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

APPLICATION OF OXY USA, INC FOR APPROVAL OF A PRESSURE MAINTENANCE PROJECT, EDDY COUNTY, NEW MEXICO

CASE NO 15616

ORIGINAL

REPORTER'S TRANSCRIPT OF PROCEEDINGS

EXAMINER HEARING

February 2, 2017

Santa Fe, New Mexico

BEFORE PHILLIP GOETZE, CHIEF EXAMINER
WILLIAM V JONES, TECHNICAL EXAMINER
DAVID K BROOKS, LEGAL EXAMINER

This matter came on for hearing before the New Mexico Oil Conservation Division, Phillip Goetze, Chief Examiner, William V Jones, Technical Examiner, and David K Brooks, Legal Examiner, on Thursday, February 2, 2017, at the New Mexico Energy, Minerals and Natural Resources Department, Wendell Chino Building, 1220 South St Francis Drive, Porter Hall, Room 102, Santa Fe, New Mexico

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EXHIBITS OFFERED AND ADMITTED

(10 17 a m)

EXAMINER GOETZE Seeing how we've had numerous breaks, we'll continue

Okay Ladies and gentlemen, let's move on to the next case and get these folks up here so they can continue with their day

Let's start Case Number 15616, application of OXY USA, Inc for approval of a pressure maintenance project, Eddy County, New Mexico

Call for appearances

MR FELDEWERT Mr Examiners, Michael Feldewert, from the Santa Fe office of Holland & Hart, appearing on behalf of the Applicant I have three witnesses here today

MR BRUCE Mr Examiner, Jim Bruce appearing for Matador Production Company I have no witnesses

EXAMINER GOETZE Very good

May I be forward and ask what Matador has as far as interest?

MR BRUCE They're an offset operator

EXAMINER GOETZE Yes, but have you expressed any concerns we should know of?

MR BRUCE I have met personally with OXY, and OXY satisfied all concerns

EXAMINER GOETZE Very good Thank you

Regarding the witnesses, will you please stand, identify yourselves and be sworn in

MS MONTGOMERY Kelley Montgomery

DR LIU Shunhua Liu

MR GUNDERSON Spencer Gunderson

(Ms Montgomery, Dr Liu and Mr Gunderson sworn)

MR FELDEWERT Mr Examiner, I have three witnesses Ms Montgomery will come up first and describe in general the high level of the project and go through the -- and Mr Liu will come in and talk to you about the actual injection operations and land drive, and then Mr Gunderson will be present -- or come up to discuss the geology that's associated with this project

EXAMINER GOETZE Very good

(Mr Bruce leaves the room)

MR FELDEWERT So in that case, we'll call our first witness, Ms Montgomery

KELLEY A MONTGOMERY,

after having been previously sworn under oath, was questioned and testified as follows

DIRECT EXAMINATION

BY MR FELDEWERT

Q Would please state your full name for the

record, identify by whom you're employed and in what capacity?

A Yes I'm Kelley Montgomery I'm employed by Occidental Petroleum I'm a regulatory manager

Q And, Ms Montgomery, are you also a professional engineer?

A Yes

Q How long have you been a registered professional engineer?

A Since 1998

Q And you have previously testified before this Division as an expert in petroleum engineering?

A Yes, I have

Q And are you familiar with the application that's been filed by OXY in this matter?

A Yes, I am

Q In fact, Ms Montgomery, did you oversee the assembling and did you sign the certification for the C-108 form that has been provided to the Division with their application?

A Yes, I did

MR FELDEWERT I would tender Ms Montgomery once again as an expert in petroleum engineering

EXAMINER GOETZE She is so qualified

Q (BY MR FELDEWERT) Would you be kind enough to turn to Exhibit Number 1, and please identify it and then use this to briefly summarize what OXY seeks with this application?

A Sure So what you're looking at in Exhibit Number 1 is Section 16 of Township 24 South, Range 29 East, and that is our project area It's a single state lease where OXY is the sole operator and the only lessee What we are asking for in this project is authorization to inject to produce gas and to produce water in the 2nd Bone Spring interval of the Bone Spring Formation So we'd like to do that in two existing horizontal wells, and those are depicted in red on Exhibit 1 And then we have three offset producer horizontal wells that are depicted in black on Exhibit 1

Q So, Ms Montgomery, now if I look -- keep my thumb on here and I turn to what's been marked as OXY Exhibit Number 2, are these the file C-102 plats for the two proposed injection wells identified on Exhibit Number 1?

A Yes, they are

Q Okay And as I -- are these wells -- existing wells completed in the 2nd Bone Spring Sand?

A Yes, they are

Q And are they currently producing wells?
A Yes, they are
Q Okay The one thing I notice as I look at this -- let me step back And we'll have a geologist confirm this later, but to your knowledge, are they completed essentially in the same correlative zones?
A Yes
Q Or zone, singular?
A Yes
Q And what I notice when I look at this is that the 2 and 7H is placed in the Pierce Crossing Bone Spring pool, and the 12H has been placed by the Division in the Corral Draw, Bone Spring Pool Do you see that?
A Yes, I do
Q Okay Do you know why these two wells were placed in two different pools even though they're in the same correlative zone?
A Well, when I looked at the map, both of these Bone Spring pools kind of butt up against each other on Sections 15 and 16, so there seems to be a little bit of overlap when they were assigned I don't know of any reason why one was put in one pool or the other
Q Okay And is that why, then, our application lists authority to inject both of these pools underlying this project area?

A Yes, it is

Q All right The other thing I notice is that both of these wells have their surface locations in Section 15, correct?

A That is correct

Q Are all the perforations in Section 16?

A Yes, they are

Q Then continuing on and just keeping my finger on Exhibit Number 1, does OXY Exhibit Number 3, then, provide the filed C-102s for the -- what we'll call the offsetting producing wells in Section 16?

A Yes, they do

Q And, again, are they included in the same correlative zone as the proposed injection wells?

A Yes, they are

Q Then, once again, we see that two of these wells, the 8H and the 6H, have been placed by the Division in the Pierce Crossing Bone Spring pool, while the 2H is in the Corral Draw Bone Spring pool, correct?

A That is correct

Q Now, looking at the -- back at Exhibit Number 1, these offsetting producing wells, they offset the proposed injection wells both to the north and the south, correct?

A That is correct, yes

Q All right And does OXY expect these offsetting wells to benefit from the proposed injection operations?

A Yes We hope that we will see increased production from the offset producers to the injectors

Q And is OXY producing a second witness here today that will address these injection operations in more detail?

A Yes, we are

Q Okay With that said, let's go to the document that you assisted in assembling and you put together, and that is the C-108 form, which is provided to the Division under OXY Exhibit Number 4

A Okay

Q Okay?

And fortunately, Ms Montgomery, when you did this, you were kind enough to paginate the pages for us --

A Yes

Q -- make it easier to go through

All right I wanted to talk about the injection well data I think that begins on page 6 of this C-108 form

A Yes

Q All right Now, this is for the two proposed

injection wells, which are existing horizontal wells?

A Yes, that is correct

Q And in your application, you included a wellbore schematic for each of these proposed injection wells?

A Yes, we did

Q All right Has the company, since filing application back in December, reviewed the matter and revised the wellbore schematics?

A Yes, we have

Q And what was the purpose of revising the wellbore schematic?

A The purpose was to look at the packer setting depth We originally put the packer setting depth in strictly the vertical portion of the hole, but in reviewing it, we decided to try to get as close as we could to the top perforations We -- so what you're going to see in the revised schematic is that we've moved them down much closer to about 30 to 35 degree deviation in the hole That's as low as we feel comfortable going where we can still use wireline operations

Q And are those revised schematics and the change in the injection well data sheet provided in OXY Exhibits 5 and 6?

A Yes
Q Okay And they show the change in the packer setting depth?
A Yes, they do
Q And then the corresponding change to the first page on the injection well data on the packer setting depth line, correct?
A That's correct That's the only change on that well data sheet, is the packer setting depth
Q Perforations, casing, everything else stay the same?
A That's correct
Q Where you have placed the packer setting, is that still in the cemented portion of the casing?
A Yes
Q Okay And will that locate -- you said that's the closest you can get comfortably to the top perfs?
A Yes, as close as we feel comfortable
Q Will that location still allow you to the use of a wireline, if necessary, for the injection operations?
A Yes, it will
Q Okay Now, talking about the injection operations and addressing some of the issues that the Division usually examines, what are you going to use as

a packer fluid during the injection operations?

