will then be plugged back to a kickoff point of approximately 1,552 feet, which has been selected to permit us to build a medium radius curve at 12 degrees per hundred within the Mancos shale.

The curve will then intersect the Niobrara A member at an angle of 76.4 degrees and a measured depth of 2,189 feet. At that point we plan to hold angle and drill 2,500 feet of hole within approximately a 120-foot thick section of the Niobrara. The reservoir is expected to be underpressure, so we plan to drill with an aerated mud in order to minimize the formation damage.

The location of this well while we're directionally drilling will be monitored continuously by logging and surveying with an electromagnetic MWD gamma ray tool. We are using this special tool since we're using an aerated drilling fluid, and conventional MWD tools are unable to operate in this environment.

Upon reaching a total measured depth of 4,761 feet -- approximately 4,761 feet, we plan to set a five-and-a-half-inch sliding casing liner across the zone. A similar plan has been prepared for each well. There's

three other diagrams. The formation tops and dip, kickoff point, maximum hole angle and drilling depths reflect the position of each well within the basin. This is why they vary from well to well.

Q. If I understand what you're saying, not only when we start drilling the vertical hole will we know the azimuth of the well, but we won't, at that time, even know the exact kickoff point; is that correct?

A. This is correct.

Q. What you do is you log the vertical hole to determine formation tops, and then you back off from that figure to get the exact kickoff point so when you build your curve you intersect the formation?

A. Exactly. There's the radius of curvature based on 12-degrees-per-hundred-build rate that we anticipate that we will be able to build an angle at.

Q. Based on your experience drilling other horizontal wells, do you anticipate any problem in maintaining your position within the formation while drilling the highly deviated or horizontal portion of the hole?

A. No, we do not. We -- based on the -- what we've learned from other wells drilled by other operators within the basin, plus our experience in other basins, and the use of conventional technology that we've used here in the

United States and Canada, we feel we can control the well.

Q. Will American Hunter run a directional survey on each well and provide a copy of that survey to the Oil Conservation Division?

A. Yes, we will.

Q. Were Exhibits 5 and 6 prepared by you?

A. They were -- Exhibit 5 was prepared by me and Exhibit 6 was under my direction.

MR. CARR: Mr. Morrow, at this time we would move the admission of American Hunter Exhibits 5 and 6.

HEARING EXAMINER: Exhibits 5 and 6 are admitted.

MR. CARR: We will also be calling an additional engineering witness following the testimony of Mr. Bondarchuk.

HEARING EXAMINER: Mr. Kellahin, do you have questions?

MR. KELLAHIN: Just a couple, Mr. Morrow.

CROSS-EXAMINATION

BY MR. KELLAHIN:

Q. With regards to the location of the well within each of the sections?

A. Yes.

Q. Do you know what the reasons are for locating the wells within each section as processed?

MR. CARR: Mr. Kellahin, our engineer witness is going

to explain why they're on the north, and that will be the thrust of his testimony.

Q. (By Mr. Kellahin) The distance of the lateral, if you will, within the formation?

A. Yes.

Q. Is determined by the angle from the top of the Niobrara to the base of the Niobrara B, an 11-degree distance?

A. Well, basically, what we did was we determined that we'd like to have a 2,500 foot lateral within that section, and that determined the angle that we had to build to. And the influence of the formation dip also plays a part in determining what that maximum hole angle will be.

Q. What's the basis for the 2,500 foot lateral?

A. It's a practical number, I would say, as far as being able to drill that far horizontally. We have gone in excess of 3,000 feet, but for planning purposes we feel that 2,500 feet is a practical number to work with.

Q. And that lateral will have a slotted liner?

A. Yes, sir, that's correct.

Q. Why have you decided to use that?

A. We -- well, normally, you don't see cement the casing across the zone, especially in this environment where we're anticipating that the under-pressured -- the -- by going slotted, that way we don't have to perforate. We're

opening up the whole lateral section for production.

Q. Why not an open hole completion attempt?

A. Preference of our completions people is to have some type of casing in there to reduce the risk of losing the well bore in the future.

MR. KELLAHIN: Thank you, Mr. Examiner.

HEARING EXAMINER: You indicated you'd drill with an aerated mud. Would you expect to be under-balanced so that you'd have formation flow during your drilling operation?

THE WITNESS: We are going to attempt to be as close to balance point as physically possible. We may get some flow of oil during the drilling operations.

HEARING EXAMINER: How do you control that?

