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. 11,436
APPLICATION OF ARMSTRONG ENERGY CORPORATION FOR APPROVAL OF A PRESSURE MAINTENANCE PROJECT AND QUALIFICATION FOR THE RECOVERED OIL TAX RATE, LEA COUNTY, NEW MEXICO	ORIGINAL

REPORTER'S TRANSCRIPT OF PROCEEDINGS

EXAMINER HEARING

BEFORE: MICHAEL E. STOGNER Hearing Examiner

December 7th, 1995

Santa Fe, New Mexico

This matter came on for hearing before the New Mexico Oil Conservation Division, MICHAEL E. STOGNER, Hearing Examiner, on Thursday, December 7th, 1995, at the New Mexico Energy, Minerals and Natural Resources Department, Porter Hall, 2040 South Pacheco, Santa Fe, New Mexico, Steven T. Brenner, Certified Court Reporter No. 7 for the State of New Mexico.

* * *

I N D E X

December 7th, 1995
Examiner Hearing
CASE NO. 11,436

* * *

E X H I B I T S

Applicant's	Identified	Admitted
Exhibit 1	7	14
Exhibit 2	7	14
Exhibit 3	9	14
Exhibit 4	11	14
Exhibit 5	12	14
Exhibit 6	21	38
Exhibit 7	32	38

* * *

A P P E A R A N C E S

FOR THE APPLICANT:

CAMPBELL, CARR & BERGE, P.A.
Suite 1 - 110 N. Guadalupe
P.O. Box 2208
Santa Fe, New Mexico 87504-2208
By: WILLIAM F. CARR

FOR NEARBURG PRODUCING COMPANY:

KELLAHIN & KELLAHIN
117 N. Guadalupe
P.O. Box 2265
Santa Fe, New Mexico 87504-2265
By: W. THOMAS KELLAHIN

* * *

WHEREUPON, the following proceedings were had at 11:55 a.m.:

EXAMINER STOGNER: Hearing will come to order.

At this time I'll call Case Number 11,436, which is the Application of Armstrong Energy Corporation for approval of a pressure maintenance project and qualification for the Recovered Oil Tax Rate, Lea County, New Mexico.

At this time, I'll call for appearances.

MR. CARR: May it please the Examiner, my name is William F. Carr with the Santa Fe law firm Campbell, Carr and Berge.

We represent Armstrong Energy Corporation, and I have two witnesses.

EXAMINER STOGNER: Any other appearances?

MR. KELLAHIN: Mr. Examiner, I'm Tom Kellahin of the Santa Fe law firm of Kellahin and Kellahin, appearing on behalf of Nearburg Producing Company.

I have no witnesses. We are an offset interest owner.

EXAMINER STOGNER: Any other appearances?

Will the witnesses please stand and raise your right hand?

(Thereupon, the witnesses were sworn.)

EXAMINER STOGNER: Mr. Carr?

MR. CARR: At this time we would call Mr. Boling.

MICHAEL BOLING,

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

DIRECT EXAMINATION

BY MR. CARR:

Q. Would you state your full name and place of residence?

A. Mike Boling, Roswell, New Mexico.

Q. By whom are you employed?

A. I am employed by Armstrong Energy Corporation as a consulting petroleum geologist.

Q. Mr. Boling, have you previously testified before this Division and had your credentials as a geologist accepted and made a matter of record?

A. Yes, I have.

Q. Are you familiar with the Application filed in this case on behalf of Armstrong Energy Corporation?

A. Yes, I am.

Q. And have you made a geological study of the area which is the subject of this Application?

A. Yes, I have.

MR. CARR: Mr. Stogner, at this time we would tender Mr. Boling as an expert in petroleum geology.

EXAMINER STOGNER: Any objections?

MR. KELLAHIN: No, sir.

EXAMINER STOGNER: Mr. Boling is so qualified.

Q. (By Mr. Carr) Mr. Boling, would you briefly state what Armstrong Energy Corporation seeks with this Application?

A. We seek approval of permission to inject water in a well in the southwest quarter of Section 2 of 20-34, to improve the productivity of our producing Delaware wells in that quarter-quarter section -- that quarter section.

Q. Do you intend to maintain production by pressure maintenance?

A. That's correct.

Q. Does Armstrong also seek qualification of this project for the recovered oil tax rate, pursuant to the New Mexico Enhanced Oil Recovery Act?

A. Yes, we do.

Q. Into what formation do you propose to inject for pressure maintenance?

A. We intend to inject into a portion of the upper part of the Cherry Canyon section of the Delaware formation.

Q. And what is the approximate depth of the interval that you're going to be injecting into?

A. Approximately 5900 to 5990 feet.

Q. Let's go to what has been marked for

identification as Armstrong Energy Corporation Exhibit Number 1. Would you identify and review this, please?

A. Yes, this is a land plat of the general area of the Lea Northeast-Delaware Pool, with the southwest quarter of Section 2 highlighted in yellow, showing our producing wells in the southwest quarter of 2 and the proposed location of the injection well in red.