A We'll use an inert fluid in the back side, in the packer fluid I mean -- so we'll have your typical bacteria -- oxygen scavengers to take care of the bacteria

Q Okay Now, there is going to be a lot of talk about the huff-and-puff injection operations

A Yes

Q When you're involved in the huff-and-puff process, is there a point in time where you have to place gas in that annular space instead of the inert fluid?

A So yes And the next witness will go into more detail on the huff and puff But typically there is a production portion of the huff and puff And if the well -- the well will hopefully flow at first, but if we need to use gas-lift operations to lift the well, then we will have gas in the tubing casing annulus in order to lift that fluid

Q And just to be clear, that would be during the production phase in these wells of the huff-and-puff operations?

A Yes, it will

Q So for the record, these wells are going to be utilized for both injection and production?

A Yes, that is correct

Q Okay And during the injection phase, will the company have the inert fluid in the annular space?

A Yes, we will

Q In addition to that, will OXY be monitoring the pressure in the annular space and in the tube?

A Yes, we will We'll have a long central on tubing, and the tubing casing annulus that we can see real time

Q Now, looking at your -- I guess your revised schematics or whichever is easier to examine, why don't you just briefly review the casing on these two proposed injection wells and the cement as well?

A Sure I'll just use Exhibit 5, the wellbore schematic on page 2 of Exhibit 5 and just kind of go through that

For the Cedar Canyon 16 State 7H, we have three strings of casing We have a surface casing set at 335 feet and cement circulated to surface On our intermediate casing, we have the shoe set at 3,095 and cement circulated to surface And then on the production string, the measured depth is 13,725, and we have cement circulated to surface

And then we can go through in Exhibit 6, the second page, you'll have the wellbore schematic for

the Cedar Canyon 16 State 12H You again have three strings of casing

Did you get there, Mr Goetze? There you go That's a little easier to read

So we have surface casing set at 445 feet, cement circulated to surface Our intermediate is set at 2,965, with cement circulated to surface And our production string, the measured depth is at 14,417, and we have a calculated top of cement at 600 feet

Q That calculated top of cement, does that overlap the -- I guess it would be the intermediate string

A Yes, it does

Q All right With respect to the perforations at -- for these two wells, are there going to be any changes in the perforations for these -- existing perforations for these wells?

A No There will be no changes

Q Is there going to be any stimulation -- additional stimulation?

A No There will be no additional stimulation

Q What type of tubing are you going to utilize for these injection wells?

A We're proposing to use unlined tubing for our operations

Q Why unlined tubing?

A So there are a couple reasons for that One of them is, as we mentioned previously, in the huff-and-puff phase of the project, when you're producing, we anticipate having to use a gas lift And so we typically don't use lined tubing during gas-lift operations

In addition, we would like the opportunity to use wireline on these You always run the risk of nicking or scratching that lined tubing with the wireline But really the biggest part or the biggest reason is that we're not operating in a corrosive environment here that would dictate the use of lined tubing

Q Now, are you going to be monitoring the pressures while you're injecting?

A Yes, we are

Q And how will that be done?

A Well -- so as I mentioned previously, we will have sensors on the tubing and the tubing casing annulus that we can monitor real time We also have a pressure regulator or pressure-reduction valve prior to the wellhead that will make sure that the pressures can't go over a certain setting

Q Okay Ms Montgomery, based on your review of

these wells, in your expert opinion, are these wells designed safely and efficiently to inject produced water and produced gas into the Bone Spring Formation for this proposed pressure maintenance project?

A Yes, they are

Q All right Then let's turn to the next subject, and that would be the area of review And that is incorporated into the C-108, starting at, I believe, page 13, is that right?

A Yes

Q Okay So we're at Exhibit Number 4, at page 13 Now, does this -- this is a land map that identifies your Section 16 and all of the existing horizontal wells in that section?

A Yes, it does

Q So let's start there I see the five lay-down horizontal wells we previously discussed I also see some stand-up horizontal wells Are they completed in different formations?

A Yes, they are I believe there are two in the Brushy Canyon There are two in the 3rd Bone Spring, and then we recently, at the end of 2016, drilled two wells in the Wolfcamp

Q And they show up on here because this is a land map showing all of the existing wells?

A Yes

Q Now, your half-mile area of review -- I think this is apparent from the picture, but I want to get it into the record -- that is drawn around the lateral portion of the well -- the perforated lateral portion of the wellbore, correct?

A That is correct

Q So it's not a true circle?

A That is correct

Q All right And within this -- this radius and for purposes of preparing for this hearing, did you provide notice to the State Land Office, since state lands are involved?

A Yes, we did

Q And did you provide notice to the affected parties within the half-mile area of review?

A Yes, we did

Q And in addition, noting that the surface locations are in the west half of the west half of Section 15, did you notify those surface owners as well?

A Yes, we did

Q And if I flip over to pages 33 and 34 of the C-108, does this provide the identity of all the parties that were provided notice?

A Yes, it does

Q Now, the one thing I noticed on here, page 33, it has most of the individual -- or interest owners are listed under "Leasehold Operators " Do you see that?

A I do

Q Okay Is that a little mis- -- not misleading, but isn't it true that you identified more than just leasehold operators?

A Yes, it is So when we looked at the leasehold operators, OXY is the operator for the majority of the adjacent sections all around these So we went a little further and identified all working interest owners and then any unleased mineral interest owners

Q Okay So they are included in your notice list?

A Yes

Q And if I -- just to finish that up, if I look at OXY Exhibit Number 7, is that an affidavit prepared by my office with the attached letter providing notice of this hearing to the affected parties?

A Yes, it is

Q And in addition to that notice letter, did OXY also take the step of providing notice by publication in the local newspaper to these -- by name to these affected parties?

A Yes, we did

Q Is that reflected in OXY Exhibit Number 8?
A Yes, it is
Q Okay Then the next subject would be the well data for well penetrating the Bone Spring Formation in the area of review If I turn to page 15, is that a tabulation of the wells within the area of review that penetrate the Bone Spring Formation?
A Yes, it is
Q Now, in this application that was put together in December -- well, I guess November of 2016 --
A That is correct
Q In preparation for this hearing, Ms Montgomery, did you take the time and effort to do an additional review to ascertain whether wells were -- that were drilled that penetrated the Bone Spring Formation in addition to those that are on this list?
A Yes To make sure that it was current, we reviewed the AOR just before the hearing
Q Okay And did you find some additional wells that had been drilled?
A Yes OXY -- I mentioned it in the first exhibit OXY has recently drilled, at the end of 2016, two Wolfcamp wells in Section 16
Q Okay If I turn to OXY Exhibit Number 9, does this supplement the list of wells penetrating the Bone

Spring Formation that is included within the C-108?
A Yes, it does
Q So you've added two additional wells?
A Yes
Q Now, for each of these wells, were you able to identify the cementing done?
A Yes
Q For the active wells?
A For all the active wells, yes
Q Okay And what did you find?
A Well, there is a column on the tabs that talks about how the cement was -- top of cement was determined The vast majority have circulated cement to surface There are a few that ran CBL, so we have those depths There are several that are calculated Those calculated numbers come directly from the NMOCD -- what was submitted to the NMOCD Web site, but I did go back and do a quick verification of these wells
Q And in your opinion, are these active wells on this list sufficiently cased and cemented to prevent fluid migration out of the proposed injection zone?
A Yes, they are
Q Now, in your area of review, did you find any plugged and abandoned wells?
A Yes There is one plugged and abandoned well

Q And is the diagram for that well provided on page 18 of the C-108?

A Yes, it is

Q Okay And what's the top of cement there, or how was it cemented and cased?

A So we -- we pulled the plugging record from the NMOCD records, and this diagram is reflective of all the plugs set and the sundry for the plugging record

Q And in your opinion, Ms Montgomery, is this well sufficiently plugged and cemented to prevent fluid migration out of the proposed migration zone?

A Yes, it is

Q All right Then I'd like to move on to page 21, which deals with the information on the gas and water injection operations

A Okay

Q Okay?

You provide a surface injection -- maximum surface-injection pressure here for water of 1700 psi Do you see that?

A I do

Q Does that injection pressure follow the 2 psi per foot that the Division utilizes based on its UIC manual?

