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

APPLICATION OF LOS LOBOS RENEWABLE POWER, LLC FOR APPROVAL TO INJECT INTO A GEOTHERMAL AQUIFER THROUGH TWO PROPOSED GEOTHERMAL INJECTION WELLS AT THE SITE OF THE PROPOSED LIGHTNING DOCK GEOTHERMAL POWER PROJECT, HIDALGO COUNTY, NEW MEXICO.

CASE NO. 14948

ORIGINAL

REPORTER'S TRANSCRIPT OF PROCEEDINGS

COMMISSION HEARING

VOLUME 4
(Afternoon Session)

BEFORE: JAMI BAILEY, CHAIRPERSON
TERRY WARNELL, COMMISSIONER
ROBERT S. BALCH, COMMISSIONER

March 26, 2013

Santa Fe, New Mexico

This matter came on for hearing before the New Mexico Oil Conservation Commission on Tuesday, March 26, 2013, at the New Mexico Energy, Minerals and Natural Resources Department, 1220 South St. Francis Drive, Porter Hall, Room 102, Santa Fe, New Mexico.

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INDEX

EXHIBITS MARKED, OFFERED AND/OR ADMITTED

EXHIBITS MARKED, OFFERED AND/OR ADMITTED

	PAGE
LOS LOBOS EXHIBITS:	
15A - (Red line) "Lightning Dock Geothermal (HI-01) LLC Project, Class V Injection Well 53-07 (GTHT-001), G-112 Form, OCD Santa Fe Office, Conditions of Approval, 3/19/2013	601
15B - (Red line) "Lightning Dock Geothermal (HI-01) LLC Project, Class V Injection Well 55-07 (GTHT-001), G-112 Form, OCD Santa Fe Office, Conditions of Approval, 3/19/2013"	601

(1:20 p.m.)

CHAIRPERSON BAILEY: We'll go back on the record.

Before we had the public comment, we were still listening to cross-examination by Ms. Henrie.

MS. HENRIE: Madam Chair, I do have one question that would help me know how to better cross-examine the witness. Will the Applicant be allowed to bring up rebuttal witnesses? May I recall my witnesses to rebut specific information after the Applicant -- or the Protestant rests its case?

CHAIRPERSON BAILEY: That's standard, yes.

MS. HENRIE: Very good.

DAMON E. SEAWRIGHT, Ph.D.,

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

CONTINUED CROSS-EXAMINATION

BY MS. HENRIE:

Q. Mr. Seawright, just one more question for you. During the pumping well test and hopefully throughout operations, would you let us monitor your wells?

A. We're open to discussion on the subject. At the minimum, we will be monitoring them.

Q. Would you share that information with us?

A. We're open to discussing that.

MS. HENRIE: Thank you. I have no more questions.

CHAIRPERSON BAILEY: Mr. Brooks, do you have questions?

MR. BROOKS: I have a few questions, yes.

CROSS-EXAMINATION

BY MR. BROOKS:

Q. Mr. Seawright, good afternoon.

A. Good afternoon.

Q. How many acres of geothermal do you have under geothermal lease -- that AmeriCulture has under geothermal lease?

A. Ten acres.

Q. Ten acres. Okay.

And that is a lease from the State of New Mexico?

A. It is.

Q. And that's your only geothermal lease in this area?

A. It's the only direct geothermal lease.

Q. Do you have anything that's subleased --

A. Well, we are a designated operator under the -- the federal lease under the 15 acres.

MR. BROOKS: Your Honor, I would like to have Mr. Seawright identify the AmeriCulture boundary on what's about to become a part of the record, because that (indicating) will not become part of the record and before a court, in the event anyone takes this proceeding to court.

First of all, I borrowed this from the court reporter. This is the original AmeriCulture exhibit book, and she made me swear, much stronger than the oath to the witnesses, to return it. But I would like to have Mr. Seawright mark the AmeriCulture boundary on this map that will be part of the record, if that pleases the Commission.

CHAIRPERSON BAILEY: And which exhibit is that?

MR. BROOKS: This is Los Lobos Exhibit 3. It's page 4 of Los Lobos Exhibit 3.

CHAIRPERSON BAILEY: Which is a PowerPoint?

MR. BROOKS: Well, these are various maps. Exhibit 3 starts out with a map of the state of New Mexico, and then page 4 is a map of this immediate vicinity. I believe Commissioner Balch had it in front of him.

CHAIRPERSON BAILEY: Oh, Los Lobos.

MR. BROOKS: Oh, I didn't realize they have a drawing, but I want it marked on something that will be a part of the record.

MS. HENRIE: Let's do both.

MR. BROOKS: Okay. That's fine. I believe Commissioner Warnell has found Exhibit 3. Yeah, that's it. Commissioner Warnell has it, and I believe the Chair has it, also.

CHAIRPERSON BAILEY: Which is labeled as "Cross-Section Location"?

MR. BROOKS: Yes.

May I approach the witness?

CHAIRPERSON BAILEY: Yes.

Q. (BY MR. BROOKS) Now, you have marked a number of things on this map. And I'm looking at what has been marked on this map, which is page 4 of Los Lobos Exhibit 3, and I'll give you this marking pen which will be very distinct from anything that's on that exhibit now. This is a black marking pen, I believe, so that a court reading the transcript can tell what your marks are and what was on the exhibit before. I would like you to mark AmeriCulture's boundary on that exhibit.

A. Very well (indicating).

Q. Well, I believe -- let's see. Are your wells -- there are two wells there that are identified as AC. I assume those are AmeriCulture's; is that correct?

A. They are.

Q. Now, those are different -- those look like they're different numbers from the wells you've marked on here.

A. No. It's a -- this says "ST #1," which would be --

Q. Oh, State #1.

First of all, mark your boundary, and then we'll talk about the wells?

COMMISSIONER WARNELL: Are we marking the two acres?

A. I'm marking the 15 and the 10.

Q. (BY MR. BROOKS) Okay. What is the significance of these two tracts that you show up here on the board (indicating)?

A. The tract to the left is 15 acres. It's rectangular in shape. And it's comprised of 15 surface acres, and it is deeded land.

Q. By which you mean it's private ownership?

A. It's private ownership and mineral reserve land for the federal government --

Q. So the United States of America owns the minerals?

A. Yes.

Q. And a private party owns fee simple title to the surface?

A. Correct.

Q. Now, what about this tract over here (indicating)? What's this (indicating)?

A. That's State Trust Land, as far as it's -- it's a perfectly square quarter-quarter-quarter section comprised of ten acres, basically, yeah; so 60-feet square, and it is State Trust Land. We also have a business lease on that land as well, besides --

Q. And you have a geothermal lease on the state minerals?

A. We do.

Q. And here (indicating), you said -- is it Los Lobos that has a geothermal lease on this land?

A. Yes, they do.

Q. You're using the 15 acres?

A. Yes.

Q. And you are the designated operator?

A. Yes.

Q. Now, would you mark both of those tracts as best you can, on page 4 of Los Lobos Exhibit 3, in black -- with a black marking pen?

A. (Witness complies.)

Q. And please don't cover up any well names -- well numbers with your mark.

Now, Ms. Henrie has requested that you make similar marks up here on the board, on the blowup of this exhibit. I'm inclined to think this will not become a part of the record, so I don't really care, but if Ms. Henrie would like for you to do it, that's fine with me.

MS. HENRIE: Mr. Brooks, I was thinking it would allow the Commissioners to see those boundaries.

MR. BROOKS: It's entirely satisfactory with me.

MR. LAKINS: Me, too.

A. May I put it on the ground?

Q. (BY MR. BROOKS) You may. Mark it wherever you want to.

A. (Witness complies.)

Q. And thank you, again, for not covering up anything with your marks.

A. That's probably good to five-foot resolution.

Q. Okay. Now, the square -- confirm this for me: The square tract to the right that you have marked on both the original and the blowup is the state ten-acre tract?

A. Connect that one right there.

Q. That's all right.

MR. LAKINS: You need to speak up, so the court reporter can hear you better, Damon.

THE WITNESS: Okay. Sorry about that.

Q. (BY MR. BROOKS) And the elongated tract to the left, that is the fee simple title to the surface federal minerals tract that you testified about?

A. That is correct.

Q. Okay. Now, on the board here, you have marked State Well 1. Is the well on the exhibit, the red dot marked "AC ST #1," the same well you've marked as State #1 on the board?

A. Yes, it is.

Q. And is that -- let's see. You didn't mark State #2?

A. (Indicating.)

Q. Oh, you did. Okay. That State #2 is AC ST #2 on the exhibit?

A. The exhibit and the drawing are the same.

Q. Now, you also marked another well that is over in the federal tract, A-444. Do you note the location of that well on the exhibit?

A. This is approximately close. Should I write "A-444"?

Q. Yeah. Write "A-444" somewhere there.

A. (Witness complies.)

Q. And please go and do the same on the original.

A. I can make a dot. May I?

Q. Yeah, make an arrow. That will be fine.

A. (Witness complies.)

MR. LAKINS: That's not a pen.

Q. (BY MR. BROOKS) Now, what is the water temperature in what you've marked as State Well #1?

A. 232 Fahrenheit.

Q. Is that the temperature at the surface, or is that measured downhole?

A. That's under pumping conditions.

Q. So it's measured at the surface, but it's under pressure?

A. Yeah. On the discharge head of the pump, there is a well in which you can stick a probe.

Q. And what is the fluoride -- I take it that's the measured flouride content that's produced from State --

A. It has been measured.

Q. And what is that?

A. Approximately ten -- each time it's measured -- there are certain differences in measurements, but it generally falls between the level of approximately 9 and 11, I would say, with the various measurements over the course of time.