Q. And what is that location?

A. That is 330 from the south line and 990 from the west line, in Section 2.

Q. And what is the current status of that well?

A. That well has yet to be drilled.

Q. Offset operators are also indicated on this exhibit?

A. That's correct.

Q. Will they be reviewed in detail by Mr. Stubbs when he reviews the C-108 Application?

A. Yes, they will.

Q. Let's go to Armstrong Exhibit Number 2. Will you identify and review that exhibit?

A. Number 2 is a type log of the sands above and below the producing formation -- I mean producing horizon, that we're going to inject into, along with the producing horizon.

The nomenclature that is mine, that I've used

here, is denoted on the left-hand side of the section. This nomenclature of first, second, third and fourth sands are just names that I informally assign to these sands, because they are individual sand packages that can be mapped separately in the area.

The interval that we are interested in is the third sand, which occurs in this well from 5880 to about 6020 feet, and it is marked "producing interval". This is the interval that we'll be injecting into.

It is separated, as you can see, by a limestone that's about 30 feet thick above it. Above that limestone is a thick sand. In this area the sand is 80 feet thick. In some portions of the southwest quarter of 2 this sand gets up to 150 feet thick. It is a porous sand. It is wet everyplace that we've tested it in Section 2.

So our productive interval is isolated from the sands above and below it, not only by limestone but by wet sands.

Q. Where does this type log -- where does this well -- Where is this well located in regard to the injection well?

A. Okay, this is a type log from the Mobil Lea State Number 2, which is in the northwest of the southwest of Section 2. It's about 1500 feet north of the proposed location.

Q. All right. Let's go to the cross-section, Armstrong Exhibit Number 3. I'd ask you to review that for Mr. Stogner.

A. Okay, Exhibit 3 is a stratigraphic cross-section. If you'll refer to the --

EXAMINER STOGNER: Let me get this thing unrolled.

THE WITNESS: Okay.

Q. (By Mr. Carr) Okay, if you'll refer to the index map on the right-hand side of the cross-section, this cross-section is a stratigraphic cross-section hung on the base of the producing interval crossing the southwest quarter of Section 2.

It shows -- Starting on the northeast, it starts with the West Pearl State Number 2 well. If you'll look at the producing interval in that well, we're in a carbonate and dolomite facies. There's only about 15 feet of sand left here; this is on the right-hand side of the section. You'll see that base of the producing interval datum. There's only about 15 feet of sand in that wellbore. Okay, there's only 15 feet of sand in the wellbore. The dominant portion of this section is dolomite in that well.

This is a facies change that's occurring out in this area on the eastern edge of this reservoir. This defines the eastern edge of the productive reservoir, where

this facies change takes place.

As you proceed to the west or left on the section, you come into the discovery well, which is the Mobil Lea State Number 1 well. You can see you go from about 15 or 18 feet of porosity to almost 100 feet of porosity in this well, thick, porous sand.

You continue going west, the sand actually thickens a little bit more in the Mobil Lea State 2.

Finally, the last well in the cross-section on the west is the Read and Stevens Mark Number 8, which is in the northeast of the southeast of Section 3. As you can see, there is no sand present in this well. This defines the western edge of the accumulation and defines the trap.

So as you go east to west here, you can see the two defining trapping mechanisms, facies on one side, complete pinchout on the west.

And if you'll refer back to Exhibit Number 1, in the southwest of the northwest of Section 2 there is a Well Number 5, the Mobil Lea State Number 5. This well was drilled 900 feet north of the Mobil Lea State Number 2 well that had 100 feet of sand in it. It has no sand in it.

So we have defined by drilling the trap -- the accumulation and the trap out here. We know where the sand is isolated. It's all in the southwest quarter of 2, defined by our drilling program.

Q. Mr. Boling, let's now go to the structure map, Exhibit 4.

A. Exhibit 4 is the structure map in the area out there, constructed on the base of this producing interval.

The critical thing to note on the structure map is that in the southwest quarter of Section 2 and in the east half of Section 10, there are two definable low spots. Separating these two low spots is a nose that trends northwest to southeast across Section 2, across the southeast quarter of Section 2, into the northeast quarter of Section 10, and into Section 11.

This nose separates these two low spots, and separates the two pods of sand that have been deposited out here, the one in the southwest quarter of Section 2 and the one in the central portion of Section 10. These two sands were deposited at the same time, and they're connected in the water leg downdip to this nose, but not in the oil leg. So that we have separate oil accumulations on either side of this nose, not connected.

And the cross-section -- If you refer back to the last well on the cross-section, Number 8, which is in the northeast of the southeast of Section 3, you will see there's no sand in that well. There's no sand in that well because it's sitting on top of this nose that's separating these two piles of sand.

Q. So basically what we have is a nose separating the southwest quarter of 2 from the production off to the southwest?

A. That's correct.

Q. All right. Let's go to the last exhibit, the last geologic exhibit.

A. The last geologic exhibit is the net porosity isopach map that shows -- of the producing portion of the Delaware that we're interested in, which shows the two separate pods of sand, the one in the southwest quarter of Section 2 and the one in Section 10.

As you can see, we have a very thick pod of sand, up to 100 feet of sand, isolated in the southwest quarter of 2, defined by drilling. We know that the sand is only in the southwest quarter of 2. As you come to the south, you get into the water leg.

The red dot on the map is indicating the proposed location of the injection well. You can see we have -- we're anticipating approximately 100 feet of sand in that location.