A Yes, it does

Q In preparing for the hearing today, did the company examine and decide to adjust the maximum surface-injection pressure for gas?

A We did We have reduced the request for our maximum injection pressure to 4,250

Q And does OXY believe that they can operate this injection operation at lower surface-injection pressure for gas at 4,250 psi?

A Yes We think we can

Q And does that -- the gas surface-injection pressure, does that likewise then follow the 2 psi per foot accepted by the Division?

A Yes, it does

Q And will the next witness discuss how that was calculated?

A Yes He's got a slide that walks through the calculation showing how they compare

Q Okay And I think you mentioned this, but since we're on it at this point, will OXY install pressure-reduction valves at the surface to ensure that the wells will remain within these maximum injection pressures?

A Yes, we will

Q Will this system be a closed system?

A It's a closed system

Q And what will be the source for the proposed gas injection?

A Okay It's the Cedar Canyon Central Distribution Center or Distribution --

Q Delivery Point?

A Delivery Point There you go

Q And is that operated by OXY?

A It is operated by OXY

Q And if I turn to page 25, does that provide for the Examiners a gas analysis for the native gas in the 2nd Bone Spring interval?

A Yes, it does

Q Okay And this was taken in November of 2016, is that correct?

A That is correct

Q And was it from a nearby well?

A Yes It's the Cedar Canyon 21 #5, which is in the adjacent section to the south of our project

Q And are there any H2S issues out in this area in the 2nd Bone Spring?

A No, there are not

Q Then if I turn to page 26, you provided the Division, as part of this application, a produced gas injection analysis, is that correct?

A That's correct

Q That is for gas that was taken from the Cedar Canyon Central Delivery Point?
A Yes, it was
Q I note that this sample was taken in July of 2016?
A Yes
Q You mentioned, since that time, the company has drilled two additional wells?
A Yes, we have
Q And is it true, therefore, that Wolfcamp gas has now been added to this Central Delivery Point?
A Yes, it has
Q Prior to that, gas was from the Delaware and the Bone Spring?
A That is correct
Q And that is encompassed within this gas analysis on page 26, but you've recently added the Wolfcamp?
A Yes, we have
Q As a result of that, is the company going to submit to the Division as a supplement an additional gas analysis that will take into account the addition of the Wolfcamp gas at the Central Delivery Point?
A Yes, we will
Q Are you -- first off, when you looked at the

initial gas analysis, do you have any compatibility concerns between the native gas and the proposed injection gas?

A No, I don't

Q I know you don't have the gas analysis, but looking ahead, do you expect to have any compatibility problems by adding Wolfcamp gas from these two additional wells?

A No, I don't I've actually seen the gas analysis, and I haven't seen any issues with that But we'll provide the supplement

Q What is the source of the injection water?

A The Cedar Canyon Treating Facility

Q Again, is that the facility operated by OXY?

A Yes, it is

Q If I turn to page 27, is this the water compatibility analysis that OXY provided with this report to examine the native water and then the water from this Cedar Canyon Treatment Facility?

A Yes, it is

Q And what was the conclusion of this study?

A The conclusion is that the waters are compatible and that actually the addition of the two waters reduces the scaling tendencies

Q Okay And you signed this, so you agree with

that conclusion?
A I agree with that conclusion
Q Okay Now we have the same issue, do we not?
A With the addition of the Wolfcamp well
Q Okay Does OXY, therefore, intend to provide the Division with a supplemental water compatibility study that takes into account water of the Wolfcamp Formation?
A Yes We will do that
Q And do you anticipate seeing any compatibility problems with the addition of the Wolfcamp water?
A No, I don't
Q Ms Montgomery, in your expert opinion, does this injection operation pose a threat to public health or to the environment?
A No, it does not
Q And in your opinion, would the approval of this injection project for multi-efficient recovery of oil underlying these state lands thereby prevent waste?
A Yes, it will
Q And were OXY Exhibits 1 through 9 prepared by you or compiled under your direction and supervision?
A Yes, they were
MR FELDEWERT Mr Examiner, I would move admission into evidence of OXY Exhibits 1 through 9

EXAMINER GOETZE Exhibits 1 through 9 are so entered

(OXY USA, Inc Exhibit Numbers 1 through 9 are offered and admitted into evidence)

MR FELDEWERT That concludes my examination of this witness

EXAMINER GOETZE Very good Thank you Mr Brooks?

EXAMINER BROOKS No questions

EXAMINER GOETZE Mr Jones?

CROSS-EXAMINATION

BY EXAMINER JONES

Q The other two witnesses, are they going to be reservoir and land, is that correct?

MR FELDEWERT Reservoir and geology

EXAMINER JONES And geology Okay

Q (BY EXAMINER JONES) About the land issues -- you probably already covered this, but Section 16, is that all common ownership?

A Yes We are -- OXY is the sole operator and sole lessee

Q OXY is the sole operator and sole lessee And how about the -- the mix of royalties, or is it all the same in a section? You're an engineer

A Yeah I don't know I don't think I can

answer that I'm not sure

Q But you're the operator of the section?

A Yes

Q And you've noticed this to everybody in the section, is that correct?

A That's correct

Q Everybody that owns an interest in the minerals has been noticed of this application within Section 16, is that correct?

MR FELDEWERT And within a mile

EXAMINER JONES Within a mile Okay

THE WITNESS Yes

EXAMINER JONES Okay Okay

Q (BY EXAMINER JONES) And what about the conversations you've had with other owners? Have you had people call you and express any concerns?

A So we -- no is the answer The only people that we have talked to who had an interest was Matador, and they -- they have a section further up -- not really in Section 16 They're out further, I believe, in Section -- I'm not sure which section, to the left of Section 9 And we did discuss with them the logistics of the project, and then our landman spoke briefly to the State Land Office And so we've seen no opposition, you know, to this

Q Okay Okay So you're going to have someone talk about the reduction, decline -- existing decline in the Bone Spring wells to date probably, is that correct?

A Yeah Our next witness will do that

Q Okay So are you the one to ask about the frequency of switching between injection and production and between gas and between water and between production?

A I think the next witness will be better at that question

Q Okay This is Ground Hog Day, so, you know, we'll see (laughter)

But you're 8,600 feet TVD, and your plugged well is actually shallower than this That is what, 6,000 feet TD, the well that's --

A I can look to make sure

Q So that's covered

A Okay Yeah, that's correct

Q Okay Okay The DV tools, you said -- you calculated tops you had Was that based on gross volumes and yields, or was that with DV tools? I noticed it's only 3,000 feet for the intermediate, and then the whole thing was drilled So there must have been some DV tools involved in the --

A On the injector -- on the two injectors?

Q The injector, yeah
A Okay Let me look back And I can address each one individually
On the 7H, those were not calculated tops I think we had circulation We saw cement at surface on all three strings on the 7H
Q Okay
A And then if I move to the 12H, we had circulated cement to surface on the surface and the intermediate The production casing was a calculated, and that was based on the yields, a volumetric calculation
Q That was a two-stage job or so? Maybe a --
A When I looked at the drilling report, it didn't appear to be a two-stage job, but, I mean, we had a lead cement and a tail cement But I don't believe I saw any mention of a DV tool in that one
Q And the tail cement, would that -- was that calculated to cover the Bone Spring, or is that intended to cover the Brushy Canyon also?
A I think it goes further I'd have to look at the exact -- I know our tail cement was a much larger volume It was 900
Q Oh, it was?
A The tail cement was a 900, and I think the lead

cement was the 520 sacks So without doing the calculation in front of me, I believe we have a lot more cement in our tail cement

Q Okay Have you had trouble cementing any of these wells out here?

A Not that I know of And then the two recent wells that I just looked at that we cemented in AOR [sic], looks like we cemented all the way to surface on those two wells So I'm not aware of any issues

Q Not aware of breakdowns?

A Or lost circulation

Q Or lost circulation

And you're going to inject this gas without splitting out the propane and the butane? It's all going to be wet gas you're re-injecting?

A Yes The treatment -- as I understand it, we will not be splitting out the methane and propane, but because it goes through six stages of compression, a lot drops out in those six stages of compression

Q Oh, wow So it's -- you're getting it -- you're going for low pressures You're going to compress it up high -- from really low to way up high?

A Yes

Q Six stages?