Q. And are you aware of what the state water quality water standard is for flouride?

A. Yes, I am.
Q. What is it?
A. 1.6 milligrams per liter.
Q. This is quite high for the State?
A. Yes.
Q. I believe you testified to this before, but I sometimes have trouble hearing you, so I'll ask you to testify again, if you'll be so kind. What is the tolerance for your operation for flouride that you testified to?
A. The precise upper bound for flouride for the helper fish, we have to estimate it --
Q. Yeah.
A. -- because we know that ten is too high. We know that 5.6 is fine. As far as the impacts of flouride on tilapia growth and skeletal health, it's not an area of active research in my discipline, so it's not precisely studied, but it does lie between those backgrounds. And we have seen considerable skeletal anomalies when we use too much hot water.
Q. And I'm going to return to my seat now, because I think I'm through with the board.
So you're currently treating your water before you put it into your fish tank; is that correct?
A. No.

Q. Does that come from some other source other than State Well #1, the water in the fish tank?
A. Yes. It comes, currently, from two sources, State Well 1 and our A-45-A well, which is far beyond the bounds of this particular map, or this one, that lies 1.6 miles to the west.
Q. And does that have a much lower flouride content?
A. Much lower.
Q. So you mix the two and that --
A. Yes.
Q. -- reduces the overall content?
A. Yes.
Q. Before I lose track of what I'm doing, you've also marked State A-444 on the exhibit and on the blowup, correct?
A. I have.
Q. And what is the water temperature measured there?
A. The last time we measured it, which was years ago when it was pumping, it was 110 Fahrenheit.
Q. Very good. We don't have to mark that.
Well, now, let's see. What is that other well that is off -- you said a mile and a half away?
A. It's Well A-45-A.

Q. Oh, okay. That's the one where you're getting your low-flouride water, right?

A. Yeah. And it's also quite cool, 68 Fahrenheit.

Q. Very good.

Now, Mr. Seawright, are you familiar with the concept of incidental use as that's stated in the Geothermal Resources Conservation Act?

A. I've read that many times, though I'm not an attorney.

Q. Okay. Are you contending that any of AmeriCulture's extraction of geothermal resources is simply incidental to your use of your water?

MR. LAKINS: I'm going to have to object. It calls for a legal conclusion on that.

MR. BROOKS: Your Honor, whether it is or isn't a legal conclusion, I'm just asking if he's contending that. And if he doesn't -- hasn't decided or doesn't know if that's his legal position, then he can just say so.

CHAIRPERSON BAILEY: Then please respond. If you don't know, then that's perfectly acceptable, too.

A. My understanding of incidental, to a degree, is synonymous with intentional, and by and large, certainly when we pump State Well 1, we fully intend to use the

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thermal energy in that well. It's quite intentional. It's not accidental or extraneous.

Q. (BY MR. BROOKS) That's a little different from the way I would understand the term, but I guess the bottom line is, are you contending that you have a right, by virtue of your water right, to use a certain amount of water for extraction of geothermal resources regardless of the portion of reservoir in which you have geothermal lease rights? And, again, if you don't know, you may defer to your lawyer then.

A. I will defer to my attorney, because it deals with correlative rights, and I am not an expert in that discipline.

Q. That's fair.

I'm trying to think if I had any other questions for you, and I don't believe I do.

MR. BROOKS: So I will pass the witness.

CHAIRPERSON BAILEY: Mr. Warnell?

MR. LAKINS: Do I do redirect?

CHAIRPERSON BAILEY: Redirect after we do our questions.

COMMISSIONER WARNELL: No questions.

CHAIRPERSON BAILEY: Commissioner Balch, any questions?

COMMISSIONER BALCH: That's a funny

statement, because I always have questions.

CROSS-EXAMINATION

BY COMMISSIONER BALCH:

Q. Good afternoon, Mr. Seawright.

A. Good afternoon.

Q. Or Dr. Seawright. I'm sorry.

Over the 18 years or so that you've been involved in using water from the State Well #1, that temperature of 232, has that been stable, or has that changed?

A. It's been approximately stable. It has increased slightly. We noticed over the course of time, the temperature of these state wells has increased modestly with usage. It was in -- I may not be correct here, but I believe it was in the early '90s that the Rosette operation acquired the state lease to the north of our facility and began pumping, and that has had a modest upward effect on temperature and probably is just a modification of the underlying hydrological flow that existed in absence of that pumping.

Q. And for the A-444 well, I guess that hasn't been used -- was it since 2009 or --

A. Yes, 2009.

Q. So intermittent use, but not since 2009?

A. It was used continuously up until 2009. The beginning date, I would have to -- I would have to review our records on that.

Q. There is some confusion. I think Ms. Henrie's pointed out that you mentioned, in 2002, it wasn't being used.

A. Oh, no, it was not at that time either.

Q. So it had a period of use, and then it went back into use about when?

A. I can only estimate, if that would be acceptable for purposes of the record. It would be, you know, 2006, 2007, in that time period.

Q. Three or four years?

A. Although I'm not certain.

Q. Why aren't you using that well now?

A. The pump burned out.

Q. Pumps can be replaced. You built the pipeline to the other well, or was that already replaced?

A. As far as already using State 1 well, and we were already using the A-45-A well.

Q. So you didn't need the heat content from the A-444 well?

A. We improvised our operations to get by. We do want to get it running again. We improvised in the meanwhile with the resources that we have. The cost of this engagement by Raser Technology and Cyrq is very costly and has a taxing effect on our discretionary capital. Because it is mildly conventional, submersible motors are not usable in this type of well. Even water temperatures in the 80s are unsuitable, generally, for long-term submersible pumps, and especially of higher temperatures. Submersible motors like the one that burned out, they're more costly.

Q. There is no way to test the water in that well right now?

A. We could fairly and expeditiously if we wanted to. It would be a simple matter of -- we could put a pump in there and run it. I'm talking about long-term duration.

You know, for example, the McCants' homestead, which is right here (indicating) -- for many years, he pumped super-heated water with conventional motors, but if you go out behind his house, he has a huge stack of burned-up motors. He chose to replace them all the time. That's not our approach.

Q. When you had the Rhodamine in your fish tanks, did you check the water in A-444?

A. No. No.

Q. And, obviously, then, you go to A-45-A?

A. We did not notice it through our -- the fluorescence test we looked at, which was not quantitative. However, we did cooperate with a subcontractor for Cyrq who collected cold and hot water samples. It was determined that the level, at least at one point, of Rhodamine WT was 83 parts per billion. He did not indicate that they found any in the freshwater well to the west, and, honestly, I wouldn't expect it out there.

Q. When the water went from -- you said the water is still green?

A. It's turned green.

Q. And it was pink before?

A. Yes.

Q. And what's the green? Is that the same tracer or a different tracer?

A. I would like to know the answer to that question as well.

Q. You sent that out for analysis?

A. No. We've collected samples but not had it analyzed. I requested of Cyrq -- I know they collected samples after it turned green, and I was interested in what it was. It was verified that the absorbing of spectrum changed from the Rhodamine WT. I presume they had not identified it, because -- the subcontractor I'm referring to is Mr. Gregory Miller. He did not indicate to me what it was, what chemical species it was. I

would like to know.
Q. So last week -- I know you were here in the room -- Dr. Shomaker was showing us plats of the water table during the previous pump tests and various wells, and I noticed distinct diurnal fluctuation in that.
A. Uh-huh.
Q. Do you know if that was corrected for Mr. Burgett's test, where he just kind of checked flow level?
A. I would -- I don't believe it was. I think with regard to that correction, I would have been aware of it, and I'm not.
Q. On the Raser test -- I think it's in your Exhibit 16. Could you just tell me which wells are the West State and the East State?
A. I just need to know where you are.
Q. In your exhibits, 16.
A. Oh, in my exhibits.
Q. It's probably four or five pages back.
MR. LAKINS: That's not in that. You might have a hard copy.
A. My exhibit book goes up to 15. Could I speak to that slide?
Q. (BY COMMISSIONER BALCH) The West State and East State, could you identify those wells for me? Everybody

uses different names for each of these wells.

A. I cannot identify them. Rosette has six wells, to my knowledge. Four of them are fairly close to our ten-acre boundary.

May I draw here?

Q. Yeah, go ahead.

CHAIRPERSON BAILEY: And duplicate it on the --

COMMISSIONER BALCH: On the official copy.

CHAIRPERSON BAILEY: So we can have something in record.

A. There's a lot of guesswork in where it is. Maybe it's best not to contaminate the record, unless --

Q. (BY COMMISSIONER BALCH) Point with your finger first, and then --

A. There's a well approximately here, here, here and here (indicating), and the Rosette designations are A, B, C and D. I don't know which ones --

Q. But the West State and East State on this interference test is not State 1 and State 2 wells?

A. Because there are four in an east-west trajectory. I don't even know which ones were --

Q. And if you don't know, you don't need to guess.

A. Yeah. Because of his nomenclature, there was -- one well was considerably more productive than the others, a production rate of about 1,200 gallons.

Q. You think, generally, northwest of your operations -- or northeast?

A. Yeah, they're north and east of our operations and, essentially, north of our state well completions.

Q. So also north and east of the 55-7 well?

A. Pardon?

Q. Then also, obviously, north of the 55-7 well?

A. Yeah. The 55-7 well would probably be in a south-southeast -- south-southwesterly direction.

Q. So when I look at this interference test, I see a dip in water level, when you turn on the West State, at 1,000 gallons per minute.

The next thing is, turn off the West State and turn on the East State, and shortly thereafter, you turn on the T-55, which I think is the 55-7 well.

A. Uh-huh.

Q. At that point, you see the water level going up.

And then a few days later, you turn the West State back on, while leaving the East State T-55-7 well on. And then at that point, the water level starts to dip again, until such time you turn all of them off --

A. Yes.

Q. -- or the level goes back up.
The other thing I'm noticing on this is that the 55-7 well is drawing down 300 gallons per minute. I'm presuming that's the pumping limit or something at that time, but it's a third of the draw rate of either of those other two wells. So my concern is that any impact on the 55-7 well, on this diagram, is going to be buried in noise.
A. It may very well be.
Q. And, really, if I look at it, I think the biggest impact is when the West State is on. That's where I see most of the drawdown coming from.
A. Yeah. And this interference test is completely different from the 30-day closed-loop test that was conducted. The reason we included this slide is to show the high level of interconnectivity between the wells, and the rapid response that one sees when pumping or not pumping a well on static water level in adjacent wells.
Q. I guess when I look at this, I'm thinking, if you only -- it seems like this is dominated by the effect of the West State well.
A. That may very well be. My understanding is that the production of -- production rate of T-55 has increased.
Q. Certainly proposing a much higher rate --

A. Yeah.

Q. -- for their new test?

A. But I would agree with your conclusion, that the predominant effect is the state well is in close proximity of that observation well.