Q. What geologic conclusions have you been able to reach, based on your study of this area?

A. The fundamental one is that -- and the most critical one is that these two accumulations in 10 and 2 are separate. They're not connected in the oil leg, so

that any activity that we undertake in the southwest quarter of Section 2 will not affect any production in Section 10 or 3.

Q. Based on your study of the area, is it appropriate to define the project area for this pressure maintenance project to include only the southwest quarter of Section 2?

A. Absolutely.

Q. Based on your geological review of the area, do you believe in this southwest quarter of 2 we have a continuous zone that can be effectively waterflooded?

A. Yes.

Q. And do you have a zone that is separated from producing intervals above and below the third Bone Spring sand?

A. Yes, we do.

Q. Is it Bone Spring?

A. No, it's Delaware.

Q. Delaware.

A. Delaware.

Q. Were Exhibits 1 through 5 either prepared by you or compiled under your direction?

A. Yes.

MR. CARR: At this time, Mr. Stogner, we would move the admission into evidence of Armstrong Exhibits 1

through 5.

EXAMINER STOGNER: Any objections?

MR. KELLAHIN: No objection, Mr. Stogner.

EXAMINER STOGNER: All right, Exhibits 1 through 5 will be admitted into evidence.

MR. CARR: And that concludes my direct examination of Mr. Boling.

EXAMINER STOGNER: Thank you, Mr. Carr.

Mr. Kellahin, your witness.

MR. KELLAHIN: No, sir, I have no questions.

EXAMINATION

BY EXAMINER STOGNER:

Q. Mr. Boling, referring to Exhibit Number 2, I want to make sure that I'm familiar with the nomenclature that you're showing here. You mentioned that the injection is going to be in the upper portion of the Cherry Canyon formation. The base of your first sand, is that also the top of the Cherry Canyon?

A. No, all these -- Well, yeah, fundamentally, not the base. This first sand is the first sand that -- the first depositional event in the Cherry Canyon in this area, so effectively it's the top of the Cherry Canyon in this area.

Q. Okay.

A. But, you know, that top moves up and down the

section, depending on where you're at relative to the shelf edge.

Q. Okay, just in with the southwest quarter or with the information that you have here --

A. Uh-huh.

Q. -- you would put the top of the Cherry Canyon at the same line that you have the base of the first sand?

A. No.

Q. No?

A. I would put it at the top of the first sand --

Q. Okay.

A. -- because this --

Q. Which is not shown, yet?

A. Well, it is shown; it's just not marked.

Q. Okay.

A. See, the top of that -- That 5520 break, when you come out of that carbonate into the sand --

Q. Yeah.

A. -- okay, that would be the top of the Cherry Canyon sands in this area.

Q. 5520, where that break is?

A. Yeah, yeah. There's no sand in the Delaware -- There is no sand deposited above that depth in this area.

Q. And the whole Cherry Canyon, then, continues downward?

A. Yeah, as you move south, that section is going to expand, and you'll pick up sand.

Q. Now, is the base of the Cherry Canyon shown on here, or --

A. No.

Q. -- or is it further down?

A. The base of the Cherry Canyon would be further down, about another 700 feet.

Q. Okay, which would make it correspond to about what? 6900 --

A. 6800, something like that.

Q. 6800 --

A. Yeah.

Q. -- 6900?

Now, let's talk about the interval -- Well, let's talk about your cross-sections

A. Okay.

Q. That would be Exhibit Number 3. And how many wells does Armstrong have producing in that southwest quarter at this time?

A. There are four wells in the southwest quarter of 2 that are producing at this time.

Q. Okay. Now, the two that are shown here, the Mobil Lea State 1 and the Mobil Lea State Number 2 --

A. Correct, they're in the north half of the

southwest quarter.

Q. The perforated interval is shown on this cross-section?

A. Right.

Q. They seem to correspond fairly well to what kind of an environment? What kind of producing properties would the producing portion of this interval best be described? High porosity?

A. Oh, yeah, porosity is approximately 20 percent, 20- to 21-percent porosity, and the -- what's -- What did you figure the perm was?

MR. STUBBS: The permeability of the oil is about 12.7 millidarcies.

THE WITNESS: It's a much better reservoir than you normally find in the Delaware.

Q. (By Examiner Stogner) Is this the kind of question I should be asking the engineer later?

A. I don't -- Not necessarily. Where are we going? And I'll --

Q. The other two wells that aren't shown on this cross-section --

A. Yeah, the 3 and the 4.

Q. -- does their perforated interval correspond --

A. Yes.

Q. -- with these?

A. Yes.

Q. Now, on Exhibit Number 4, that nose that you referred to, the separation of the two low paints --

A. Yeah.

Q. -- is that a permeability --

A. That is a topographic nose. It's a topographic feature.

Q. Okay.

A. What's happened is, that nose -- that nose is in place at the time of deposition of the sands, and we know that because you can see that -- from the cross-section, that when you get out here on the west-hand side -- left-hand side of the cross-section, that well is on the flank of the nose, topographically it's sitting on the flank of the nose, and there's no sand in it.