A That's what the facilities engineer mentioned

to me, so we anticipate a lot, you know, dropping out It'll be pretty -- no additional free water in it It'll be dry gas

Q So how do you handle taxes and royalty on this kind of stuff?

A So we discussed that And at this point, what we are going to do is purchase the gas So the gas will go through the sales

Q Okay

A We'll purchase it after sales on the lease and then inject it, and then we'll end up paying royalties on the gas that is produced

Q That is sold?

A That is essentially --

Q That is produced?

A Yes, that is sold So, essentially, we're paying double royalties I'm sure that we'll have to talk to the State Land Office This is a pilot we're trying to get in place We would certainly have to work with them and make sure everything that we do from an accounting perspective is in compliance with our leases But initially that's how we anticipate working it

Q Okay Your leases might have some use-gas clause in there, so you can actually use gas to produce or at least for facilities, I guess It would kind of

imply use for facilities, but this is used downhole to actually, I guess, lower the viscosity Is that -- I guess we're going to have another witness

A We're going to have another witness I don't want to go into detail I don't want to tell you the wrong thing But certainly we'll work with the State Land Office to make sure we account for all of that correctly

Q Okay What about charts on your tubing and your casing? You're going to have the Murphy switches, I guess, and you're just going to be able to monitor the pressures You've got a SCADA System? Is that the --

A Yes We have a SCADA System

Q Okay So, actually, you're expecting no influence off lease, is that-- off of Section 16, is that correct?

A That is correct And our next witness will testify to that

EXAMINER JONES I'll pass it on to Mr Goetze

EXAMINER GOETZE You done?

EXAMINER JONES I'm done

CROSS-EXAMINATION

BY EXAMINER GOETZE

Q For full disclosure in this, I did contact you,

and we did have discussions about the C-108 preparation --

A Uh-huh

Q -- which had to be brought to an end as a result of Mr Bruce's application on behalf of Matador, for which he got up and left So considering what you gave us in the C-108 already, your area of wells, you found two new ones that were recent --

A Uh-huh

Q -- and no more?

A Uh-huh

Q And so I looked at your AOR wells and do not have a concern with what was put in

Secondly, clarification on this pilot project So we're looking at only Section 16 as to be the definition of what this project area will be?

A Yes, that is correct

Q And this is held by a single lease or a set of leases or --

A Single lease, single state lease

Q Now, for my little concerns, the northwest-northwest includes, I believe, one of your wells It's a Delaware disposal well, SWD 1421 Having looked at that and an adjacent injection for disposal, do you have any concerns with the operation of this well

and possible impact on your project?
A So the disposal well is --
Q Is in the northwest-northwest of 16 That's your --
A Is it the shallow disposal well?
Q Yeah, it is
A I believe that it's a shallow disposal number three I think it's well number three
Q Yeah It's the Cedar Canyon 16 SWD #16 -- or #3 Excuse me
A Okay Yes, I remember that Because it's in a shallower zone, I don't believe we have any concerns
Q But we have considered it?
A Yes
Q And we will make sure that we don't -- if we have interference from it, we will know?
A Yes
Q Okay Tubing We have requested a nonlined tubing set We're stating it's not corrosive We're running a pH of five and six That's kind of corrosive How does OXY anticipate -- and, again, we're running into this issue of changing the annulus And so we have this issue that -- we have with the EPA & MIT every time --
A Yes

Q -- we do something Has OXY proposed, other than monitoring, some other way to address how we're going to see if there is an issue of corrosion breaking through tubing?

A Well, we -- I think we -- we will have the monitors on the tubing and on the annulus, so I think we'll see pretty clearly if we've got a hole in our tubing

Q And you're going to respond immediately? Because at this point, that would make you have to shut this well in and notify us?

A Yes Yes

Q Okay So we're going to include some sort of communication with district level as this operation goes from one phase to the other?

A Uh-huh Okay

Q That information is going to be maintained also by OXY as far as pressure information?

A Yes, it will

Q Okay Next item with the packer location I appreciate your effort to get as close as you can to the top perforations, but I don't want to box you in with a situation where we have to go through exceptions and whatnot

A Sure

Q In the foreseeable future -- and I don't know if you've answered this question -- if we had to retreat, if we had to replace the packer and found the original location was not able to sustain a seal, would OXY -- is there, in your plan, to do that? Is this something we're going to learn as we do this experiment, or should the Division think about putting in a little leeway as far as where the packer should be set?

A So OXY would appreciate a little leeway You know, you never -- we hope to set our packer where -- where we have designated in our application, but as you know, if you don't get a seal, you have to move up a little bit We don't anticipate doing multiple runs of that, but if we had a little bit of leeway, that would be helpful during this pilot to make sure we get it right

Q We'll make sure that's put into consideration

A Okay Thank you

Q You're welcome

EXAMINER GOETZE I have no further questions for this witness

EXAMINER JONES I have one more

EXAMINER GOETZE Mr Jones does

EXAMINER JONES Sorry about that

EXAMINER GOETZE That's okay

RECROSS EXAMINATION

BY EXAMINER JONES

Q The difference about two different Bone Spring pools --

A Yes

Q -- you didn't decide to ask for a contraction, an expansion of one and the other here? It would be simpler if it was all reported to the same pool

A So we can do that I think it was -- to be perfectly honest, when I looked at this, it was a little bit of a surprise to me As you permit these, you don't -- I wasn't keeping track of which ones were in which pools and run into each other We can certainly do whatever is easiest for the Division on that I don't think it really matters to OXY the pools We have statewide rules for both

Q Statewide rules for both?

A Yes Yes

Q It's just a record-keeping thing, I guess

EXAMINER GOETZE I think it's also something we should bring into the State Land Office for consideration because it is their lease and provide uniformity for them

THE WITNESS Okay

MR FELDEWERT I'm wondering,

Mr Examiner, whether the Division can actually just do that on its own, because I would think -- and I didn't draw it on there, but I think that pool only overlaps the south half of the south half It's a very short overlap And I would think that the Division on its own could do a nomenclature that could contract it out on Section 16, given what we're trying to accomplish here

EXAMINER JONES Yeah That way we could just look at --

MR FELDEWERT Report it all --

EXAMINER JONES Yeah Yeah Paul's doing this type of stuff all the time

EXAMINER GOETZE Well, no, I mean, the history of the development of the Bone Spring in this area, it's not uncommon to have -- because it has been so aggressive, to have pools mashing up against each other, so this is something we should consider

MR FELDEWERT Well, the other thing I don't know -- okay? And, again, this is not something we picked up on until later I don't know whether it was placed in the pool because of the one-mile buffer or whether it actually listed -- you know, that may come into play

EXAMINER GOETZE Whether it's designated as an --

EXAMINER JONES In other words, it could be an optional, one pool or the other

MR FELDEWERT Yeah And I don't know I think Paul is the only one who knows that

EXAMINER GOETZE Well --

MR FELDEWERT But my suggestion is what is -- perhaps Mr Kautz and the Division on its own can certainly track the pool out of Section 16 and make it clearer

EXAMINER JONES We could possibly mention that in the order, to have a subsequent action by the Division

EXAMINER GOETZE Well, both you and Mr Feldewert have taken it upon yourselves that the Division has some initiative

(Laughter)

EXAMINER JONES But you're the scribe in this case

EXAMINER GOETZE I would ask the Applicant to talk with the State Land Office --

THE WITNESS Okay

EXAMINER GOETZE -- the Division will look at the status of both pools and, with the order, suggest a best remedy

EXAMINER JONES It's not going to be

expanded, this project?

THE WITNESS I think we're going to evaluate the pilot, but if it's a successful pilot, then certainly there is the opportunity to expand

EXAMINER JONES Okay

THE WITNESS Yeah

EXAMINER GOETZE I think at that time we can get to that situation But for the pilot project, we'll attempt to resolve this two-pool situation

THE WITNESS And if I may say, I've looked at the nomenclature for both of those pools and if I'm not mistaken, I think the Pierce Crossing East pool is Section 16 So we'll take that up with the State Land Office and Paul Kautz

EXAMINER GOETZE Actually, we have a new geologist down there

THE WITNESS Oh, okay Great

EXAMINER GOETZE Mr Jones, are you done?

EXAMINER JONES I'm done

EXAMINER GOETZE Mr Brooks?