THE WITNESS: We'll have our normal flow -- or system on the top of the well head, plus we'll have gas busters if there's any gas associated with the fluids coming out. And also we have the manifold and flutterhead that we can direct those fluids to, if, indeed, we need to.

HEARING EXAMINER: So if the well began to flow, you would control that before you continued your drilling; is that correct?

THE WITNESS: Yes.

HEARING EXAMINER: You wouldn't expect to drill with a formation flowing ~~conditionally~~ continuously.

THE WITNESS: It wouldn't be -- it's not the desired

way to operate. We would be able to control that. Since we're going with an aerated fluid, we would just reduce the amount of air flow to the mud, and by doing that increase our hydrostatic. But for design purposes, we are going on the virgin reservoir radiant for the existing fields in the area.

HEARING EXAMINER: You may be excused, sir.

MR. CARR: At this time we call Mr. Artindale, Jim Artindale.

JIM ARTINDALE

the witness herein, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. CARR:

Q. Will you state your full name for the record, please?

A. It's Jim Artindale.

Q. Where do you reside?

A. Calgary, Alberta, Canada.

Q. By whom are you employed and in what capacity?

A. I'm employed by Canadian Hunter Exploration in the capacity of a district reservoir engineer for the U.S. properties.

Q. Have you previously testified before this division?

A. I have not.

Q. Would you briefly review your educational background and then summarize your work experience for the Examiner?

A. I graduated from the University of Calgary in 1979 with a degree in engineering. I then worked for Superior Oil in Calgary for approximately three years, followed by five years with an independent company called Gas Can Resources in Calgary. I've spent the last four to five years with Canadian Hunter.

Q. Are you a registered petroleum engineer?

A. I am. I'm registered in the province of Alberta.

Q. Have you prior experience with horizontal wells?

A. Yes. I've been involved in approximately ten of our horizontal projects through Canadian Hunter. I also am currently the team leader for the Canadian Hunter horizontal task force.

Q. Are you familiar with the applications filed in each of these cases on behalf of American Hunter?

A. Yes, I am.

Q. Are you familiar with the proposed wells and the subject formation?

A. Yes, I am.

MR. CARR: We tender Mr. Artindale as an expert witness in petroleum engineering.

HEARING EXAMINER: We accept Mr. Artindale's qualifications.

Q. (By Mr. Carr) Could you identify and review for Mr. Morrow what has been marked as American Hunter Exhibit Number 7?

A. Yes. Exhibit 7 consists of three diagrams which are designed to schematically illustrate the nature of the reservoir that we're trying to drill horizontally into. The first diagram illustrates a single vertical well drilled into this type of formation.

Let me begin by characterizing the formation. Under the Neilson ratings it would be classified as a Type 1 fracture system, meaning that the porosity and permeability associated with this formation really originates from the fracture system. The fractures are primarily oriented north-south, the primary fracture system.

This has been evidenced through at least two interference tests run by Benson-Montin-Greer, also through production data. There's also a conjugate set of fractures of less permeability running approximately east-west. There appears to be a ten-to-one anisotropy ratio between the north-south direction and the east-west direction. This means that there is a ten-to-one ratio permeability between those two directions.

The primary drive mechanism associated with this

reservoir is a combination of solution gas drive and gravity drainage. The effective porosity associated with this formation is likely under one percent, somewhere between .3 and one percent. The diagrams illustrate the manner in which previous operators have attempted to exploit this reservoir. The first diagram illustrates a single vertical well in a section.

And what has statistically happened is that the majority of vertical wells in this section which have been subsequently stimulated have not managed to intersect the major fracture system which runs north-south. They have only managed to intersect the conjugate fracture system which runs east-west. And as a result, the majority of vertical wells are marginal producers.

In fact, in the area offsetting our wells the majority of vertical wells make less than 20,000 barrels of oil during their life. However, there is a percentage of wells, approximately 15 percent of the vertical wells, which do, in fact, intersect the major fracture systems, and they have cumulative rates between 100,000 to two-and-a-half million barrels of oil.

The second figure illustrates the historic method of developing this reservoir. Examples of this type of development are, in fact, the East Puerto Chiquito field and the Boulder field, which is just north of our proposed

wells. In these examples the operators have gone in with numerous number of wells, anywhere between four and six wells in a section, trying to optimally develop the reservoir just through a large number of vertical wells. Unfortunately, what has occurred is that still a large majority of these vertical wells have been marginal producers. And for the most part, development vertically in this manner has been uneconomic.