So that high was there, that nose was there when the sand came down. The sand goes around the noses. And so that defines where the sand is going to be deposited --

Q. Okay.

A. -- and it's a topographic feature.

Q. Is that a limestone structure or --

A. Yeah, the under -- yeah, and you can see that -- if you'll refer back to the tight section, you can see the base of the producing interval, there is a small limestone -- thin limestone and a thin sand and then a

thick limestone underneath it. That map was constructed on the base of this sand, so this is a limestone base that this -- bedrock that the sand is sitting on.

Q. Now, Exhibit Number 5, this is showing the third sand?

A. Yes, this is the producing interval.

Q. This is the producing interval?

A. Yeah.

Q. These four wells define, like you're showing here, the top of that -- the thick portion of the sand, correct?

A. (Nods)

EXAMINER STOGNER: Okay, I have no other questions of this witness.

MR. CARR: We have no further questions of Mr. Boling, and at this time we would call Mr. Bruce Stubbs.

BRUCE A. STUBBS,

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

DIRECT EXAMINATION

BY MR. CARR:

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

A. Bruce A. Stubbs.

Q. Where do you reside?

A. Roswell, New Mexico.

Q. By whom are you employed?

A. I'm a consulting petroleum engineer, presently employed by Armstrong Energy Corporation.

Q. Mr. Stubbs, are you familiar with the portion of southeast New Mexico which is involved in this case?

A. Yes, I am.

Q. And have you previously testified before this Division and had your credentials as a petroleum engineer accepted and made a matter of record?

A. Yes, I have.

Q. Are you familiar with the Application filed on behalf of Armstrong?

A. Yes, I am.

Q. Have you made an engineering study of the portion of the Northeast Lea-Delaware Pool that is the subject of this case?

A. Yes, I have.

Q. Have you prepared certain exhibits for presentation here today?

A. Yes, I have.

MR. CARR: Are the witness's qualifications acceptable?

EXAMINER STOGNER: Any objections?

MR. KELLAHIN: No objection.

EXAMINER STOGNER: So qualified.

Q. (By Mr. Carr) Mr. Stubbs, what type of secondary recovery project is Armstrong proposing in this case?

A. We propose to drill an injection well in the southwest-southwest of Section 2 to inject water to supplement the natural water drive and maintain reservoir pressure, and the fill-up process will push oil updip to the producing wells.

Q. Let's refer to what has been marked for identification as Armstrong Energy Corporation Exhibit Number 6. First, I think it would be helpful just to review how this exhibit is organized.

A. Okay. Exhibit 6 is -- the first 7 pages is just verbiage that I put together to answer specific questions concerning this case.

After that is the C-108 Application that was filed for the authority to drill this injection well.

And following that, it's numbered Exhibit 2A, there's individual well decline curves, showing the production, oil, gas and water, GOR, for each well in the third sand.

And Exhibit 3A is a numerical model of the porosity feet above the oil-water contact in the third-sand reservoir that I've used to calculate the volumetrics and estimate the recoveries from.

3B is just a 3-D representation of that model, so

you'll get a little better idea of what it looks like in reality.

Exhibit 4 is an economics page.

And the final Exhibit is a summary production curve for the four Mobil Lea State wells.

Q. All right, let's go back and go first to the tab that is marked C-108. Pages are numbered at the bottom, and I would ask you to go to pages 4 and 5 of this exhibit and review the area plats contained therein.

A. Okay. The first plat is a two-mile radius map, which identifies the injection well, proposed injection well, in the southwest-southwest of Section 2, which is the little triangle. And then the circle is two-mile radius around that well.

Second map is the same map enlarged with a half-mile-radius circle drawn around the injection well. Everything within a half-mile-radius circle has been reviewed to determine the construction of the wells and the status of the wells. And also included -- One well is just slightly outside the circle, just for my own information, more than anything.

Q. And the offsetting leases and ownership within two miles of the injection well are also indicated on this map; is that right?

A. Yeah, this is a land plat, and it shows the

offset operators and leasehold interests.

Q. Let's go to the portion of this exhibit which contains the data on all wells within the area of review that penetrate the injection zone. Could you identify for Mr. Stogner the portion of this exhibit that contains that information?

A. Okay, the wells that were reviewed start on page 6, with the Mobil Lea State Number 1 well.

Q. And run through page 22?

A. That's correct.

Q. On each of these sheets, have you set forth all data required by OCD Form C-108?

A. I believe that's correct. It's got the casing, cementing, perforated intervals, total depth when the well was drilled, locations.

Q. Are there plugged and abandoned wells within the area of review?

A. There's three plugged and abandoned wells. One of them was not drilled deep enough. That's the Federal A Number 1 well in section -- Unit Letter P of Section 3. It was a shallow Yates well, so it doesn't even enter into this. There's two deep wells.

Q. Can you identify where in this exhibit the information on those wells is located?

A. If you'll turn to page 12, this was called the

Mobil State Number 2. It was drilled by Spectrum 7 back in 1986, and they had a poor completion on this well and didn't make a producer, and it was subsequently plugged.

It has a perforated interval from 5698 to 5716, and that -- right above that they've set a -- to plug the well, they've set a 25-sack cement plug at 5650 to 5600 feet, so that zone is isolated and, as you can see on the schematic, has other plugs set in the well to properly plug it.