EXAMINER BROOKS Nothing further

EXAMINER GOETZE Call the next witness Thank you

THE WITNESS Thank you

SHUNHUA LIU, Ph D ,

after having been previously sworn under oath, was questioned and testified as follows

DIRECT EXAMINATION

BY MR FELDEWERT

Q Could you please state your name and identify by whom you're employed and in what capacity?

A I'm Shunhua Liu I work for OXY as a manager of process design, and I work for OXY for more than -- for ten years now

Q And, Mr Liu, are you part of a team that put together this injection project?

A Yes I'm leading a team with reservoir engineers, Geomodels, and then we are trying to design new processes for unconventional reservoirs to try to increase production

Q And you mentioned you've been a reservoir engineer at OXY for ten years?

A Yes

Q Have you previously testified before the Division?

A No, I have not

Q Why don't you outline your educational background?

A I got a Ph D in chemical engineering at Rice

University, Houston, Texas, and my -- actually my thesis topic was about enhanced oil recovery, chemical gas injection

Q When did you get your Ph D ?

A 2008 Actually, at that time, I was employed at OXY already

Q And so since you got your Ph D , you've been employed by OXY, right?

A Uh-huh

Q Was there a period of time that you were actually a research assistant at Rice University?

A Yes I have been like a research assistant for five years for enhanced oil recovery projects, including DOE projects

Q And then you went to work for OXY after that --

A Yeah

Q -- during that time, while got your Ph D ?

A Yes

Q Okay And are you a member of any professional affiliations and associations?

A Yeah I've been an SPE member since 2004

Q And -- I'm sorry You already testified you are part of the team that designed this project?

A Yes

MR FELDEWERT I would tender Mr Liu as

an expert in petroleum reservoir engineering

EXAMINER GOETZE He is qualified

Q (BY MR FELDEWERT) Would you turn, Mr Liu, to that big packet in front of you and turn to tab ten marked as OXY Exhibit Number 10?

A Okay

Q And first off, you see in the upper, right-hand corner a map that is similar to what we've already seen identifying the injection wells and the offsetting producing wells?

A Yes

Q Using this particular slide, can you kind of give the Examiners a little more detail about the injection project that your team has put together in Section 16?

A Yeah The final plan that we state in the slides, we plan to inject in the 7H first and then do the huff-and-puff process And then after that, we evaluate what's the result of the injection, production and the pressure, even the offset producers' performance And then we will move to the 12 -- 12H to evaluate, you know, different spacing, different completion design And then as you can see, the compression station -- Section 15

Q Now, why are you starting this project first

with the 7H?

A Because the 7H has a slightly larger spacing, actually twice the spacing as the 12H We think it has a large contact area, so we probably just -- we decided to try this first before we go to the tight spacing

Q And the 12H -- if you're successful in the 7H, the 12A will give you an analysis of the tight space?

A Yes

Q Now, you mentioned that you were going to do a huff-and-puff project first?

A Yes

Q And then according to this, you'll move in and do a line drive project?

A Yes

Q All right Well, then let's first start with the description of the huff-and-puff project

Before we get there, if you look at Exhibit Number 4, which is the C-108 Go to page 20

A Okay

Q Does this, you know, at a general level, describe in writing for the Division the nature of the huff-and-puff project?

A Yes

Q Now, with respect to this type of injection project, has OXY conducted this huff-and-puff project in

other areas?

A Yes, we do We have one in Midland Basin, Texas, and then -- also unconventional formation, but not Bone Spring, and we see quite positive initial results That's why we want to try it in the New Mexico setting

Q And so -- but this would be in the Bone Spring, right?

A Yeah The pilot in Texas is not Bone Spring, but this one is Bone Spring

Q But your pilot in Texas, was it an unconventional reservoir?

A Yes Yes, it is

Q And you've had some success with that?

A Yes

Q If I turn to, then, what's been marked as Exhibit Number 11, does this provide the Examiners with some of the benefits and a little more description of what you hope to see from the huff-and-puff project?

A Yes

Q Why don't you walk us through this?

A Yeah So based on our -- analysis on this reserve and the OIP geological analysis and the primary production just based on the current decline, we probably just recover 8 to 10 percent original oil in

place And then we started -- we -- we have a Geo -- Geological Model We did the original state We have some lab work And then from that, simulation work We think it's possible to add 15 percent recovery factor, you know -- gas project, injection project And then as I state before, we've got pretty promising results in Texas, Midland Basin, Texas

And also, the 2nd Bone Spring, we -- from our geological description, we found it's even probably better -- better quality than what we have tried in the Midland Basin So we think there is some quite big potential there So that's why OXY is planning to test the huff and puff and then a conventional line drive -- in the pilot

Q So huff and puff first and then follow it up with a line drive?

A Yes Yeah, that's right

Q Let me ask you this Mr Jones -- Examiner Jones asked the question These wells are not that old, correct?

A Yeah They are -- they are still producing

Q Yeah They're still producing

A Uh-huh

Q So in this reservoir, we're still in the primary production phase, right?

A Yes Yes

Q So this is not an EOR project This is an effort to enhance the primary production?

A Yes

Q And that's why we not have a lot of boxes That's why we labeled this as a pressure maintenance project, is that right?

A Yeah That's the main reason

Q You asked me to pick one, so I threw a dart, and that's where it landed?

A No No (laughter)

Q All right I want to talk a little bit more about the huff and puff Would you turn to what's been marked as OXY Exhibit Number 12? Does this help explain to people like myself the nature of a huff-and-puff injection project?

A Yes

Q Just kind of walk us through that, please

A Yes Actually, this -- this cartoon come from the Department of Energy, you know, about the huff-and-puff process, and then this has been used for the thermo CO2 produced gas for conventional reservoirs So the process is -- there are three steps, three stages

The first stage is inject the produced gas

into the reservoir Then we go to the second stage Let the gas compact the reservoir oil, and then gas -- when we have enough pressure, it will swell into the oil At least it will be a reduced viscosity of oil and also increased, actually, reservoir pressure a little bit And then we go to the third phase Then we produce back We can call the oil being energized, you know, so we can -- we can get additional oil from that It's not just pure acceleration

Q Now, this shows a vertical well

A Yes

Q And based on your experience here -- or limited experience in this area, is it -- you don't have a set time frame for each of these phases, do you?

A No, we don't The experience we had in the Midland Basin is -- actually, we tried multiple wells in the Midland Basin

(The court reporter requested the witness speak slower)

A The thing is that -- you know, what we found is, you know, you have to monitor pressure, surface pressure You have to monitor the cum injection and monitor the rate Then we decide how much time we have to inject Then like some time, then production time So it's not like a cookie-cutter for the process You

have to, you know, monitor that then do engineering analysis before you go to the next step

Q So you really don't know at this point when you would see a positive response from your wells, correct?

A Yes Yeah We -- of course we did some analysis, but clearly this is a likely experiment We want to, you know, monitor the data We plan to monitor the injector We plan to monitor offset pressure and rate and then decide how we are going to proceed

Q Okay Now, this is a cartoon that shows up the huff-and-puff project in a vertical well setting If you turn to what's been marked as Exhibit Number 13, does that take that, then, and put it into a horizontal-well context?

A Yes In the horizontal well, we expect that would be similar to the vertical well, but probably the biggest difference is the horizontal well -- you take an unconventional, for example, well They have hydraulic fractures So those hydraulic fractures, we provide additional pathway Like the plot show this blue line that's like couple of hydraulic fractures That would provide additional pathway let the gas go the contact the matrix oil

So still we have the three steps, right? First thing, we inject, but then water go through the

tubing But also, you know, like I said, fracture provide the highway, and then the high pressure create admissibility [sic], gas -- type of oil -- natural oil, and then the third phase is we produce back [sic]

Q And then you mention after you do this initial huff-and-puff project, you would then move to a line drive project?

A Yes

Q And is that, you know, depicted in Exhibit 14?

A Yes

Q And that's pretty straightforward, right?

A Yeah

Q The Division's seen something like this before?

A Yes It's injector-producer pair

Q Now, why do you do a line drive project after the initial huff-and-puff project?