Q. Obviously, we can't get involved in joint operating agreements. That's not in our domain. We can't tell people what to do in contracts, but has there been any attempt or would you be open to some kind of attempt in modifying the joint operating agreement between the two organizations? It goes back to 1995. Both of you have changed what you're trying to do in the interim a couple of different times. Maybe it's time for a new agreement.

A. Well, is that a question, or --

Q. I'm wondering if there has been any attempt, first of all, to try to work out a new operating agreement between the two entities.

A. There was more than one attempt at coming to a resolution between the parties over the years. The content of that, as much as I would like to share it, was protected because it was under the control of a settlement conference agreement, and we were not able to come to a conclusion.

Q. It seems to me that a lot of the disagreement is in the meaning of that language, so perhaps it could be clearer between the companies. Just an observation.

COMMISSIONER BALCH: I think those are all the questions I have.

CROSS-EXAMINATION

BY CHAIRPERSON BAILEY:

Q. Let's go to Exhibit 10, page 5, the bottom photograph on that page indicates quite a bit of the precipitant on the pipe. What is that?

A. Jim Witcher, I believe, will speak to that. It's calcium carbonate.

Q. Is that detrimental to the fish to have that high level of calcium carbonate?

A. Not at all. In fact, the technology we use in recirculating systems, one of the key elements is what's called a biofilter, and it's an adaptation of municipal wastewater bacteria, beneficial bacteria found in the soil, and water convert ammonia, fish excrete, which is very toxic to fish if allowed to concentrate into nitrate, which is essentially nontoxic. Carbonate -- bicarbonate alkalinity is a food source for the fish, and they consume a great deal of it, and we're fortunate that the water has sufficient carbonate where we do not have to add sodium bicarbonate to our water. But many of our customers do have to supplement to produce that.

Q. Do you have failure of your pump because of the high carbonate?

A. Occasionally, yes. We've gone -- it's a matter of matching the appropriate technology, the proper application, the pump. Our water is pumped from the ground into an insulated storage tank, and from that insulated storage tank, water is drawn and distributed throughout. The facility has the secondary booster bumps used to distribute water, and we went through a number of different models until we found one that was not forging [phonetic;sic]. And basically it's a materials question. Stainless steel -- this type of precipitate does not attach to stainless steel, so we've had a lot of success since then.

Q. Because you described the collapse of your pump, and I was wondering how big of a factor the precipitation is on -- obviously, the pipes in this situation would come into play in this falling apart.

A. Yeah. What you find -- in our case, our production pump has a valve very close to the outlet of the pump, and that is where the pressure is maintained in that pumping system to prevent the flashing that occurred in that instance. Once it gets past that valve, the pressure will drop considerably. And what we found there is precipitate formation, but because it is a turbulent flow, the precipitate forms sand grains, I would assume, composed of the same compounds. And those sand grains basically travel down the pipeline with the fish. And we have a sand pipe that precedes our insulated storage tank where those, for lack of a better term, sand grains settle out. They're easily removed. Occasionally, when we do have to remove flashing [sic], you'll see that the inside of the pipes has a degree of filament on the inside, where the Rosette -- the rose farm simply ran high temperatures through their production with space heat. At their facility, they have very little scaling inside pipes, and the reason for that is, they maintained a high level of back pressure on that geothermal water throughout the course of its use. And once it reaches -- hits the boiling point or less, it's in the beginning form to precipitate, which is a flashing-related cause.

Q. The water in the tanks is green, or is the water coming into the tanks green?

A. Both. And it depends on the system. Some systems on our farm -- we have a lot of different tanks, a lot of different subsystems that have different functions. Some operate at what's called a very high recirculation rate. That means they don't exchange much water, very little water. They're thermally efficient.

Those tanks tend to be low to the surface area, which reduces evaporative heating loss, which is -- the prime driving forces of heat loss in a system like ours is evaporation of water. That's why swamp coolers work so well.

We have other tanks like breeding tanks that are shallow and very wide and very long. As far as the ratio of surface area to overall volume, it's very high. They tend to cool very quickly. They require a higher volume of hot water. And so the pictures that you saw, at least three in the slide presentation shown, the initial pink-fish and colored-water pictures, those are the breeding tanks, and they require a lot of hot water to keep them warm.

Q. Did you produce hot water or a blend with it?

A. Basically, when we collect the young, the offspring eggs, those tank pressures refilled with a mixture of hot and cold water so that they're ready the next morning. And depending on the season; in summer, very little hot water. In winter, you need more. And, naturally, coming into the spring season, and I would expect the color of this water to lessen in intensity as just the overall average temperature increases and we need less hot water.

Q. So if Well A-444 was reactivated with its

110-degree geothermal heat, you would actually be using more of the fresh water -- or less of the fresh water --

A. Oh, we would use the same amount of fresh water. We may have, because of the modest thermal content water, used somewhat less from the State 1 geothermal. But when we lost the use of that well, it altered the water budget for our entire farm. We had to operate things differently, and I would say suboptimally. In order to operate optimally, we would require that to be running.

Q. So you intend to reactivate A-444?

A. We do.

CHAIRPERSON BAILEY: Those are all the questions I have.

Do you have redirect?

MR. LAKINS: Madam Chair, Commissioners, you asked most all my redirect questions.

REDIRECT EXAMINATION

BY MR. LAKINS:

Q. Mr. Seawright, when you plan to reactive- -- in your plans to reactivate Well A-444, do you plan to reactivate your water rights that you have in that well?

A. Yes.

MR. LAKINS: No further questions.

CHAIRPERSON BAILEY: You may be excused.

MR. LAKINS: Oh, wait, wait wait.

Q. (BY MR. LAKINS) Before we do that, the exhibit that has been marked on, I just want to make sure, for clarity purposes, that everything is on there, that you have written the number, the temperature and the flouride.

A. I have only -- I have written "A-444." I have drawn boxes around both the fee land and the state land, and there is no other information included.

Q. What I would just ask is that the drawing that you make, you include the temperature and the flouride on there, as you've indicated on the visual aid as well.

THE WITNESS: Is that okay?

MR. BROOKS: I have no objection to that. I didn't ask him to write those things on there, which is why it's not on there, but I have no objection to that if he can do so without obliterating anything that's on there.

CHAIRPERSON BAILEY: There is that caveat, please.

THE WITNESS: Okay. I'll be careful.

CHAIRPERSON BAILEY: Call your next witness.

MR. LAKINS: Call Jim Witcher.

JAMES C. WITCHER,

after having been first duly sworn under oath, was questioned and testified as follows:

DIRECT EXAMINATION

BY MR. LAKINS:

Q. Good afternoon.

A. Good afternoon, Chair and Committee.

Q. Mr. Witcher, could you tell me, how long have you been involved in doing any work for AmeriCulture?

A. I have worked for AmeriCulture since approximately the 2001, 2002 time frame.

Q. Just sort of as a summary of work that you've done for them, could you kind of describe that?

A. Yes. Some of the first work is a pump test that was done, that we've already talked about, and I also was involved in some work where we were evaluating some of the geology and geoscience that was associated with the AmeriCulture lease and with the surrounding properties so that we would have an understanding of how productive that resource may be and how AmeriCulture could best use the resource for their plans in the future and their current operation.

Q. I want you to turn to Exhibit 1 in that blue binder, if you would, please. Could you tell me what that is?

A. This is a short resume --
Q. Short?
A. -- for James Witcher.
Q. And without reading every single thing on there, could you give me a summary of your educational background and professional experience?
A. Yes. My education is New Mexico State University, bachelor's degree, and I also have a master's degree from New Mexico State University. My main emphasis in graduate school was inorganic aqueous geochemistry. And I am also fairly familiar with potential field geophysics, which deals with heat flow and gravity methods. And that also dates back to my undergraduate studies. This is where I became interested in geothermal engineering, as an undergraduate, and spent several summers working with the professors on some of their research in that time frame.
Q. I'm sorry. Go ahead.
A. My work experience, I have 35 years, roughly, of experience working with geothermal. I started my professional work at the University of Arizona, with the state geological survey in Arizona. I generated the first geothermal map of Arizona.
Since that time, I came back to New Mexico

and worked with the Southwest Technology Development Institute, which is an applied research institute on the NMSU campus that teaches geothermal renewable energy, and for most of that time, I headed, you know, geothermal projects at the Institute.

And since that time, I also have started a consulting business, and so I do geothermal work all over the western United States. And as an aspect of all of my work, I have expert knowledge of the geothermal resources in Arizona, New Mexico and Colorado, and I actively work in all of these areas. Most of my work is dealing with direct-use geothermal operations, and I have a lot of expertise in designing and evaluating geothermal greenhouse operations, also.

MR. LAKINS: Move to admit Exhibit 1.

MS. HENRIE: No objection.

CHAIRPERSON BAILEY: It is admitted.

(AmeriCulture Exhibit Number 1 was offered and admitted into evidence.)

Q. (BY MR. LAKINS) Now, Mr. Witcher, if you would turn to page -- or excuse me -- our Exhibit Number 2, and could you describe for me what that is?

A. This is a paper that was published in -- I have to look on here -- 2008. It's in the New Mexico Geological Society Guidebook. These are peer-reviewed papers, and this paper outlines the basic geologic framework for the Lightning Dock area. And my main interest in taking a look at this was taking a look at some large-scale structures that occur regionally across southern Arizona and southwestern New Mexico, and Lightning Dock provided a very good example of this.

Lightning Dock being a blind geothermal system, my thought is that there may be many more of these types of systems existing in the Southwest area and southwest New Mexico. So I thought it would be a very good idea to take a look at the detail on how that occurs, and also it allowed me to explore and advance my knowledge on the regional geology in the area.