Q. Where are the other wells that have been plugged and abandoned?

A. Okay, the other well, the other deep well, is on page 17. This is the Federal 10 Number 2. It was drilled by Greathouse, Pierce and Davis back in 1964. It's a deep Morrow well, drilled to 13,200 feet. They cut the casing off at 8606 and set a 25-sack plug, and that's right at the top of the Bone Springs, around the top of the Bone Springs.

Then they set another plug at the casing shoe at 5050. That fairly well isolates the whole Delaware interval.

Now, that well, if you'll turn back to the little map on page 5, it's just barely outside of the half-mile circle. Like I said, I just included that one because I wanted to know what was going on in the area. That well is

located in Unit Letter B of Section 10. It's a plugged gas well there.

Q. Mr. Stubbs, have all the plugged and abandoned wells within the area of review and in the immediate area been plugged so as to prevent migration of injection fluid from the injection interval?

A. Yes, I believe they have.

Q. Would you refer to pages 2 and 3 of the C-108 and review the proposed completion of the injection well?

A. Okay, let's turn to the schematic on page 3. It's a little easier to see.

This well will be drilled by initially setting the conductor pipe at about 40 feet and Redi-Mix used to set that string of casing.

Then the surface pipe will be -- or hole will be drilled, a 14-3/4-inch hole will be drilled to 1700 feet. 9-5/8-inch casing will be set at that point and circulated back to surface with approximately 1100 sacks of cement.

And the reason they set 9-5/8 is, there's a possibility of losing circulation in the Seven Rivers Reef in this area. So if they lose circulation, they'll run another string of casing through that reef.

Now, the other wells in the southwest quarter of 2 haven't had too severe a loss-of-circulation problem, so they are not drilled that way.

Now, Read and Stevens in Section 3 and Section 10 have had some real severe loss-of-circulation problems, so there's about a 75-percent chance we won't have loss-of-circulation. But if we do, we're drilling the well in such a way that we can run an extra string of casing.

Assuming we have no problems, we'll continue to total depth of 6100 feet, we'll run 5-1/2-inch casing, we'll use a DV tool at approximately 5200 feet, circulate cement from TD back to 5200, then of course open the DV tool and cement from there back to surface.

At that --

Q. What -- Go ahead.

A. At that point in time we'll be ready to go ahead and perforate. Right now, we're thinking we'll perforate 40 feet of the third sand, the top 40 feet of the third sand. We'll acidize it, frac it, and install plastic-lined or ceramic-coated injection tubing with a nickel-plated packer right above the injection zone.

Q. Are there any other productive zones in the immediate vicinity?

A. Yes, there are. The -- What we're calling the Cherry Canyon first sand is about, oh, 100, 150 feet above the third sand. It's separated by the second sand, which is wet and nonproductive.

There's also Bone Springs production in the area,

and it's down around 9000, 9400 feet. There's Morrow production in the area below 13,000 feet, and Devonian production in the area below 14,000 feet.

Q. What is the source of the water you propose to inject in the subject well?

A. We're going to use Delaware produced water from Armstrong's wells there in Section 2.

Q. And what volumes are you proposing to inject?

A. We're anticipating, once this thing kind of settles down, that we'll be injecting 400 barrels of water a day.

Q. What is the maximum that you anticipate needing to inject?

A. 500 barrels a day.

Q. Will the system be open or closed?

A. It will be a closed system.

Q. Are you going to be injecting under pressure or by gravity?

A. Initially, it will probably be gravity. As it fills up and we build a little reservoir pressure, we're looking probably 500 p.s.i. injection pressure.

Q. Would that be a maximum pressure you anticipate needing?

A. We've requested a maximum of 750, but --

EXAMINER STOGNER: I'm sorry, what?

THE WITNESS: We've requested a maximum of 750 p.s.i.

Q. (By Mr. Carr) And how does that figure compare to the .2-pound-per-foot-of-depth to the top of the injection interval?

A. That's much lower; .2 pound would be roughly 1100 or 1200 p.s.i., and this would be less than a tenth of a p.s.i. per foot.

Q. Do you anticipate ever having to go above that .2 pound per foot of depth?

A. At this point in time, we don't. This zone has exceptional permeability and capacity and shouldn't have to exceed 500 pounds.

Q. Is there a water analysis of the injection fluid contained in Exhibit Number 6?

A. Yes, there is.

Q. And where is that located? Page 23?

A. Twenty-three.

Q. And what does that show?

A. This is a fairly typical Delaware water, has moderately high chlorides, 132,000 milligrams per liter; total dissolved solids, 213,000 milligrams per liter.

Q. Now, since you're reinjecting water into the producing formation, you obviously aren't going to anticipate -- or have problems with compatibility; is that

correct?

A. We don't anticipate problems with compatibility. We'll probably have to treat a little bit for oxygen and scale, maybe. But all in all, we're just reinjecting water that's coming out of the same formation.

Q. Are there freshwater zones in the area?

A. I've visited with the State Engineer's Office, and the surface water or fresh water in the area is very limited. There's no freshwater wells within a mile of the proposed injection well.

The closest well is about a mile and a half due west, in the southeast of Section 4. And we checked this well the other day, back in October, to see what the status was, and it has been capped. And that stock tank now receives water through a small plastic pipeline from about two miles north of there.

So there's very limited supplies of fresh water or accumulations of fresh water in the area.