A So we have seen some -- first, we have seen some success on the huff and puff, but typically, you know, from our experience in the conventional huff and puff usual contact less volume than the drive mechanism So, of course, the huff and puff usually gives you a quick result, so make us more confident to do like a line drive But line drive is -- if that works, that will be really, you know, helpful to get that So that's -- that's the logic behind that

Q So am I correct, then, you do your huff and puff and then you'll do your line drive?
A Uh-huh
Q And then you'll step back and see how it works?
A Yes
Q Simple way of looking at it?
A Yes Yes
Q And you really don't have any plans beyond that, do you?
A Yeah If this is successful, then we will calibrate our model, you know, design probably large phase, maybe an extension But, you know, current stage, we have to analyze the data, analyze the pilot first
Q Is it possible that you'll begin alternating, huff and puff and then the line drive and then the huff and puff?
A Yeah, could be It could be It's possible based on the result
Q Okay Now, if I turn to what's been marked as OXY Exhibit Number 15, this kind of depicts what you hope to see from your huff and puff and then the line drive injection --
A Yes Exactly
Q One of the questions that came up was the

project area in Section 16
A Yes
Q You depict on here that the influence is going to be roughly north-south
A Yes Yes
Q Do you -- why is it going -- the influence going to be north-south for these injection wells?
A Yeah There is mainly like two -- couple of reasons First phase, you know, this is a north-south We have direct offset They provide a huge pressure sink And then other thing is we know that hydraulic fracture go to northeast-southwest So this hydraulic fracture provide the highway, pathway for the gas to go through, so we expect most of the gas -- if we see any response, it will be inside of Section 16
Q So all of these wells are currently producing, right?
A Yes
Q Okay And the offsetting wells to the north and the south of the injectors will continue to produce?
A Yes
Q All right So that provides your pressure sink you're talking about?
A Yes
Q Do you expect, Mr Liu, in your opinion, any

migration east to west from the injection wells?

A I don't believe it will go east to west And the other thing is, even the east-to-west section, OXY operates all the producers We will monitor that as well, but we don't expect it to go east to west

Q All right Now I want to move on to the second topic, and we had some discussion about how we change the surface-injection pressure for gas?

A Yes

Q Okay If you turn to what's been marked as OXY Exhibit Number 16, first of all, does this provide an exhibit for the Division that identifies the actual surface-injection pressures that we request?

A Yes

Q 1,700 psi for water?

A For water

Q And then 4,250 for gas?

A Yes

Q OXY has actually, therefore, lowered the surface-injection pressure to gas than what was initially requested?

A Yes

Q And am I correct, Mr Liu, that based on the calculations that were done, that that follows the point psi per foot found in the Division's UIC manual?

A Yes, 2

Q And without going through all the math, does this provide the Division with the calculations that were done based on the nature of gas to reach that 250 psi surface-injection pressure?

A Yes

Q Okay All right One of the things that you also note on here, which is important for the next slide, is that based on your calculations that 42 psi-per-foot injection pressure -- surface-injection pressure yields -- and I hope I'm saying this right -- a 63 psi-per-foot pressure gradient, is that correct?

A Yes Yes

Q Now, is that important, then, as we move to the next slide?

A Yes

Q Okay So let's keep that in mind, and let's go to slide -- or OXY Exhibit Number 17 It was mentioned in the C-108 that one of the things that OXY did in preparing for this project was to do a DFIT?

A Uh-huh

Q D-F-I-T Test

A Yes

Q Would you please explain to us what a DFIT Test is and how it differs from a step rate?

A Yes The DFIT test is widely used in the unconventional well for the completion design, for the completion engineer to do their design It's a -- it's a small injection rate and the pressure plot Usually the completion engineer uses this to identify, you know, once the fracture initiate the pressure, you know, identify what is the leak [sic] off of the reservoir Maybe he can get a little bit of matrix or reservoir pressure, all this information Usually this is -- this has been widely used, as I said, in the completion design

So it's usually performed at the toe stage And -- and what we use here is we actually -- we don't want to, you know, frac the reservoir, so we use this as assurance, say The pressure we request is lower than whatever the fracture -- initiate fracture So this just assures our request that surface pressure is -- is good

Q Now, one of the -- one of the benefits of using a DFIT Test for horizontal wells, it requires less fluids?

A Much, much less fluid

Q Is that because you're doing it at the toe?

A At the toe stage

Q And, for example, keeping in mind that 63

psi-per-foot gradient pressure --

A Uh-huh

Q -- how does that compare with your analysis done using your DFIT in this case, as shown on this slide?

A Yeah I'm showing in this slide -- as you can see, we have the three wells We have the DFIT in the toe stage, and then we found all the fracture initiation pressure gradient is higher than what we request, which means when we operate at our surface pressure gradient like a 63, we want initiate the fracture

Q And is there -- in the world that you work in, is there a big difference between 63 and 68?

A Yeah That's still pretty significant, even like the second digit because you times the depth That's still pretty big You're talking about a few hundred psi difference

Q So, Mr Liu, based on your expert opinion, the injection pressures requested by OXY for oil and gas, are they conservative surface injection pressures?

A Yes

Q And does OXY believe that it can conduct its huff-and-puff project and this line drive project using these more conservative surface-injection pressures?

A Yes

Q In your opinion, does the proposed surface-injection pressures from this -- for the targeted --

A It won't

Q All right Mr Liu, looking at all this, in your expert opinion, will your proposed injection project impair the correlative rights of mineral owners in adjacent sections?

A No, it won't

Q And in your expert opinion, will this project promote the efficient recovery of oil underlying these state lands?

A Yes

Q Were OXY Exhibits 10 through 17 prepared by you or compiled under your direction and supervision?

A Yes

MR FELDEWERT Mr Examiner, I would move admission into evidence OXY Exhibits 10 through 17

EXAMINER GOETZE Exhibits 10 through 17 are so entered

(OXY USA, Inc Exhibit Numbers 10 through 17 are offered and admitted into evidence)

MR FELDEWERT That concludes my examination

EXAMINER BROOKS And at this time, I need

to advise that from what I've heard of the case so far, it does not sound like my eminent colleagues will need legal counsel in this case So if they choose to continue without counsel, that will not be something I will object to

EXAMINER GOETZE Very well, Mr Brooks We appreciate your time and enjoy Someday we'll all eat at the same time

(Laughter)

EXAMINER BROOKS Well, usually it happens, but in this particular case, I thought it might be more convenient --

EXAMINER GOETZE We appreciate that

(Mr Brooks exits the room, 11 25 a m)

EXAMINER GOETZE Mr Jones?

CROSS-EXAMINATION

BY EXAMINER JONES

Q I appreciate you coming up, and I appreciate you trying this on the reservoir We were hoping someone would start looking at enhanced recovery from these types of reservoirs

A Yeah

Q But -- but I guess I'm really curious of what type of model you're going to set up to --

A You mean the simulation model?

Q Yeah, the grids and --

A Okay So we have an Eclipse 300 Model, you know, composition simulation, and then we use -- we enhance the transmissivity of the fracture impact -- hydraulic fracture, you know, to mimic, you know, the hydraulic fracture so that you have the pathway for the gas, you know, go deep, right, contact more rock And then actually the grid was generated by -- you know, the Geomodel Right?

Q Oh, okay

A So Geomodel, we based on the logs, based on -- also peaked the tops, based on the log and then we populated into like a 3D petrol model And then the petrol model is strapped to the reservoir simulation model And then the reservoir simulation model also include all the wells, perforations, you know, and the permeability -- calculated permeability, porosity, saturation, you know Then we history match whatever primary production And then we try, okay, do-nothing case, keep going, and then we inject or we do huff and puff, what kind of incremental we have We provide like a 15 percent -- about a 15 percent incremental This is our best case Okay We can get that much Then, you know, let's go forward

Q Okay Stepping back a bit, the production

right now from those wells --

A Yeah

Q -- how can you describe the production from the wells right now?

A So those production -- currently, the 7H, it's like probably 40, 50 barrels now And 12H is higher, but it's less I think it's less than 200

Q Oil?

A Oil

Q Okay What about water production?

A Water, it's -- you know, the water-oil ratio is actually lower than 1

Q Oh

A So you have more oil than oil -- than water

Q Oh, okay So why would you want to inject water?