The final illustration represents what we hope to achieve with horizontal wells, and that is by orienting our horizontal wells in the east-west direction we hope to intersect the major fracture systems which run in a north-south direction. And with the horizontal length of approximately 2,000 to 2,500 feet, we hope to intersect enough of these fractures to effectively drain the section.

Q. What kind of recovery are you anticipating for each of these wells?

A. The recovery throughout the Mancos formation varies considerably. It can vary between 100,000 barrels of oil per section to five to 600,000 barrels of oil per section. We hope to recover on average around 300,000 barrels of oil per section.

Q. Do you believe that these wells, if they do intersect the fractures as you anticipate, will be able to drain 640 acres?

A. Yes, they will.

Q. As I look back at Exhibit Number 1, the wells numbers 4, 2 and 6 are located in the extreme northern portion of the 640-acre spacing units dedicated to those wells. Could you explain how these proposed well locations were selected?

A. Yes. There are -- I've spoken on the primary benefit of the horizontal wells, being that of being able to effectively intersect the fracture system. However, there is another tangible benefit of horizontal wells, and that is that they tend to minimize the effect on the -- of the land in the sense that there's a lot less wells drilled.

We selected the locations for two reasons; number one, they were selected based on topography so that they would minimize ecological damage to the Jicarilla tribe. The locations were really based on locations that were available to us for that purpose. In addition, we plan to run a series of seismic lines across these horizontal wells to basically calibrate the geologic data obtained through drilling the wells with seismic data. And the seismic lines were able to be run along the north end of the sections.

Q. Mr. Artindale, the locations in Sections 2 -- or in Sections 2 and 4 of the West Puerto Chiquito, those are actually the locations that were selected for topographical reasons; isn't that correct?

A. Yes, they were.

Q. And then as we move to Section 6, the reason for that location being in the extreme north wasn't topographic, was it? It was to tie into the seismic line?

A. That's right. We hope to run one seismic line which would cross Section 6, Section 2 and Section 4, and then another seismic line, independent of that, which would run through the Section 8 location.

Q. These seismic lines would enable you to tie together the information you'll acquire during the drilling of each of these wells?

A. That's correct.

Q. Now, for each of the wells in the East Puerto Chiquito, the wells in Sections 6 and 8, you're seeking 640-acre spacing; is that correct?

A. Yes, we are.

Q. And what allowable provision are you requesting for each of those wells?

A. We're requesting that the allowables associated with each one of the quarter section spacings be assigned to the 640-acre parcel.

Q. And Mr. Lister indicated that you had been in communication and reviewed these proposals with the Jicarilla Apache tribe. When was your most recent contact with the tribe, and what is the status of their approval

process at this time?

A. The most recent meeting with the Jicarillas was last Friday where we sent a technical representation down to their counsel meeting. At that time they approved the project.

Q. In your opinion, will approval of these applications result in a recovery of oil that -- or hydrocarbons that otherwise will not be recovered?

A. Yes. We believe that horizontal wells have the ability to truly optimize the development and recovery from this type of system.

Q. In your opinion, will approval of these applications be in the best interest of conservation and the prevention of waste and the protection of correlative rights?

A. Yes, we do.

Q. Was Exhibit Number 7 prepared by you?

A. Yes, it was.

MR. CARR: At this time, Mr. Morrow, we move the admission of American Hunter Exhibit Number 7.

HEARING EXAMINER: Number 7 is admitted.

MR. CARR: That concludes my examination of this witness.

MR. KELLAHIN: Just one question, Mr. Morrow.

CROSS-EXAMINATION

BY MR. KELLAHIN:

Q. You indicated that the anticipated recoverable oil assigned to the horizontal well was in the range of 300,000 barrels?

A. That's what we anticipate to be an average. It can be -- vary between 100,000 to five to 600,000 per section, yes.

Q. Give me some background on how you've reached that estimate.

A. Okay. There are a number of fields that have already been developed on vertical spacing in the Mancos. Included in those would be East Puerto Chiquito, West Puerto Chiquito, Gavilan, the Bear Canyon unit and Boulder. If you -- and most of those fields now have pretty well been depleted. Most of the production has been taken out. The wells are now in stripper status.

From that information we were able to deduce the amount of recovery on a per section basis, particularly the areas like Boulder where they had dense spacing. In addition to that, Al Greer with Benson-Montin-Greer has run several interference tests where they have measured the volume of reserves associated with the reservoir, and that also confirmed the numbers. So that has given us an estimate. In Gavilan the numbers tend to be very low, in the order of 100,000 barrels per section. In Boulder it

appears to be very high, in the order of five to 600,000 barrels.