Q. Have you included in the C-108 Application any samples of fresh water from the general area?

A. We took a sample out of that stock tank, just for reference purposes, and it's included on page 26.

Q. And what does that show?

A. It's -- I wouldn't drink it. It's got -- has about 5000 milligrams per liter of sodium. Total dissolved

solids are almost 12,000. So it's not real good quality water.

Q. Have you examined the available geological and engineering data on the area?

A. Yes, sir.

Q. As a result of that examination, have you found any hydrologic connections between the injection interval and any underground source of drinking water?

A. Yes, I have investigated all the geological/ engineering data, and based on my study this zone is isolated and there's no communication between zones above it or below it.

Q. In your opinion, will approval of this project result in the increased recovery of oil from the project area?

A. Yes, it will.

Q. Has this proposed project area been depleted to such an extent that it's prudent to implement a waterflood project to now maximize recovery from the area?

A. Yes, it has. We're in the final stages of a solution gas drive on the northern end of the reservoir, and it's now time to start water injection.

Q. Why don't you refer to Exhibits, I think, 2A and 2D in the engineering exhibits and generally just identify and review those?

A. Exhibits 2A through 2D are the production curves from the Armstrong Mobil Lea State 1, 2, 3 and 4. And as a typical solution gas drive reservoir acts, we have an increasing GOR up until about the middle of the summer of this year, 1995, and you'll notice that the GOR is starting to tail off.

You'll also notice a fairly steep drop in production since that time. The water cuts have remained fairly constant, or real constant.

The maximum GOR got up to about 3000 to 1 on the Number 1, about 2200 or 2400 to 1 on the Number 2, and almost 3000 to 1 on the Number 3, and about 2200 or 2300 to 1 on the Number 4.

Q. Has this Application been provided to all leasehold operators within the area of review for the injection well?

A. Yes, it has.

Q. And this is a state lease?

A. It's a state lease.

Q. Has the Application been reviewed with the Commissioner of Public Lands?

A. There's a meeting set up with the State Land Office today after this meeting to go over this proposal with them in person.

MR. CARR: Mr. Stogner, as we discussed earlier,

the Application will be presented to the Land Office today. And for that reason, at the end of the hearing we will request that the case be continued to the Examiner Hearing on January 11th to allow the required time for the Land Office to review the Application.

Q. (By Mr. Carr) Now, Mr. Stubbs, is Exhibit Number 7 a copy of an Application -- or an affidavit confirming that notice has been provided to the leasehold operators in the area of review?

A. That is correct.

Q. I'm going to ask you now some questions concerning the Application for qualification of this project for the recovered tax rate.

What are your -- What is the status of your current efforts to implement this pressure maintenance program?

A. We've just finished an update of our field study and have determined that it's now about time to start pressure maintenance in the south end of this sand. So we've made Application to the OCD to get authority to drill this well and inject water.

Q. And how soon do you plan to -- or hope to commence water injection?

A. This well is scheduled to be drilled either middle or late January, and if that happens on time we'll

probably start injection in February.

Q. Okay, let's go just back to page 5 in the C-108, and looking at that, would you identify for Mr. Stogner the producing wells that in fact will -- you anticipate, will receive pressure-maintenance support?

A. Okay, if you'll look at the injection well in the southwest-southwest of Section 2, the four wells just north of that, numbered 1, 2, 3 and 4 are the Mobil Lea State wells, and those wells lie in the sand pod that Mr. Boling described. It runs north and south through the southwest quarter of Section 2.

Q. What are the estimated additional capital costs to be incurred in this project?

A. We estimate that the cost to drill and equip the injection well is $328,675, the cost of the injection pump and facility is $32,500, for a total capital cost of $361,175.

Q. Now, what do you estimate to be the total value of the additional production that can be recovered from this project?

A. If we're successful in affecting the area -- Let's turn to Exhibit Number 3A. It's the colored picture.

Q. In the engineering exhibits?

A. Yeah, it would be about three or four pages -- three pages from the back.

We're expecting that injection well to affect the area highlighted in red around these four wells.

Q. 3A is where, Mr. Stubbs?

A. It's about three or four pages from the back. It's the colored exhibit, the numerical simulation.

EXAMINER STOGNER: Is that the 108 portion?

THE WITNESS: No, it's all the way in the very back of the --

EXAMINER STOGNER: -- of the book?

THE WITNESS: -- very back of the book. It would be the third page from the back.

EXAMINER STOGNER: Oh, here they are. Okay.

THE WITNESS: Okay, we plan to put our injection well at the lower end or the south end of this sand pod, and by injecting water, supplementing the natural water influx from the south, we'll push -- we'll not only pressurize, but we'll push oil up to the four producing wells in that sand pod.

And if we're successful in affecting half of the area in red, we'll recover about another 15 percent of the oil in place, which amounts to 306,000 barrels. At today's oil price, which is around $17.54 a barrel, to a 100-percent working interest, 80-percent net revenue interest, that has a value of $3,184,000.

Q. (By Mr. Carr) If this pilot project, or if this

pressure maintenance project is successful, does Armstrong have any plans to perhaps expand the project?

A. Yes, the natural thing, I think, would be to -- if we see a response from this well, would be to put another one or two wells on the perimeter of this sand. It would be along the east edge of the southwest quarter, on the downdip.