And we had enough information to do this because one of the holes that was drilled on the AmeriCulture property was done with core drilling. This (indicating) is a sample of some of the core that has come from that. We may talk about it later (indicating). And we also had very good cuttings, so I was able to put together a very interesting picture in an exploration framework for the region, and Lightning Dock was a very good example. And this is probably the -- probably the best paper that's existing out there on the local geology of Lightning Dock right now.

Q. Now, you had mentioned two particular things.

CHAIRPERSON BAILEY: Mr. Lakins, are you tendering him as an expert witness? We haven't gone through that exercise yet.

MR. LAKINS: I'm working on it.

Q. (BY MR. LAKINS) You had mentioned two specific phrases for potential field geophysics and aqueous geochemistry. Could you explain what both of those are?

A. Aqueous geochemistry is a fancy -- fancy word for water chemistry. And in my particular case, I'm interested in the temperature of -- interested in the chemistry of temperature, elevated temperatures and how that may change, and that's how it relates to geothermal.

My background of geophysics considers most everything except seismology and gravity and heat flow, would be very good examples of that sort of field of endeavor.

Q. And could you just kind of expand a little bit on your experience in those two things, the potential field and that aqueous?

A. With the aqueous geochemistries, I've published papers along these lines. I've developed my expertise over the years in the Las Cruces region. I have real expertise on the sources of salinity in groundwater and also the Rio Grande within the Mesilla Basin and some of the surrounding areas there. And that's one of the areas where I've published work quite a bit. And also, over the years, I've done some work in the particular areas of geothermal.

In geophysics, I've worked and published a couple of reports on heat flow of specific areas and also have worked doing gravity surveys. I've also been coauthor and co-investigator on several electrical geophysical dipole-dipole resistivity surveys, and survey electrical properties under the ground and identify water and the permeability and porosity and even temperature, and also SP surveys, meaning the published papers with a colleague at the University of Utah on that.

MR. LAKINS: Madam Chair, I would tender Mr. Witcher as an expert geologist, expert in aqueous geochemistry and an expert in potential field of geophysics and an expert in the Lightning Dock Geothermal Reservoir.

MS. HENRIE: No objection.

MR. LAKINS: Move to admit Exhibit 2.

CHAIRPERSON BAILEY: He is accepted.

Any objection to Exhibit 2?

MR. BROOKS: No objection.

MS. HENRIE: No.

CHAIRPERSON BAILEY: It is admitted.

(AmeriCulture Exhibit Number 2 was offered and admitted into evidence.)

Q. (BY MR. LAKINS) Now, Mr. Witcher, the first thing I'd like to ask you about is this slide -- whoops -- which we looked at -- these slides which we looked at yesterday, this slide was from Mr. Janney's testimony. Could you give me an opinion on this slide and the accuracy of the information on this slide?

CHAIRPERSON BAILEY: Would you reference what exhibit number it is?

MR. LAKINS: This was from Mr. Janney's -- let's see. Just one moment, Your Honor.

MR. BROOKS: I believe it's Exhibit 3.

MR. LAKINS: 3.

MR. BROOKS: Los Lobos Exhibit 3, page 3.

Q. (BY MR. LAKINS) Los Lobos Exhibit 3, page 3. Could you give us your opinion on the accuracy of this slide?

A. This particular slide is reported to show the geology of the region around the Lightning Dock area, and I find it to be very sloppy. And I find it to be typical of a lot of information that gets thrown out by Raser and Cyrq over the years, and there are some inaccuracies here that need to be pointed out.

The first one that really struck me is the labeling of the unit called TKv as Pyramid Peak volcanic rocks. That is nonsense. In fact, there is not even such a nomenclature for volcanic rocks in that particular region. The nomenclature for Pyramid Peaks refers to rhyolite dome, which is located down in the Tv unit. The TKv unit is a much older unit that goes back to the Late Cretaceous and earlier, and is mainly andesite. So that is completely mislabeled, and it's inaccurate.

If you go over to the blue unit on the left, that's listed as "undifferentiated carbonate rocks." Well, that's not true. At least half of that terrain right in there is Precambrian granite. In fact, there is a mainstay in there, a granite gap. If you drive the highway over to Rodeo, New Mexico, that peak is Precambrian granite; and also older intrusive rocks there actually form the peak to the mountain itself, and to the north is Precambrian granite.

The other problem I have is that the Muir Cauldron, which is a -- cauldron, which is a term for the remnants of a caldera structure that forms by a very large alluvium that then collapses. Well, the ring or circle is inaccurately mapped, and especially the northern end of that. That caldera boundary should not exist past the Tv unit that's on there. And so the south part ends further than it should. And this can be double-checked by going to a publication by Wolfgang Elston and other students, which is a New Mexico Bureau of Mines publication. I've got a copy of it. And we could go through that in detail if anybody wants to check my analysis on that.

MS. HENRIE: Madam Chair, we have a copy. We would like to go ahead and do that.

THE WITNESS: Let's do it.

MR. LAKINS: Wouldn't that be appropriate for cross?

CHAIRPERSON BAILEY: He has offered to go into detail.

MR. LAKINS: Yes, Madam Chair.

MS. HENRIE: Mr. Witcher, do you have a copy? I thought you said you did.

THE WITNESS: In my briefcase.

MR. LAKINS: May I?

CHAIRPERSON BAILEY: Yes.

VOIR DIRE EXAMINATION

BY MS. HENRIE:

Q. Mr. Witcher, I'm looking at page 20, which is a figure --

MR HENRIE: For the record, this is

New Mexico Bureau of Mines and Mineral Resources Circular 177, dated 1983.

Q. (BY MS. HENRIE) So we're looking at the first --

A. Yes.

Q. -- page, and it's by Wolfgang Elston, Edmond Deal and Mark Logsdon, right?

A. Yes.

Q. "Geology and geothermal waters of Lightning Dock region, Animas Valley and Pyramid Mountain, Hidalgo County, New Mexico," correct?

A. That's correct.

Q. And page 20, Figure 7. And what I'm looking at is up at the top, which you call the TKv, there in orange?

CHAIRPERSON BAILEY: Well, let's let him go into the detail he offered to go into. Then you can have your cross-examination.

MS. HENRIE: Fair enough.

A. Okay. With reference to page 20, Figure 7, this particular geologic map ends right about there (indicating) and the volcanics that you see at the end of the north edge of this Figure 7 is right there where my squiggly, shaking hand laser pointer is.

CHAIRPERSON BAILEY: If he doesn't offer

anything else, then you have to come in with cross. I'm allowing his attorney to give him the time he needs to have in order to go ahead and take advantage of his offer that he made.

MS. HENRIE: Thank you. I wasn't clear.

MR. LAKINS: Well, Madam Chair, I'm a bit confused at the moment, because I was pretty much done questioning on this, and anything left to cross is cross. I am not sure exactly how to proceed, since the Chair has offered Los Lobos an opportunity to discuss this with Mr. Witcher.

CHAIRPERSON BAILEY: No. I was offering him the opportunity to continue his offer of the description of the differences during his direct testimony.

MR. LAKINS: Now I understand. Thank you, Madam Chair.

CONTINUED DIRECT EXAMINATION

BY MR. LAKINS:

Q. Mr. Witcher, do you have other opinions about the accuracy of the data on this slide that we're looking at, page 3 of Los Lobos Exhibit 3?

A. That's my opinion.

Q. Okay. Let's move on to the Stiff diagrams, which are page 5 of Los Lobos Exhibit 5.

MS. HENRIE: Madam Chair, I'm still confused about procedure. I wanted to kind of flesh out where Mr. Witcher disagrees or where he believes that the prior slide is in disagreement with --

CHAIRPERSON BAILEY: That's cross-examination. We are allowing him to give his direct, as he offered. Then if that's the extent of his direct, then you can ask him questions during cross-examination.

MS. HENRIE: Thank you. Thank you. I'm sorry.

Q. (BY MR. LAKINS) Now, Mr. Witcher, you heard Mr. Janney's testimony about these Stiff diagrams. Do you have any opinions about that?

A. With Stiff diagrams -- my experience with Stiff diagrams is that they're normally plotted up on a topographic map. You have a well location, and you use these Stiff diagrams to get sort of a feel how water quality has changed across a region and maybe see how it changes in the direction of waterflow.

This is just a set of columns with diagrams in it. And with that said, it really doesn't mean that much to me other than the fact that I can see the shapes are similar and sizes are similar. That's about all it says.

Q. Do these Stiff diagrams give detailed information to compare the water chemistry across the wells in this area?

A. Actually, there are some things here that are not seen with a Stiff diagram, and one of these is mixing. And to really see mixing, you have to take a look at the chemistry, which I consider as conservative. In other words, its chemistry is not going to be involved in a chemical reaction very easily. Chloride is one of these. It stays in solution when other things precipitate out. Bromide, that's another one of these things. And then there is some other chemistry that's associated with geothermal systems, like lithium, which is likely soluble and usually doesn't pop out of solution that easily. And boron; that's another one. Boron, lithium. Fluoride is another.

And these are constituents that if you plot these up on an X-Y diagram with a particular chemistry that you're looking at, if you've got mixing, you could probably see a linear plot that shows the mixing direction and also the amount of mixing that you can determine. And with this, there's mixing that goes on in this area, but it's totally undecipherable in a Stiff diagram the way they're drawn and the chemistry you'd be looking at.

Q. Mr. Witcher, let me ask you: The Stiff diagrams, in your opinion, do they definitely show the water chemistry across the entire basin is basically homogenous?

A. They don't. If you look at these Stiff diagrams, there are subtle differences and shapes and sizes. So it's not entirely the same.

Q. I'm moving on to the "Conclusions" slide, which is slide six from Los Lobos Exhibit 3. Do you have an opinion about the first sentence there, that "Los Lobos' geothermal production and injection wells may be in hydraulic communication with AmeriCulture State Well No. 1"?

A. My opinion is, the geothermal injection wells, as we currently know it, are in communication with AmeriCulture State #1 well.

Q. I'm going to ask you your opinion on one other -- this is from Los Lobos -- excuse me -- AmeriCulture 16, the last slide. Have you seen this diagram before?