Q. I guess I'm not clear on the difference between potential recoveries with the horizontal well. If we've got an area that's being depleted on vertical wells of approximately 100,000 barrels of oil per section, how do we get 300,000 with the horizontal well?

A. The -- well, the area that drained the 100,000 barrels is quite some distance away from us. It's on the flat side of the basin. Now, it's possible that they just did not develop it efficiently because of the drive mechanism that was associated with those wells. As I mentioned, there are two effective drive mechanisms: Solution gas drive and gravity drainage drive. In Gavilan it does not appear that they had significant effect of gravity drainage, therefore, they were just relying on solution gas drive. Vertical wells would certainly be a lot more inefficient than that area than horizontal wells with that type of drive mechanism. The primary function of horizontal wells is that the -- they really are designed to be able to intersect this type of system very efficiently. Vertical wells are statistically ineffective in recovering this type of reserves.

If you look at the Boulder field, they recovered 500,000 barrels per section, but they had to drill in the

order of six to eight wells per section. In other parts of the pool, the economics have been very marginal, at best, using vertical wells to capture this type of reserve.

Q. I guess it's not clear to me. Can you attribute a certain efficiency ratio in terms of oil recovery? Is it three to four times better with a horizontal well, potentially, than a vertical well?

A. There are statistics based on other type of pools. For example, the Balkan pool, which is a fractured reservoir as well, source rock-type environment, the horizontal wells, on average, had rates approximately four times better than the average vertical well. The vertical wells, 40 percent of them averaged less than 50 barrels of oil per day initially. Conversely, horizontal wells averaged -- 40 percent of the horizontal wells averaged more than 200 barrels of oil per day. A similar situation would be the Austin chalk where they're seeing rates ten times that of vertical wells. So there is an established increase in efficiency from equivalent-type reservoirs, and that's what we hope to optimize on.

Q. What is the difference in cost between the horizontal and the conventional vertical well in the Niobrara?

A. Traditionally, it's in the order of one-and-a-half to two times that of a vertical well, with

the first wells potentially being higher than that, and then you have quite a steep learning curve associated with these wells.

Q. Give me a general range of your anticipated costs for one of these horizontal wells.

MR. CARR: If it's all right, Mr. Bondarchuk can answer that.

MR. BONDARCHUK: We're anticipating in a range of 500, 000 to $1,000,000.00.

HEARING EXAMINER: Say that again, please.

MR. BONDARCHUK: We're anticipating in the range of 500,000 to $1,000,000.00.

THE WITNESS: The difference in cost is really attributed to the difference in depth as we go down the monocline.

MR. KELLAHIN: Thank you, Mr. Examiner.

HEARING EXAMINER: We've approved some other horizontal wells in this same general area. Have you checked to see how well those did or whether they turned out good?

THE WITNESS: Yes, we have. In this -- on the eastern side of the San Juan Basin there have been at least three wells approved, that I know of, two by veterans, in conjunction with Sam Gary to the south in the Rio Puerto field. Those two wells have been drilled. The first well was really a mechanical failure. They had problems with

their drilling system and effectively lost the well.

The second well was successful, encountered a depleted portion of the Rio Puerto field, but is still flowing, I believe, around 150 to 200 barrels of oil per day. The third well that was approved, in fact, approved ahead of the Sam Gary wells, was applied for by Benson-Montin-Greer, I believe, during the process of getting the equipment necessary to spud that well in the near future. That will be in the West Puerto Chiquito field.

HEARING EXAMINER: What would the allowables be for the -- if they're approved as you propose, what would the allowable be for a well in the east field and then in the west field?

THE WITNESS: I believe they both would have similar allowables. We checked it this morning. The west part of Chiquito is currently spaced on 640, whereas the east part of Chiquito is spaced on 160s.

MR. CARR: Mr. Lister may be able to respond to that.

HEARING EXAMINER: What I'm hunting is number of barrels.

THE WITNESS: Both allowables for a 640-acre parcel would work up to be approximately 800 barrels of oil per day.

MR. STOVALL: What about the GOR? The West Puerto

Chiquito has got a limiting GOR different from the East Puerto Chiquito.

THE WITNESS: I'm only familiar with the West Puerto Chiquito at this point in time. It was, I believe, set at 2,000 to one.

HEARING EXAMINER: You're not requesting any GOR relief?

THE WITNESS: No, we're not.

HEARING EXAMINER: Do you expect that these vertical fractures -- do they extend from A down to the B interval, and would you expect drainage into the horizontal well bore from the B zone, say, even though the horizontal extension of the well did not encounter that zone?