Q. Would that require, in fact, expanding the project area?

A. Yes, it would. Well, it wouldn't necessarily expand the area. It would still be the southwest quarter of Section 2.

Q. It just would --

A. It would be an addition of wells.

Q. Okay. Do you seek authority to add these wells with an administrative procedure, should in fact that become necessary?

A. Yes, we do.

A. Let's go to the last page of this exhibit, and I would ask you to review the production history on this project for Mr. Stogner.

A. This is a summation of the production from the Mobil Lea State 1, 2, 3 and 4, through October.

The oil production is solid black squares, and you'll notice there's a dashed line through those squares,

indicating the present decline through those points. That's about six percent a month.

You'll also notice that the last point jumps above the line, and that's -- they did some work on that well. That well is also a first-sand producer, the Number 3 well is also a first-sand producer, and they increased the pump capacity and got a little jump in the oil, about ten barrels a day, and a pretty big jump in the water.

Q. If I understand your testimony, by implementation of this project, you believe you can recover as much as 306,000 additional barrels of oil?

A. That's correct.

Q. Is it your opinion that to maximize the recovery of crude oil from the project area you need to implement this project at this time?

A. Yes, in our initial analysis of this reservoir, we determined that there is some water influx. It's not enough to call it a full water drive, but there is water coming into the reservoir, and we feel like by supplementing that natural influx, that we'll increase the recovery.

Q. If we delay implementation of the project, do you believe that could result in reserves ultimately being left in the ground?

A. Yes, we're starting to build some pretty high gas

saturations. So to avoid getting gas saturations too high we'd like to go ahead and start injection and start keeping the pressure -- maintain the reservoir pressure.

Q. You have shown with your testimony that the project is economically feasible. Do you see anything that would suggest to you that technically there would be any problem with implementing the project?

A. No, technically I think it's a very viable prospect -- or project. I might refer, if I can find it real quick, refer to Exhibit 2I

Q. In the engineering exhibits?

A. In the engineering exhibit, it would be in the individual well curves. 2I and 2J. These are two Read and Stevens wells that are located in the next little pod of sand to the west. But they're real close to the oil-water contact.

And you'll notice that they have relatively low GORs. And this Number 6 well, the GOR now is just slightly above 500 to 1. This indicates that the reservoir pressure in that area is staying relatively high, due to the water influx.

So we know that in going back through the volumetric calculations, it looks like these wells are going to recover a very large percentage of the oil in place, compared to some of the other wells.

Same thing is true on the next one, 2J. It's got a little higher GOR, but it's still a lot lower than a lot of the wells have been. Production has remained fairly constant, and it's also seeing some of the effects of the water influx to the south.

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

A. Yes, it will.

Q. Were Exhibits 6 and 7 prepared by you or prepared at your direction?

A. Yes, they were.

MR. CARR: At this time, Mr. Stogner, we would move the admission into evidence of Armstrong Exhibits 6 and 7.

EXAMINER STOGNER: Any objections?

MR. KELLAHIN: No, sir.

EXAMINER STOGNER: Exhibits 6 and 7 will be admitted into evidence.

MR. CARR: And that concludes my direct examination of Mr. Stubbs.

EXAMINER STOGNER: Thank you, Mr. Carr.

Mr. Kellahin?

MR. KELLAHIN: I have no questions.

EXAMINATION

BY EXAMINER STOGNER:

Q. Mr. Stubbs, what wells, once injection starts occurring, will see the increased production from the injection?

A. The first wells -- If we refer back to the little map on page 5 of the Application with the half-mile radius, the first well, the closest well, is the Armstrong Number 3.

The second closest well is the Armstrong Number 4, which is a little bit to the northeast of the injection well.

Q. Will Wells 1 or 2 ever see any increase, just from this injection well alone?

A. I think they probably will eventually. That injection well is right in the axis of the channel sand, right in the heart of the channel. So as water is injected, it's going to push oil up to the north, to the 3 and the 4.

Once those wells get a fairly high water cut and probably even at some point in time are plugged, well, then you're going to continue injection and push water up to the 1 and 2.

We want to -- Our reservoir management plan is to produce 1 and 2, keep the reservoir pressure relatively low

in that north end where the oil is up against the facies change, and let that oil go ahead and expand and get as much out of that -- attic oil out as we can from gas expansion.

Q. In looking at Exhibit Number 2C -- that's your engineering report -- you've given a graphical presentation of the history.

Once water injection starts, what are we going to be noticing? Or once response starts, are we going to see the oil increase as -- with the gas and the water production?

A. Initially, I think you'll see primarily an oil increase. As we pressurize that part of the reservoir, some of the gas will go back into solution, so you may even initially see a decrease in gas production.

Based on the Read and Stevens wells, it looks like we're getting very efficient displacement from the water, so I wouldn't expect to see any increase in water production for some period of time.

Q. Now you're proposing initially the injection will be taken under gravity?

A. I believe it will, yes. The reservoir pressure is probably -- in that part of the reservoir is probably -- we're going to find it in the range of 1200 to 1500 pounds. That gives us the delta P of 1000 pounds. Based on the

producibility of the wells, it's about half a p.s.i. -- or a half a barrel per p.s.i.