A. I saw it today.

Q. Now, in your opinion, does that represent the true nature of the geology of the area?

A. No. That's a cartoon.

Q. Now, Mr. Witcher, have you formed some particular opinions that you're prepared to give here today?

A. I have.

Q. And could you summarize those for us, please?

A. Yes. One of the things that I've learned in my studies out here -- and this is primarily starting off with the heat flow of the Lightning Dock system. There's been a large amount of temperature-gradient drilling done over the years, and one can work with this data and determine with -- certainly with some error, but you can get, certainly, an order of magnitude, an estimate of how much the natural heat loss of a geothermal system is, and that gives all kinds of information as to how productive and what the potential of that geothermal system may be. And I use this routinely in exploration because heat flow is just another geophysical survey, actually. So if you're looking for a resource that's got a 30-megawatt electrical power potential and you've got a resource that is only five megawatts natural heat loss, that's not one to be looking at for a 30-megawatt power plant.

And the other thing I've learned here is how some of the geology in this region operates in terms of the hydrogeology of the geothermal system. And another is that you can apply simple models and determine what the natural heat content of the system is and what its potential for electrical power generation may be.

I've looked at the water chemistry, and you can say something about what the potential temperatures are at depth with a process called geothermometry. And in simple terms, geothermometry is a technique similar to taking salt and dissolving it in water. You can dissolve your salt in hot water better than you can in cold water. And there are certain constituents in groundwater that will preserve that chemistry even after it has cooled off, and you can use that to actually predict a subsurface temperature. And that's one of the things that is important that I've learned in this area.

I'd like to point out -- and we can talk about that more -- that after studying geothermal systems and from reading the literature over the years, it's my conclusion that geothermal systems are never at an equilibrium, and that can be taken at all time scales, whether it's geologic or whether it's in the process of being developed on a month or year basis.

The geothermal systems are always heating up or they're always cooling off, or one or the other, I should say, so there's never an equilibrium there. And so they're always changing. And geothermal systems, by their very nature, they're a transient phenomenon, and that tells you right there that they're not an equilibrium-type system. They are either heating up or they're cooling off.

And when you start developing a system and start moving water around, then you're adding energy and mass both into the -- if you're not completely balancing that mass and energy or conserving mass and energy, the physics of that situation also tell us it's constantly changing, and this is the case here. And we heard in some prior testimony that equilibrium was reached, and I don't believe that.

Q. Could you give me an opinion about that from your evaluation of the Lightning Dock geothermal resource and from the proposed pumping and injection? In your opinion, would that proposed project impact AmeriCulture?

A. It would.

Q. And could you describe how?

A. One of the things that could happen is, if the resource is overproduced, you could end up quenching the system, and that would really ruin it for everyone else, in the future, from using it, and including the current users, such as AmeriCulture.

And there hasn't been data-sharing between

Cyrq and other people. This information seems to be held in top confidence and top secret, and I don't understand why this process is, because they have the federal lease, and they own that property out there. And I don't understand what the top secrecy is. They don't have a competitor that's going to be bidding against them for their federal lease.

Q. I want to go to AmeriCulture's Exhibit 6 [sic], which is the PowerPoint presentation that you put together. Correct?

A. Yes.

Q. So let's walk through this together. Okay?

A. Okay.

Q. So from this first slide, give me a breakdown --

CHAIRPERSON BAILEY: Do you mean Exhibit 5?

MR. LAKINS: 3, ma'am.

Q. (BY MR. LAKINS) -- of what your PowerPoint is about and what you're here to talk about.

A. Okay. We've covered some of this already.

What I'm going to talk about is basically the geologic framework in the Lightning Dock system, both from a regional standpoint and also from a local standpoint, with information that's available, and then I'd like to say something about the thermal domains that exist with this geothermal resource. And part of that will help you understand what I mean by the system not being in thermal equilibrium.

And then I'll summarize what the subsurface geology looks like from available well cuttings and core and other information that's available, and then I would like to have a discussion on the water chemistry of Well 45-7. I have some opinions about what that water, what it may be.

And I'm also going to discuss some of the isotopic information that's available from the geothermal waters out there. And I use isotopes and the isotope ratios as a natural tracer so I have some feeling of what sort of water -- or what sort of rocks that water has set in and chemically equilibrated with or even flowed through, so you know something about the reservoir and flow path from this isotope information. And that is very informative as to what the reservoir nature is out here.

And then I'd just like to go through the Summary of Findings we have come up with.

Q. All right. The first slide, what is this?

A. This is a generic hot spring system, in a sense, that I'm actually applying to -- in a general sense, to a hot spring, or geothermal system, at Truth or Consequences, New Mexico. And this is a system which is interesting in the fact that its discharge area is down by the Rio Grande. So we have some feel for the total mass flow that this system has. And by looking at the chemistry downstream and upstream of the Rio Grande and the chemistry of the hot springs, we can calculate that that geothermal system has a mass flux of 1,200 gallons per minute.

And to go back, all geothermal systems that exist in New Mexico, except for the Valles System, they are really deep-seated regional groundwater flow systems in bedrock. There is no magmatic heat source here. And Lightning Dock is one of those, too. There is no magmatic heat source here. This heat is gathered by deep circulation of the water, and that is water that circulates deeply through the ground and gathers up temperature; and it also gathers up chemistry. So further along the path, the saltier the water gets as it interacts with the rock, and it also increases temperature with the greater depth that you get.

In the basin range and the Rio Grande rift, the temperature gradient is higher than, say, on the Great Plains. If you circulate water down to 10,000 feet, you're probably in temperatures approaching 250 to 300 degrees Fahrenheit very easily. You can see these geothermal regional groundwater flow systems. There are thermal and chemical sweeps on the subsurface they travel through. And they're not, in terms of the overall amount of flow, at the end of the discharge on these systems, depending on the type of rock that flows through. It's not a good amount of water, actually.

Q. Next slide. Talk to me about this one.

MS. HENRIE: Madam Chair, if I could interject?

Fifteen of Mr. Witcher's 23 slides were already presented in the 2008, 2009 proceedings. They're already -- they were admitted as exhibits in those proceedings, and, again, we shouldn't be duplicating testimony from the 2008, 2009 proceeding. I'm happy to hear about new information, anything that was not already presented at the 2008, 2009 hearings before the Commission, but as I've said, the bulk of these slides are identical to what was presented in 2008, 2009, including this slide here.

MR. LAKINS: The information isn't any different. This is about the geology, the hydrogeology, the Lightning Dock reservoir. And it may have been presented before, but the information was not presented to this Commission, and this Commission does not have the benefit of this information. Mr. Witcher is here as our expert witness to discuss the Lightning Dock geothermal reservoir, how it works, what it's capable of and how it's going to impact -- how the potential project will directly affect AmeriCulture. It's completely appropriate.

CHAIRPERSON BAILEY: Your objection is overruled.

Q. (BY MR. LAKINS) Please continue, Mr. Witcher.

A. Thank you.

The lower three slides is something I'd like to focus on here and give you some real definition and really some basics on a way to look at geothermal, kind of a Geothermal 101 sense from a hydrologic standpoint.

I use the term "hydrogeologic windows," and what that is is a zone that has permeability and, more importantly, variable permeability across an area that may act as a groundwater barrier to upward flow. And I use the term "aquitard" here. And that's how that works.

There are several different geologic configurations that will allow you to have a hydrogeologic window. You can have a fractured intrusion. A good example of that is Radium Springs, New Mexico. You can have a fractured bedrock uplift.

The geothermal system that's on the NMSU campus in Las Cruces, which would be Tortugas Mountain, is a perfect example. Lightning Dock may involve features of all three of these. And these aren't the only geologic configurations that would create hydrogeologic change.

The geothermal system in Socorro would be one of those where you've had a fault that has formed and separated aquitards past one another and allows an upward flow of water from the subsurface.

Q. Let's move on and start talking about Lightning Dock.

A. Okay. This is kind of a zeroing in on and applying, in a general sense, of the hydrogeologic window. Here we have an aquitard (indicating); here, some sort of deep-flow confined chemical thermal sweep (indicating). It may not be a reservoir in the conventional sense that you think of, but that's one of your flow paths.

This hydrogeologic window, or upflow zone, here, that would be the deep reservoir at Lightning Dock -- or deeper, hotter reservoir of Lightning Dock. This hot water flows up through great depths through vertical permeability, and then some shallow groundwater flows out laterally as an outflow plume.

The Burgett wells and AmeriCulture wells that we were talking about, they exist approximately in this area (indicating). Some of the exploration like at 55-7 is probably located in an area somewhat like this (indicating). I'm not sure that T-55-7 is actually in the upflow zone. I'd have to take a look at the temperature log and talk about that. Temperature logs determine whether it's in the outflow plume or whether it's in the upflow zone. But certainly what I'm showing here is the deep geothermal waters that -- Lightning Dock, by definition of a groundwater-type geothermal system, is in hydrologic connection with everything out here in the outflow plume, and whatever you do here (indicating) is going to affect something up here (indicating).

And this zone here (indicating), I show it fairly wide. This zone could be as much as a line or two across there. It could be just a fault zone that's highly permeable. I show it as a wide zone, so I can put labeling in there, but that's not necessarily reality that you're looking at. This is a cartoon that shows what's going on generally.

The aquitard I'm going to show later.

Here is that unit that Cyrq keeps wanting to bring into the feature as being part of the reservoir, which is a Horquilla -- Pennsylvanian and

Horquilla limestone, Pennsylvania and Horquilla, in the Paleozoic, out there, are part of this aquitard right here (indicating). We'll get into that a little more.

Q. Now, talk to me about this total conductive heat loss and what you have calculated.

A. Let me point out something here. The PowerPoint and software has some glitches sometimes. There should be an integration symbol in the equation right here (indicating) rather than a downward-pointing arrow.

And what we're working with here states that heat flow is the product of the thermal conductivity, which would be k, and dT/dz, which would be the temperature gradient.