THE WITNESS: From the information that we've been able to examine, and based on discussions with other operators in the fields, such as Al Greer, we believe, for the most part, that there appears to be a barrier between fractures in the A zone and fractures in the B zone.

Benson-Montin-Greer, in the past, has run selected or isolated spinner surveys that have shown that the two zones are, in fact, isolated, that the fractures do not extend all the way through from the A into the B. Now, drilling horizontally, we'd probably be able to get a better feel on that, but that's the information that we have today.

HEARING EXAMINER: If that's true, what you just said,

then these wells would apparently then develop the A interval in the east half of the section and the B in the west half. So to really develop it, you'd need another well going the other way, I guess.

THE WITNESS: That's true, if all we were relying on was the north-south fracture system. But, in fact, as I mentioned, there is a conjugate set of fractures that run east-west. And, in fact, these are proving to be still effective in terms of horizontal migration of oil.

The West Puerto Chiquito field has an updip gas injection system which, in fact, relies on the east-west fracture system. I mentioned that the permeability anisotropy was on the order of ten to one, but when you examine the magnitude of the fractures, the magnitude of the permeability within the fractures, it's still very high, even in the east-west. So we anticipate that there still will be fairly good drainage across the section.

HEARING EXAMINER: What is the permeability east and west?

THE WITNESS: Well, the permeability in the north-south direction has been measured in the order of darcy feet in the order between one to 20 darcy feet of permeability, and the east-west direction has been measured approximately a tenth of that.

HEARING EXAMINER: One darcy?

THE WITNESS: And less, one darcy and less; anywhere from .1 darcy feet to two. The other thing associated with this reservoir is that there definitely appears to be areas of sweet spots where the fracturing exists, and then, of course, where it does not exist in the same intensity. So those are numbers that have been measured from producing intervals where the sweet spots have already been developed, such as West Puerto Chiquito.

HEARING EXAMINER: In the pools that were densely drilled, comparing those to the others where there were fewer wells, how does the recovery per well compare between those two?

THE WITNESS: Okay. The -- we've made a comparison between -- in particular, between East Puerto Chiquito and the Bear Canyon unit, which is two townships to the west, which borders the -- borders the Gavilan field to the north.

The one field, East Puerto Chiquito, was developed in the early '60s. It was developed on very dense spacing. It was developed by Benson-Montin-Greer where he basically incorporated a restrained production-type production scheme where he restricted the production of the wells and basically produced them over a long period of time.

The Bear Canyon unit was developed in the 1980s,

primarily by Amoco. It was developed on larger spacing, effectively 640-acre spacing, in fact. What we have found in comparing the productivity and the ultimate recovery of the two fields is that statistically they look very similar, that, in fact, just by drilling a large number of wells in both areas, that still both fields had approximately 50 percent of the wells that made less than 20,000 barrels, and approximately 10 to 15 percent of the wells made better than 200,000 barrels of oil.

So what really occurred was that the vertical wells just became sort of a statistical drilling tool. If you drill more vertical wells, you'll get more wells in a better category and more wells in full bloom.

HEARING EXAMINER: For the fields you looked at, recovery per well --

THE WITNESS: Very similar. The only difference between East Puerto Chiquito and the other fields is that the top end wells were even better. They had a few real exceptional wells.

Q. (By Mr. Kellahin) Richmond Petroleum obtained from the division, I think in January of this year, approval for a horizontal well. Are you familiar with that one?

A. Yes.

Q. Did they ever drill it?

A. No, they did not.

HEARING EXAMINER: The witness may be excused.

MR. CARR: We have nothing further.

HEARING EXAMINER: All right, cases 10285, 286, 10300 and 10302 will be taken under advisement.

(The foregoing hearing was adjourned at the approximate hour of 12:10 p.m.)

STATE OF NEW MEXICO)

:

COUNTY OF SANTA FE)

I, FREDA DONICA, RPR, a Certified Court Reporter, DO HEREBY CERTIFY that I stenographically reported these proceedings before the Oil Conservation Division; and that the foregoing is a true, complete and accurate transcript of the proceedings of said hearing as appears from my stenographic notes so taken and transcribed under my personal supervision.

I FURTHER CERTIFY that I am not related to nor employed by any of the parties hereto, and have no interest in the outcome hereof.

DATED at Santa Fe, New Mexico, this 30th day of June, 1991.

Freda Donica
Certified Court Reporter
CCR No. 417

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case Nos. 10285 (de novo), 10300, & 10302 heard by me on May 30 1991.

Oil Conservation Division Examiner