A Okay So -- so for this, it's -- you know, we also got some like analog -- we did some analog study People have not injected into the 2nd Bone Spring yet, but in the Red Hills area, EOG did the 3rd Bone Spring water injection And then we look at that It's pretty good, you know, pressure maintenance project They see almost flat decline

And then Mewbourne did another water injection in the 1st Bone Spring Seems pretty good,

also pretty good And then based on our analysis, based on the permeability, we think it's pretty comparable So what -- what we are thinking, maybe, you know, this water might also work That's cheap injector This is the first reason

Okay Second reason is, you know, in conventional water, we use a lot of WAG operation, you know, water alternating gas So if we see a quick breakthrough, we sometimes just WAG it

Q Okay

A So we just want to keep the option open We don't want to go back, hey, again, we want water

Q Okay

A You know, we want to just tell the story once And then this is an experiment We want to see the result to determine how to do the next

Q Okay So do you have a lot of data on the frac jobs -- stages?

A Yeah We have a frac report That's how we build our model, right? We know roughly how much propane being pumped into each stage And actually that's our design factor for the injection rate or pressure

Q Okay So did you -- when they fractured these wells to complete them, did they use any kind of

chemical tracer to tell where the -- where the different fluids are coming from?

A Yeah For these, we have -- we have other -- other -- other wells, we have penetration, but for the pilot area, we don't

Q Okay

A But it might be -- you know, when we -- if we start injecting like two wells, maybe we may consider the gas tracer, but currently, you know, just --

Q Okay The Bone Spring sometimes has a relatively high GOR And in some instances -- we've had several cases over the years where they've asked for a limiting GOR --

A Uh-huh

Q -- which is kind of an OCD term, limiting GOR

A Yeah Yes

Q But they've asked for 5,000 to 1 instead of 2,000 to 1, which is more consistent with maybe black oil reservoirs

A Yeah, black oil

Q So are you considering this a volatile reservoir?

A We think this is still, you know, close to a black oil system here

Q Okay So the GOR should be relatively low?

A Yeah, relatively low
Q So you might get some help by injecting gas?
A Yeah, because, you know, maybe some -- even like a reparation [sic] can happen
Q And so your chemical -- I mean, your compositional model, you can change your viscosities over time? It automatically does that?
A Yeah It automatically does that Yeah
Q Okay And there is no way a person could put tubing down below your packer into the open hole without -- your production people would not want to do that, I guess, to kind of --
A Uh-huh
Q -- release the injection all along the one-mile lateral?
A Yeah For this -- the pilot -- initial design like this is, you know, we want to operation not so complicated
Q Okay
A Right? So the more jewelry or things you put downhole, it's hard to analyze
Q Too much jewelry is not good sometimes
EXAMINER JONES I'm going to turn it over to Mr Goetze

CROSS-EXAMINATION

BY EXAMINER GOETZE

Q Okay Again, thank you for your presentation The DFIT model and your surface pressure, are you going to revisit this between changing the operations between the huff and puff and the line drive? And would you require us to change the --

A Surface pressure?

Q Yeah

A No

Q You're going to be happy with the 2 and leave it?

A Yeah

Q Okay I just want to make sure that we don't box ourselves in the corner

A Uh-huh

Q We would probably include a clause in there to increase that above the administrative 2 gradient

A Uh-huh

Q But, again, we're going into a new realm here with this type of modelling to perform --

A Yeah

Q -- the fracture formation and getting that information, so we're going to rely on you folks to provide us some guidance

A Uh-huh

Q The fact that you're doing essentially two different types of experiments, will there be a danger of one influencing the other, or is there going to be some way to separate the effects you can see clearly?

A I think we can separate the effect based on our current study, because the thing is that, you know, we also have the hydrocarbon pore volume between the wells So when we -- when we -- we will monitor pressure When we establish injectivity, establish pressure, the huff and puff won't be -- based on our current model, won't impact the offset that much Right? So that's our current expectation, but, of course, it's an experiment

Q Okay And then talking about it being an experiment --

A Yeah

Q -- what's your scope of time on this? What do you feel -- I mean, we're not looking at each process, but for this entire experiment to occur, do you have some sort of scope as to how long?

A Yeah We do have it You know, it's hard to set a very hard -- hard line for this type of experiment, but we would think like two years before we can tell

Q And the reason we ask that is because this is a

pilot, there would be a point in time that we would like some feedback from you folks on what you got, what you're willing to tell us

A Yeah

Q So at that time, revisit this through the order and then make a determination as to expand, extend or whatever?

A Uh-huh Yeah

EXAMINER JONES Is two years enough on that?

THE WITNESS Yeah Two years -- maybe we need a little bit longer, but usually two years we can tell at least if we got the initial indication Like in the Commission award, sometimes we need more than two years And this is actually -- the spacing is pretty big spacing, right? So -- but -- but at least we expect we will see some pressure, you know, at least some pressure response So I don't want to, you know, just set up like two years Definitely we will give you the positive or some other result But, you know, I think maybe we can get something, conclusive results, maybe two years Maybe not

Q (BY EXAMINER GOETZE) Typically when we have these pilot projects --

A Yeah

Q -- two years is when you would reappear and present what you have, and then if you want to modify the order or such and continue with the experiment or change the parameters based upon your outcome

A Yes

Q Well, I'll also disclose that a lot of these questions -- the information that you presented, I submitted to you folks to review your C-108, so I have no further questions for you, sir

A Yes

EXAMINER JONES Yeah I have nothing further Thank you very much

EXAMINER GOETZE Thank you

MR FELDEWERT We'll call our last witness

SPENCER GUNDERSON,

after having been previously sworn under oath, was questioned and testified as follows

DIRECT EXAMINATION

BY MR FELDEWERT

Q Would you please state your name and identify by whom you're employed and in what capacity?

A My name is Spencer Gunderson I'm employed by Occidental Petroleum as a geologist

Q Mr Gunderson, how long have you been a

geologist with OXY?

A Six years

Q And have your responsibilities included the Permian Basin?

A Exclusively, yeah

Q Including the New Mexico portion?

A Yes

Q And how long have you worked as a petroleum geologist?

A Six years

Q And do you have a master's in geology?

A I have a master's degree from Texas A & M University

Q Okay And, Mr Gunderson, you have previously testified before this Division as an expert in petroleum geology, correct?

A I have, yes

Q Have you conducted a study of the subject area in the proposed injection zone at issue here today?

A Yes

MR FELDEWERT I would, once again, tender Mr Gunderson as an expert witness in petroleum geology

EXAMINER GOETZE He is so qualified

Q (BY MR FELDEWERT) Mr Gunderson, for the sake of time, I won't turn to it, but there are some pages,

29 and 31 of the C-104 -- or the C-108 that has been provided to the Division They contain certain geologic statements, correct?

A That is correct

Q And are you the individual that certified the accuracy of those statements?

A I did, yes

Q Okay Then what I'd like you to do is -- first off, did you develop for the Examiners the type log that identifies in more detail the proposed injection interval?

A I did, yes

Q If you turn to what's been marked as OXY Exhibit Number 15, is that the type log?

A That is the Cedar Canyon 16 State 10 pilot hole

Q Okay And you provided with a star the location of that particular well in Section 16, correct?

A That is correct

Q And does this provide a more technical description of the actual zone of injection under this particular type log?

A This shows the shallower sections, as well as the Delaware and Bone Spring Formations with more detailed inset with the -- detailing the lithology and

fluid types within the reservoir interval family, the 2nd Bone Spring Sand Another thing we're pointing out is the overlying and underlying reservoir, that being the 2nd Bone Spring Lime and the 3rd Bone Spring Lime, being a very tight carbonate with an average porosity of 1 percent and very low permeability acting as a seal above and below the 2nd Bone Spring Sand

Q So if I look at this particular exhibit, is the actual injection zone, as correlated for this type log, 8,426, 8,739?

A That is correct

Q That's the 2nd Bone Spring?

A 2nd Bone Spring Sand interval that is correlative with the horizontals drilled in this section

Q Okay And while we're kind of on that subject, have you confirmed that the five wells we've talked about here today, the two injection wells and the three offsetting producing wells, that they are all located in the same correlative zones?

A They are They're all drilled within the same sand lobe [sic], within the same correlative interval of the 2nd Bone Spring Sand

Q Okay You mentioned the nature of this particular interval Are there confining barriers both

above and below the projection interval?

A There are above and below tight limestone barriers that would act as a frac barrier and -- above and below the reservoir In addition to that, there are several -- over 1,000 feet of salt separating the Bone Spring interval from the lowest known freshwater sources

Q I'm glad you got to that point Are there any water wells in this project area?