So we should be able to gravity 400 or 500 barrels a day in there without any pump pressure, initially, till it starts to pressure up a little bit.

Q. What kind of volume do you expect to see before you start seeing the pressuring up of --

A. There's probably -- Let's see. We've voided the reservoir of about 1.4 million barrels. We're guessing that we have an influx of about 400,000 or 500,000 barrels, and the north half of the reservoir is probably another half a million barrels. We're probably going to have to put in a couple hundred thousand barrels.

Q. And then your maximum pressure you're proposing is 750?

A. Yes.

Q. What's your timetable, do you expect, before you have to reach that maximum pressure?

A. I would expect it to be a period of two or three years, at least. Even at 400 barrels a day, that's only 150,000 barrels a year.

Q. And what's the present daily production from those four wells?

A. Let me turn back to the last graph. The oil production is about 8000 barrels a month. The water

production is a little over 6000 barrels a month. And the gas production is, oh, about 14 million a month, 14 million cubic feet a month.

Q. So not only are you proposing to build up what voidage is already there, but above what the voidage that is occurring presently?

A. Right.

Q. So let's see, what kind of volumes are coming out a day? What's that come out to? You said it was 800 barrels of oil per day --

A. 8000 --

Q. I'm sorry, a month.

Q. 8000 barrels a month. That would be about 250 or 260 barrels a day of oil.

Q. Okay, how much water a day?

A. Okay, that's a little misleading, because most of the water is coming out of the first sand in the Number 3 well.

If you'll go back, there's about 30 barrels a day actually coming out of the third sand.

Q. Okay. And is the gas somewhat nebulous in this calculation?

A. Yes, the original GOR is only about 350 to 1. The present GOR is probably about 200, 180 to 1.

Q. So when would you estimate seeing in the Number 3

well any kind of response?

A. There's probably, like I said, about 200,000 barrels of injection, is the voidage.

Q. And what kind of time period are we looking at?

A. A year and a half.

Q. Year and a half?

A. Year and a half, two years.

Q. At least. That's a very liberal estimate, right?

A. It depends a lot on how much water influx we've had. And initially, we ran some pressure buildup tests and estimated that by this point in time there would have been 300,000 or 400,000 or 500,000 barrels, depending on which scenario you used to come into this part of the reservoir.

So the injection well originally had about -- would have had about 20 feet above the oil-water contact. And when we drill it, we expect to see that that location will now be right at the oil-water contact.

Q. As far as any expansion through the project, additional injection wells, or producing wells for that matter, do you have any estimate of time on that?

A. Probably two years at least. We want to see some kind of response out of this first well.

Q. I see.

A. And if it's successful, then we'll evaluate putting another one or two injection wells around the

perimeter of this thing.

Q. I'd like to go over those capital cost and all of the cost figures that you had, or are they written down in this note somewhere? Exhibit 6, I should say.

A. They're on page 6, project capital costs. There's just a short paragraph outlining the cost.

EXAMINER STOGNER: Page 6. Okay, those are the figures I wanted. Okay.

Any other questions of this witness?

MR. CARR: Nothing further.

EXAMINER STOGNER: He may be excused.

MR. CARR: We have nothing further to present in this case, Mr. Stogner.

EXAMINER STOGNER: As far as the continuation of this thing -- so January, that's essentially because of the notification to the Land Office?

MR. CARR: Yes, sir, we were to meet with them. We might continue to the 21st, if I could present a waiver from the --

EXAMINER STOGNER: Why don't we do that? Let's continue to the 21st. And if you have a waiver in hand, we can accept it.

MR. CARR: And I believe -- From our contacts, I believe that's most likely.

EXAMINER STOGNER: Okay, let's do that. Let's

continue this matter to the hearing of December 21st for the admission of a waiver from the State Land Office, and if we don't have that in hand we can continue it one more time to the January -- that's the 11th hearing; is that right?

MR. CARR: Yes, sir.

EXAMINER STOGNER: And which time it will be taken under advisement.

MR. CARR: Yes, sir.

EXAMINER STOGNER: So if the waiver is in hand, we'll take it under advisement on the 21st. If not, we'll take it under advisement on January 11th.

Anything else?

MR. CARR: Nothing further.

EXAMINER STOGNER: Okay, I don't see any necessity of readvertising for that purpose.

So with that, this hearing is adjourned, and this matter will be continued to the 21st.

(Thereupon, these proceedings were concluded at 1:52 p.m.)

* * *

CERTIFICATE OF REPORTER

STATE OF NEW MEXICO)
) ss.
COUNTY OF SANTA FE)

I, Steven T. Brenner, Certified Court Reporter and Notary Public, HEREBY CERTIFY that the foregoing transcript of proceedings before the Oil Conservation Division was reported by me; that I transcribed my notes; and that the foregoing is a true and accurate record of the proceedings.

I FURTHER CERTIFY that I am not a relative or employee of any of the parties or attorneys involved in this matter and that I have no personal interest in the final disposition of this matter.

WITNESS MY HAND AND SEAL December 12th, 1995.

STEVEN T. BRENNER
CCR No. 7

My commission expires: October 14, 1998

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 11436, heard by me on 7 December 1995.

, Examiner
Oil Conservation Division