And just so you get a feel of how things change out here, basin-fill deposits are generally going to have a lower thermal conductivity and heat flow. Higher temperature gradient or bedrock or volcanics is going to have high thermal conductivity. In other words, it transmits heat, heats better and lower thermal conductivity.

If you go out and measure -- if you drill a whole bunch of shallow wells into the water table and measure the temperature gradient above that water table and above the geothermal system and contour that data up, that gives you -- that actually gives you a quantitative measure of the natural heat loss over that geothermal system. And one of the assumptions that you'd have to make on something like this is that the heat that's being lost by this system is being lost over the top of the upflow zone. The outflow plume, all of that, is being lost.

You also have to assume that the borehole density and heat-flow density is enough to characterize this system.

Q. Now, in this next slide, you've basically mapped a heat flow. Describe for me what this particular slide depicts.

A. Okay. This is a heat-flow map of the Lightning Dock area with temperature logs that I have for the area, and what you're looking at here is heat flow in milliwatts per meter squared. The colors kind of give you the feel for what's hotter and what's cooler. The background heat flow for this region out here (indicating) would be about 80 to 90 milliwatts per meter squared, and the map I used to calculate this is actually a larger area that actually goes out and covers the area that has the lower heat flow.

The Xs that you see there are actual borehole measurements. And to give you a perspective of where things are at, T-55-7 would be approximately right in this area here (indicating), and the AmeriCulture wells would be up in this region here. And I think this actually may be the Federal -- AmeriCulture Federal Well right here (indicating).

You can view this -- you can view this heat flow -- contoured heat-flow map as a heat-flow hill, and if you measure the volume underneath that hill, that's above the background heat flow for the area, which would be about 80 to 90 milliwatts per meter squared. You come up with a total natural heat loss that's less than ten megawatts thermal. And so if you do a geothermal system out here (indicating), you're going to be producing anything that's much greater than ten megawatts thermal. It's not going to be sustainable, because the natural heat loss on this system is that much.

You can take a look at the actual geothermometry temperatures for the chemistries, and I've gone through this exercise. And you can do a mass and energy balance on this thing using the parameters that are on here with the base reservoir temperature, and what you get is a natural recharge for the actual flow in that upflow zone and probably greater than 300 gallons per minute, but probably less than 2,000 -- or

1,200 gallons per minute.

And I show a reservoir volume here of one to four kilometers cubed. Actually, the reservoir volume is closer than cubic kilometer, the more I learned about this geothermal system, for the actual upflow zone. If you include the outflow plume, then that starts to increase the system. But the actual outflow plume for this is a very small area down here where this heat flow formally originates. This is where the upflow zone is. And I'm not sure that any wells have actually been drilled into the upflow zone yet. And it's just not clear to me what's going on there. But what is clear is that whatever the size of that upflow zone is, it probably covers an area not a lot bigger than Burgett's greenhouses, that we've seen in the pictures, probably smaller than in the cross-sectional plan, cross-sectional area, small system. This is a very small geothermal system.

Q. Now, a couple of things, Mr. Witcher. You use the term "ten megawatts thermal." How does that correspond to electrical?

A. Well, if you were to take ten megawatts and convert them to thermal and convert that to electricity, there would be losses of heat energy just due to the -- first, due to the equipment that you're using.

Q. I mean, is it ten megawatts thermal or one megawatt electric?

A. I think it would be more than that. It would vary depending upon the geothermal and also the technology you're using to apply on the surface.

Q. Now, one thing you talked about was down at the bottom left there, your "natural recharge," 300 gallons -- somewhere between 300 and 1,200 gallons. Tell me what that means.

A. What that means is, that's the amount of hot water at the higher-end temperature, say, 160 degrees centigrade, that's flowing up that vertical fracture in the upflow zone.

Q. So you've got --

A. That's not the amount of water that's flowing laterally in the outflow plume. This is just the upflow zone.

Q. Basically your calculation, from your experience with Lightning Dock, is somewhere between 300 and 1,200 gallons a minute is coming up from deep --

A. Yes.

Q. -- into the reservoir?

Do you consider that number an important number in your calculation of the potential impact of the Los Lobos project on the geothermal resource?

A. It could have a tremendous impact, because that upflow is superseded by a production well or two. That basically cuts off the root supply for everything downstream, except geothermal systems. The heat content in the geothermal system is contained -- most of it is actually contained in a volume of hot rock, and when you have, say, a volume of hot rock, two percent of that rock, three percent of that rock, four percent of that rock may be open porosity, and that's filled with water. And so that heat is subsequently measured by the product of the temperature, the heat capacity and the amount of the fluid that's there. And the rest of that rock would be the lineament that would be that temperature times the heat capacity of the rock, which is about .65, compared to, say, one with water, and times that volume.

Q. What I hear you describing kind of in my mind is basically a thermal battery that's got some sort of recharge. Is that fair to say?

A. Well, it would have conductive recharge, say, from the rock, but the actual conductive input you also have that, and that's your natural recharge rate.

Q. In your opinion, would the withdrawal of up to six million gallons a day, taking the heat out of it and sticking it back into this reservoir, affect the -- how would it affect the reservoir?

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A. It would eventually cool the reservoir off.

Q. Let me ask you to move on to this next slide, the "Lightning Dock Region" slide. And could you speak to this slide for me, please?

A. Yes. This is one of the things that was integral to this paper that we talked about earlier. There are several very large west-northwest-trending structures that trend across southern Arizona and southwest New Mexico. And these things have had repeated movement on them since Precambrian, all the way up until the latter movements on these structures during -- the Eocene was probably the last time these things were real active. And there's also been the sites for faulting that occurs, or the stress field pulling the crust apart and rifting, and it's also been the focus of structures that form during compression, where you get folding and reverse faulting that occurs on these same structures.

The bottom line is, the structures have the potential to create a lot of -- a large volume of shattered ground down there, which means that you have an area for a flow path of water to create a geothermal, as well as regional groundwater flow, and you also create local potential for vertical permeability. And that's what these zones are like, and you can see them

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in an aeromagnetic map. A lot of people who work in the region call this the Texas lineament or the Texas zone, and these are the structures they're talking about when they speak in those terms.

Q. As far as this slide goes, what does the Lightning Dock region indicate that it has any patterns on the geothermal resources?

A. I'm not sure I understand the question.

Q. I'll move to the next question. Let me ask you one other question. You heard Mr. Janney's testimony yesterday [sic] that there is flouride in the water because there are fluorite mines out there. Do you recall that?

A. Yes.

Q. Do you agree with that statement?

A. I do not.

Q. Could you explain to me why not?

A. Okay. The fluorite mines that are in this area, those are basically fossil geothermal systems, probably very much like Lightning Dock, and there was fluorite deposited there because these waters were carrying high concentrations of flouride. And they were also super saturated with respect to calcium fluoride, which is fluorite. And so in favorable areas within the fault structures, or the upflow zones, that were carrying this flow, you had fluorite deposited, but the source of the fluorite is actually within an extensional regime. Those are probably hydrogen fluoride gasses that are actually degassing slowly off on the mantle, in part.

Then there are also dark minerals in the granite that form the crust out there. These things chemically interact with groundwater. They also form clays and various other things, and they also contain trace amounts of flouride so that flouride gets released into the water. So a flow path that goes through granitic rocks is a long distance, like we show here in the regional flow system natural hydrothermal -- that's what we see, and pathfinder to take a look at where geothermal systems in shallow groundwater. So that's the source.

Q. Move on to the next slide, "A West-Northwest Structure Control at Lightning Dock." Speak to me on this slide.

A. This is an aeromagnetic lineament and well drilled to the north as an oil test years ago. That's the Cockrell 1 Federal Pyramid and Steam Reserve Animas 55-7, which is Well T-55 that we're talking about. I also show the area where -- roughly where the heat-flow anomaly and hot wells are and where the greenhouses and where the AmeriCulture facility is.

On trend with all of these west-northwest is that fluorite mine, and also up in the base of the Pyramid Mountains are the calcite veins, about the same magnesium mineralization. These calcite veins are over 100 feet thick in places, and 1,000 feet long. The fluorite mine, the calcite veins, these things are very young. The ages on these systems are probably no older than four to six million years, and there's been fluid inclusion work done on the fluorite within the mine and the temperatures and salinities they see in these fluid inclusions is very similar to and compatible with the geothermal system we see today at Lightning Dock. So I view that earlier expression of geothermal system along this west-northwest trending structure --

Q. The fluorite mine and calcite veins with the geothermal system?

A. Today they don't have anything to do with it.

Q. I want to move on to this next slide, your diagram. And just in a short summary, tell me, what does that cross system show?

A. Okay. This cross section is really a way to show visually the geologic history of this area since -- since the late Jurassic. During the late Jurassic, southwestern New Mexico and southern Arizona riffed apart in a structure that was very similar to what we see today in the Rio Grande rift. It would be almost an exact analogy. The structures that formed that were then reactivated and under compression, and those same faults -- instead of the hanging wall dropping downwards like you would have in a rift-type fault or a normal fault, the hanging wall was thrust upward along a reversal fault, and that's the Laramide compression.

What's important with these two different things, during the rifting episode, this block here (indicating) was uplifted way up here, along this fault right here (indicating), shown by this arrow as an uplift. During that process, all of the rocks were eroded down to the lower Paleozoic rocks, which are the Mississippian rocks, the Escabrosa limestone.

On this side (indicating), this block would have been lower, and during that process, these rocks deposited as a basin fill called the Bisbee Group, in Arizona, one of the most active rock units in the region, and I have a piece of core with me today with that.

And the importance of this is that we keep hearing from Raser and Cyrq how the reservoir in this area consists of Tertiary volcanics and Horquilla limestone, which would be the upper Paleozoic rocks right here (indicating); and also the contact between the Tertiary volcanic rocks. Well, there is no contact between the Tertiary volcanic rocks and the upper Paleozoic rocks, because the Bisbee Group is deposited here (indicating), and it's a very distinctive unit, and it tells the history of this early rift unit.

This block uplifted (indicating) during the Laramide. Most of the Bisbee Group was eroded away. Most of that eroded away, and then Tertery volcanics filled across in this region, across the unconformity. It would be the older unconformity. This is the younger unconformity.