A There are no freshwater wells within a one-mile radius

Q Were there wells that showed up initially in your examination, that you did some more -- did some more review and made a determination that there are no longer freshwater wells?

A That is correct They're classified as brine wells now

Q And what is it the lowest depth of the groundwater in this area?

A It's 600 feet above the top of Salado Formation noted in the type log

Q So that's well above the heavy salt section that you show here in the type log, right?

A That's correct

Q Okay Now, have you prepared a cross section

to review with the Examiners that further identifies the injection interval?

A I have

Q If I turn to what's been marked as OXY Exhibit 19, does this identify the wells that you utilized to create your cross section?

A That is correct

Q Why did you choose these four wells?

A These four wells are vertical wells which cover the entire 2nd Bone Spring Sand reservoir, and they all have open-hole logs at least including triple combo covering that entire reservoir interval

Q And the -- go north to south, the second well is the Cedar Canyon State 10, right?

A That is correct

Q And that's the same well that you utilized for your type log on Exhibit 18?

A That is correct

Q In your opinion, are these wells representative of the project area?

A I think they are, yes

Q If I then turn to OXY Exhibit 20, is this the cross section that corresponds with the north-south wells shown on Exhibit 19?

A That is correct

Q First off, why don't you -- how have you identified the injection interval?

A This is a stratigraphic cross section flattened on the top of the 2nd Bone Spring Sand -- it's highlighted in that box -- in between the top of the 2nd Bone Spring Sand and the top of the 3rd Bone Spring Lime There is also a cartoon schematic of the Cedar Canyon 16 State 7H and 12H, which will be utilized in the pilot, depicting the landing zone near the base of the 2nd Bone Spring Sand And both of those wells are landed in the same sand lobe

Q All right And you've shaded in here the actual injection interval?

A That's correct

Q And does this confirm that there are indeed impermeable barriers above the injection interval?

A We see very low porosity, very low permeability between limestone layers above and below the reservoir through the entire pilot area Yes

Q And I think you mentioned this, but just for the sake of the record, the cartoon for the 7H and the 12H, it is representative of both wells, both located in the same basic correlative zone?

A That is correct They're both landed in the same zone within the reservoir

Q Gotcha Okay

Now, you've also looked at the structure in this area, correct?

A That's correct

Q If I turn to OXY Exhibit 21, is this a structure map that you put together?

A I did, yes

Q And what do you observe?

A What I observed here is that we have good well control from vertical wells and a smooth, consistent dip of 1 degree dipping down to the east

Q And do you observe any evidence of faulting in this area?

A So given the smooth and consistent dip with no abrupt changes in elevation of the 2nd Bone Spring Sand, I wouldn't expect any faulting in this reservoir We also don't see any evidence in the way of repeat section or missing section in any of the log data that would imply faults through the reservoir

Q So, Mr Gunderson, in your expert opinion, will this proposed injection project pose any threat to any underground sources of drinking water?

A No, it will not

Q In your expert opinion, will this proposed injection project have any negative impact on the

correlative rights of the mineral owners in the oil and gas zones above and below this proposed injection interval?

A No, it will not

Q Were Exhibits 18 through 21 prepared by you or compiled under your direction and supervision?

A Yes, they were

MR FELDEWERT Mr Examiner, I would move the admission into evidence of OXY Exhibits 18 through 21

EXAMINER GOETZE Exhibits 18 through 21 are so entered

(OXY USA, Inc Exhibit Numbers 18 through 21 are offered and admitted into evidence)

MR FELDEWERT That concludes my examination of this witness

EXAMINER GOETZE Mr Jones?

CROSS-EXAMINATION

BY EXAMINER JONES

Q I guess you just drilled some Wolfcamp wells out here What's your best zone out here? Your Brushy or your Wolfcamp or the Bone Spring or what?

A The 2nd Bone Spring Sand has been the most prolific one, but we're having very good initial results from our Upper Wolfcamp wells

Q Those are Upper Wolfcamp wells?
A They are We're targeting the X-Y
Q Okay
A Yeah
Q I'll leave that to him (indicating)
A Yeah
Q So do you look at your frac stages on your completion, because you get an ulty [sic,phonetic] plot probably from your Halliburton or Schlumberger or whoever does your frac jobs
A Uh-huh
Q So do you see any drop-off, or do you see it hit a barrier, or do you see it break into something in your net pressure plot on some of your stages?
A I'd say I'm not an expert in analyzing frac pressure plots, but I've never seen anything that would indicate it was breaking into an additional zone beyond the initial formation breakdown that we see I've never seen anything that would indicate it was contacting a second barrier or anything like that
Q Okay So -- so your bounding rocks are holding, and it's not -- it's pretty consistent reservoir?
A It's very consistent -- very consistent thickness over the pilot area, and it's really a

tombstone rock with 1 percent porosity and probably --

Q Is it a limestone or a dolomite?

A It's a limestone

Q Okay For some reason, it hasn't been dolomitized over --

A I don't know the details of the mineralogic history of it Since it's a nonreservoir interval, we don't have a very detailed --

Q But it's not brittle enough that your frac jobs get into it and --

A We see that the porosity is so low that it's probably not taking fluid to initiate fractures

Q Not taking fluid

Now, the 2nd Bone Spring, what porosity did you say it has, average?

A It has an average of 7 percent porosity

Q 7 percent

Is that density log porosity?

A It would be calculated on neutron and density

Q Combination?

A Combination

Q Combination cost plot

And the thickness?

A It's noted on the cross section The cross section over the pilot area is 335 feet thick for the

sand interval

Q And how much of that is producing porosity?

A That can vary That can vary as far as your net to gross The major influence on that would be there is a middle carbonate member which can come and go and can vary pretty significantly that would occlude your reservoir quality and would reduce your net to gross

Q But you would tell your engineer 335 at 7 percent and pretty much let him run with that?

A That's an average porosity If I were to calculate volumetrics on this section, I would probably use a porosity cutoff to rule out the areas where a middle lime member is probably not contributing hydrocarbons to the wellbore

Q What about your water saturation? What is your RO -- I mean your RW out here?

A I don't know the answer to that

Q But what about your water saturation that you get on your logs?

A So it's 40 to 50 percent

Q Okay So it's productive at that

And no cores?

A We have rotary sidewall core in Section 17 in the 2nd Bone Spring Sand

Q Have you cross-plotted those with your logs to see how they relate?

A We have We do have permeability measurements over -- in those plugs Yes

Q Okay Thank you very much

A Uh-huh

EXAMINER GOETZE Okay You done?

Again, your presentation was requested by me as a result of the review of the C-108 application, so most of my questions have been answered

I will make note that your brine wells is part of an ongoing project by the Interstate Stream Commission to keep the saline out from the Pecos

Other than that, you know, I have no further questions for this witness

Mr Feldewert?

MR FELDEWERT That concludes our presentation, Mr Examiner

EXAMINER GOETZE Oh, I do have one more question So the priority of this project, when do you think this is going on line?

MR FELDEWERT Well --

EXAMINER GOETZE If you can talk to your --

EXAMINER JONES Tomorrow

(Laughter)

MR FELDEWERT I think, Mr Examiner, they're hoping to start this project in April or May

EXAMINER GOETZE Okay So within the next month or so, you want to see something in front of you?

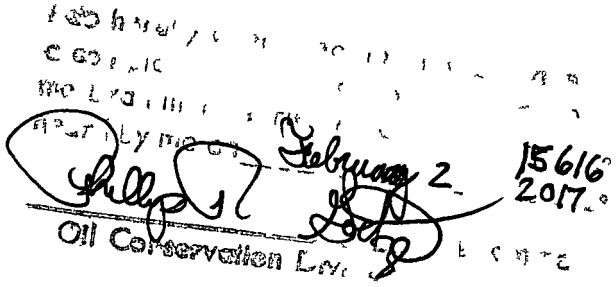
MR FELDEWERT Yes

EXAMINER GOETZE And we'll also resolve any issues we have with pools and stuff like that

MR FELDEWERT Okay

EXAMINER GOETZE Okay Given that, Case 15616 is taken under advisement

(Case Number 15616 concludes, 11 52 a m)



STATE OF NEW MEXICO

COUNTY OF BERNALILLO

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I FURTHER CERTIFY that I am neither employed by nor related to any of the parties or attorneys in this case and that I have no interest in the final disposition of this case

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