And after that, we get today's Basin and Range Formation, and that's what this fault represents (indicating). And that would be the fault that occurs on the west side of the hot wells area there, the block or the geothermal system existing and continues northward.

The reason we know all of this is taking place, we've got good stratigraphic coal in the Cockrell Number 1 well and in the Federal 55-7. The other thing that's interesting, how you know there's been this up-and-down, kind of piano keyboard-type of operation here is the Precambrian granite in both of these wells is almost the same elevation, yet the lower -- upper

Paleozoic is missing to the north, and there is -- and the Bisbee Group occurs to the south. And so that tells a whole story right there. It also says something about claims about a reservoir.

Let me point out, if you're connecting Tertiary volcanics and you're wanting to include the Horquilla limestone part of your reservoir and if you're talking about inflating the size of that reservoir and claiming the Horquilla is involved, I say the Horquilla is not involved in anything in terms of the geothermal fluids, and we see that in the core hole drilled on the AmeriCulture Number 2 well. That well was not productive in terms of any sort of geothermal production across this interval. In fact, the porosity and permeability was fairly low.

Q. Tell me, what's an unconformity?

A. An unconformity is a -- is a contact between rock units where, if you would have had continuous deposition, there would be a whole series of rocks deposited across there. But that unconformity -- those rocks are missing, and you have another younger unit that's in place to cross that, and the rocks in between have been eroded away. So that would be one definition of unconformity.

Q. Do you see any unit and unconformity that Los

Lobos is ignoring during this process?

A. Well, I think there are two unconformities, and we've talked about this. This would be this unconformity here (indicating). And there is another unconformity that is not shown right here (indicating), and this would be the Bisbee Group resting on the Horquilla limestone. And it's those unconformities that allow one to sort out the geologic history of this diagram.

Q. Can you talk to me about the Horquilla permeability and water bearing, et cetera?

A. Yeah. In AmeriCulture 2 well -- the well was not water bearing to any great extent. We tried to put water down it. And a core hole -- you can't put a pump and pump, but you can certainly try to inject water, and that wasn't very successful. And when we airlifted water up there, we weren't getting much either. So at that particular location, it was dry.

Q. Let's talk a little bit about your gravity mapping work. Could you give me an overview of what you have done and what this slide represents?

A. Yeah. First of all, let me describe what a gravity survey is. A gravity survey is a map that shows the differences and the acceleration of gravity across the region. And we go out there with an instrument that is capable of measuring that gravity field, or gravity acceleration, down to a tenth of a millionth or a millionth of the earth's gravitational field, 980 bars -- or gals -- I'm sorry -- and measure milligals. We have to make corrections of the Earth to make it into a perfectly spherical Earth and correct a few of the things in terms of the crust. And in terms of that, we end up getting an anomaly map.

And what that map tells us, if you were standing right here in the Peloncillo Mountains, the mass is pulling harder and you would weigh more than over here in the basin, where you have thick basin-fill zones, which this is a gravity low. And that's the use of these gravity surveys. It allows you to see into the subsurface. It's another set of eyes, and it's based upon the mass distribution beneath your feet.

So up between 1,000 feet of the basin fill, you've got bedrock that's buried, say, around a few feet of the basin fill -- you can use a gravitometer -- where that shallow bedrock may exist.

As it turns out, in this particular area, the geothermal at Lightning Dock exists -- and I've just named this thing -- for lack of a better word, I've called it the hot wells horst.

Q. What's a horst?

A. A horst in geologic terms looks at extension and rifting. It's an uplift that's bound by normal faults on at least a couple of sides.

Q. Okay. Please continue.

A. And another feature is the Animas Basin out to the west that forms a graben, and it's ground by a big major fault along the east side of the Peloncillo Mountains and another smaller basin that's off to the east side of the hot wells. Between there and the Pyramid Mountains forms lower gravity right here (indicating).

Also important to note -- everybody focuses on this young Animas Valley fault, which is a fault of Late Pleistocene Age. It's actually broken the caliche cap out there, distal end of the alluvial fans, but you'll notice on the gravity survey, this is a young fault, an incipient fault. It has nothing to do with the major Basin and Range structures in that area. It cuts across the gravity contours and also cuts right into this hot wells horst block. This is not a major basin fault as some people have made it to look.

I want to point out one other thing. These Xs you see that are real small, look like dots to you, that's the gravity station and gravity control in a particular survey.

Q. There's where the measurements were taken?
A. That's where the measurements were taken.
Q. Zero in a little bit and talk to me about it from this slide here. Can you show me where the Lightning Dock Geothermal System is located?
A. Yes. This would be Section 7, right here (indicating). And the Lightning Dock Geothermal System occurs on the northwest end of this horst block right here.
Q. What do those steep [sic] or narrow and wide lines show?
A. These steep gravity gradients -- the gravity contours are very close together. That's where the fault zone is at that bounds the west side of the horst block. And this area over here (indicating) would be the fault zone that bounds the area to the west -- or to the east.
Q. Now, is that the fault zone that you're talking about?
A. Yes. This would be the east fault zone, and I've taken the liberty to make the geology simple here. Normally, a normal fault has just a line with this bar and a ball on the end of it. Since it's a gravity interpretation, I used it as a broad bar here, and these are gravity-interpreted faults. You see the gray bar

and the bar in the middle?

This would be the hot wells horst block. This is, again, that north-northwest-trending zone in here (indicating) that has the tectonic inversion from rifting to compression since the Jurassic. This would be the lower Animas graben, and this would be the graben on the east side of the hot wells horst.

These are the well control. This is the Cockrell 1, and this would be AmeriCulture 2, and this would be the Steam Reserve well.

This would be just an outline of where the topographic rim at the time formed of the ring -- or the ring fracturing for the Muir cauldron.

Q. Could you kind of point out to me on this slide here approximately where that A-444 would be? Can you do that?

A. With the scale of the map here, it's very difficult to do that, but it would be approximately right in here (indicating).

Q. From your --

A. This detail is really not appropriate to see that well.

Q. Let me ask this, then. From your interpretation of the geology out there, would it make sense to you -- does it basically indicate to you that there is this fault that Mr. Seawright drew on his visual aid, with water on one side of 232 degrees, and water on the other side at 110?

A. Yes. That fault is real.

Q. Would the fact that you've got water of 232 degrees and water of 110 degrees make a difference, and basically 800 feet apart, support that?

A. I think so, and -- anyway --

Q. Anything further you would like to add about this particular slide?

A. No. This is really just an orientation slide to show where things are.

Q. This geologic log of the AmeriCulture 2 well, what does this show us?

A. This is a stratigraphic log of the AmeriCulture 2 well, and it's based upon detailed analysis of core cuttings -- or drill sample cuttings and also core that was retrieved. Part of this whole process, we actually cored with continuous wireline coring tools, which allowed us to get almost 100 percent core out of a lot of the intervals here.

The important units that we see here -- the Gila Conglomerate is the basin-fill unit in this area and this Gila Conglomerate that I show in dark gray. I called it the middle silicified unit. This has been misidentified as rhyolite. It's not rhyolite at all. It's Tertiary basin fill that has a lot of rhyolite clast or cobbles and all that in there. But it's silicified by silica, and if you're looking at cuttings, you can misidentify that as a rhyolite.

One of the things that it is, though, it represents one of the main reservoir units for that outflow plume. Everybody wants to call that an alluvium. Well, if you drill into it, it's not really alluvium now. It is very hard drilling. It's bedrock, essentially. It is bedrock, but the original rock unit before it was silicified by hydrothermal fluids flowing through it. That is the main reservoir, outflow reservoir, and some of that feeds the upper part of the Tertiary volcanics. So this would be -- this would be the main unit that Burgett drilled his wells into and AmeriCulture taps into (indicating).

Down here further (indicating), this shows you in more detail the relationship between the volcanics, the Bisbee Group and the Horquilla limestone. I put a question mark there, because I'm not sure about the Horquilla limestone. To really understand that, I would need to take a look at fossil evidence that's in there, and so far, in the core we retrieved across part of that zone, we are unable to find fossils called fusulinid, which would tell me what unit it is and what age it is. And we don't know, but I think it is probably the Horquilla Formation.

Q. Now, I'd like you to talk about this particular map and describe for me what this shows relating to the uplift and the graben and the faults.

A. Okay. This would be the westside fault, and this would roughly fit with that well. It would fit with the steep gravity gradients that are in the area. This would be the Animas Valley fault zone, that real young Pleistocene fault that cuts the alluvial in the area.

This would be the eastside fault. This gray area in here would be that hot wells uplift, or hot wells horst, and the other -- the red boxes that you see here (indicating) is well control that I used to construct this cross section. It's problematic with some of this, because the well descriptions that are provided are absolutely atrocious.

Q. What do you mean?

A. Well, for instance, this data that's been shown, the other day, Mr. Janney showed that diagram with the wells and everything. You look at the description of those units. If I had a geologist working for me that gave me stuff like that, they'd be out the door with instructions to find other work to do.

For instance, one of the units that I commonly see in the volcanic section in this is a term called "agglomerate." Agglomerate is a term that doesn't describe the composition of a volcanic rock. What it describes is the textural content of that rock, and it describes the textural content in terms of rocks that are at least cobble or boulder size. They could be the size of this room. And you're looking at drill cuttings coming out of a hole with little chips like that. There is absolutely no way in the world you can tell whether that's an agglomerate or not, yet they have that in their logs, and it's over and over. It's just stuff like that that makes you wonder. All you can say is that this is basin fill, and this is volcanics, but you don't know the nature of those volcanics, whether andesite or a rhyolite or anything else. And as a result, they also -- when you've had poor logging, you miss units like this that are really key to understanding the geology of the whole area.

Anyway, with that said, the AmeriCulture 2 well and the 55-7 well has good information for that, and there were geophysical logs in that. So I used that information to construct these.

Q. You looked at what logs?

A. I looked at the geophysical logs in AmeriCulture 2, and I also looked at the geophysical logs in 55-7. And in a visit to Mr. Janney's office, I also had the privilege of being able to take a look at a gamma-ray log, looking for 63-7. It was done in such a way that I had to really do some real gross generalization looking at the log, because of the scale, but I was able to use that information and compare that with the geophysical logs we had from the other wells and cuttings, core information we had, to construct that cross section.

Q. What did that tell you?

A. Well, it told me that -- it told me that this fault zone at the west side is on real fault and that the AmeriCulture 2 well and the Well 55-7 are identical geology in terms of their structural setting and the rock units that they expose.

Q. And how about Americulture's well on 45-7?

A. 45-7 is a completely different geologic terrain. It's in the Animas Basin. It's not in the uplift and separated from 55-7 by a fault.

Q. What fault is that?

A. That's the westside fault, and that's the fault that also has the gravity.

Q. Is that what you've called the Animas Valley fault?

A. No. The Animas Valley fault is this fault right up here (indicating).

Q. Oh, okay. How old is that fault?

A. That fault is approximately -- probably less than 150,000 years old.

Q. Is that important?

A. That's very important, because a lot of times fault tips like this -- young faults create stress fields which allow existing fractures to be open and allow upflow of fluids. And that upflow of fluids and the heat-flow anomaly occurs with the hot wells uplift.

Q. And the information that you've displayed on that slide, is that pretty well consistent with what Mr. Seawright put on his visual aid?

A. That is consistent. The AmeriCulture 2 well -- if you go to the west, in this location right in here (indicating), that would be the well that he labels as A-444.

Q. All right. I want you to move on to your next slide, the "Geologic Cross Section 1." Could you describe this cross section and identify the wells you are depicting here?

A. Yes. This would be the westside fault, and this would be the eastside fault; and everything in between here would be the hot wells uplift or horst. This is the AmeriCulture 2 well, 52-7 drilled by Lightning Dock many years prior -- several years prior to Raser acquiring the lease, and this is a water well further out in the basin. The location of this hole I didn't have geophysical logs for, and the cuttings logs were -- I'm not sure -- I'm not sure if this is right. If it is, then there is another step-down fault out here to the west, and that would jive also with the gravity, roughly.

The important thing to look at here is this QTgc and the solidified AmeriCulture 2 well. To my knowledge, no one has silicified QT -- QTgc out here, say, at 52-7. So that's more evidence that this fault exists right here, at least to this level. This fault may not have intersected the surface.

This is the Animas Valley fault. I show it intersecting with surface.

This unit I see here (indicating) is the unit Trf, and this is a rhyolite flow. It's a rhyolite that's got big hexagonal biotite crystals floating in it, and this is probably -- this represents a ring fracture zone, rhyolite in all probability. It's the same rhyolite, in-a-hand specimen, as the Pyramid Peak rhyolite that forms Pyramid Peak in the Pyramid Peak rhyolite dome. So I show it as possibly existing in subsurface here (indicating).

There is an aeromagnetic anomaly right here, so that may be a signature that --

Q. Let's move on to the next one, "Geologic Cross Section 2." Talk to me about the wells at issue here.

A. The two wells that have been in discussion today are 55-7 and 45-7. 55-7 is in the hot wells uplift and horst and has the same geology as AmeriCulture 2. It's separated by a large fault zone. And this fault zone, it is a Basin and Range fault zone, and so it probably, early on, has some interaction with the basin. This fault, the way I show it, it probably -- if there is no real silicified zones out here. That's more evidence of that.

45-7, about all we can say about that is that the lower unit down here below the Tv, we have no idea what that is. They had lost circulation right there, and they had no cuttings recovery.

Q. That's in the well log; is it not?

A. We saw the other day in Mr. Janney's poster that he had lithology listed for that area, and I don't see how that happens if there are no drill cuttings.

Q. Will you show me on here where you're talking about the Bisbee Group and the position of the Horquilla

Limestone with respect to the Tertiary volcanics?

A. Yes. Tertiary volcanics are right here at the base of the andesite flow, and that overlies the Bisbee Group units and the Horquilla. If that's what this is, it is directly underneath the Bisbee.

Q. Now, why is this of particular geologic importance to you in your evaluation of the impact on AmeriCulture and whether or not this pumping and injecting is going to work as it's been proposed?

A. Well, one of the features that is clear from this cross section is that the AmeriCulture 2 and the 45-7, they're in the same geologic block. They're in the same structural setting. The geology is almost identical. So whatever is going on in 55-7, that even enhances the project for hydrogeologic connection even more.

The other thing that's important here is that 45-7 is very close to this fault zone, and I'm not convinced -- and we'll get into later -- that this is even geothermal water down in here.

Q. Why do you say that?

A. Well, the first chemical analysis that was provided by -- that was provided and I saw there in the OCD records was an analysis of the chemistry on 45-7, and it showed the chemistry to be about 400 or 500 --

between 500 and 600 milligrams per liter, which is a far cry from the 1,100, 1,200 and 1,300 we see with the other thermal water.

And 500 TDS is sodium sulfate water. That's water that's very typical of water that's found deep in these basins in the southwest when it occurs in rhyolite. In fact, it can be very good quality water.

Q. Was it basically good drinking water?

A. Yeah. It's not geothermal water. It's -- it's -- it's water that could be tapped for irrigation.

Q. Got any idea how big that basin may be?

A. It could be basinwide. We don't know.

Q. Now, you say that in your opinion it's not geothermal. Why is that?

A. Well, it's not -- it's not geothermal water from the Lightning Dock Geothermal System.

Q. How do you know that?

A. I know that because of the total dissolved solids.

Q. From any other information as well?

A. Well, there is other information. When this was brought out to Mr. Janney, his comment was, This was water that was produced while -- while they were out there testing, and it was boiled water. And that didn't make sense, because that water would have had a higher

TDS than the existing geothermal water out here.

Then the other explanation that I heard was, This was water that was used to mix drilling mud. And that's a likely explanation, except for one problem. The freshwater analysis that I have for that area out there that they may have used for mixing mud has a TDS of 1,000 milligrams per liter, which is higher than the water that occurs in the subsurface and the water that occurs out there at 500. That does not surprise me.

Years ago -- actually, in 2010, I worked with a greenhouse operator in Wilcox, Arizona and drilled a well to heat his greenhouse. He grows tomatoes, and he drilled a 4,000-foot hole; and we tapped 140-degree Fahrenheit water between 3,000 and 4,000 feet. It will produce a couple thousand gallons-plus, and the TDS of that water is 320 parts-per-million sodium, better than his shallow irrigation water out there.

That's not the only example I've seen in the southwest. In Tucson -- if you've ever driven through Tucson on the interstate, you'll go past the Tucson Electric Power Plant, at Irvington. They have wells that are 3,500 feet deep, 2,500 feet deep, and those wells produce 125- to 135-degree Fahrenheit water, and that water is all in the neighborhood of 350 to 400 parts per million, and it's soft water. And the reason they drill that deep down for that water is, it's ideal for their cooling-tower operation. They don't have the scaling problems and other problems they have with the shallower water.

CHAIRPERSON BAILEY: Is this a good place to take a ten-minute break?

MR. LAKINS: Yes, ma'am.

CHAIRPERSON BAILEY: Let's come back at 20 till.

(Break taken, 3:26 p.m. to 3:37 p.m.; Mr. Brooks not present.)

CHAIRPERSON BAILEY: We'll go back on the record.

Q. (BY MR. LAKINS) Mr. Witcher, I would like to make sure I'm clear on what your testimony is concerning this slide and Wells 45-7 and 55-7. Okay? Now, from what I understand, what you're saying is, the 55-7 and the samples in 55-7 show the water is basically from a different source than 55-7; is that correct?

A. Yes. In that initial chemistry that I saw, that's exactly what it shows.

Q. Would it be correct to summarize your testimony that if water is pumped from 45-7 and injected into 55-7, it would be going from one source to a different source?

A. That's correct.

Q. Now, if you could, please, let's look at "Geologic Cross Section 3" slide. What is this slide all about; what does it tell us?

A. North is to the right. South is on the left. You can barely read that. This is a cross section just to the west of the fault zone that forms the uplift, and this would be a cross section within the basin. And 52-7 would be the north, 53-7 northeast, and 55-7 would be the well that's approximately in the center of that diagram. And I have question marks down there in the Tv because I'm not sure what exactly those rocks are, as that is the region that had a no-returns on our drill cuttings.

Q. Now, let's go to the next slide, the "Geohydrology and Thermal Regime of 45-7." Could you describe the chemistry and which well it was reported from?

A. Yes. This would be chemistries that were taken in -- well, it was actually -- well, it was sampled in March at Turner Laboratories in Tucson. The analyses -- this is a partial analyses of that water. Two has a total dissolved solids of 45 milligrams per liter; chloride, 44 milligrams per liter; sulfate content of

220, and a sodium level of 250. So it's the sodium sulfate water with low TDS.

The silica concentration at 120 milligrams per liter, that's high. You see that a lot of geothermal waters. It's my understanding that this water, when it was sampled, was up over 250 degrees Fahrenheit. And silica -- if the water's in contact with quartz at those kinds of temperatures, the silica would be dissolved very quickly in the water, so you get a high-silica concentration and leave everything else pretty much at the lower TDS.

And the other thing -- the other important point here is the thermal regime. And normally if this was out in the basin further, it would be lower temperature than is measured, since you're up against this fault zone and very close to the horst block, which this is thoroughly equilibrated.

Q. Are all the rocks hot, basically?

A. Yeah, they're hot, and out into the beige [sic] field to a certain -- to a certain extent. It doesn't conduct very far. Within the Earth most of the heat actually is transferred vertically, but you do get some thermal transfer out on the margins to the west.

Q. You have: "Things don't add up. Why?" What's that all about?

A. Well, things don't add up because the geothermal waters have chemistries that are in excess of 1,100 parts-per-million total dissolved solids, and this water is 580 milligrams per liter. And they're claiming that this is part of the geothermal system out there. Raser's claiming it's part of the geothermal system out there.

Q. Were any other explanations for the lower TDS given to you by Cyrq or Mr. Janney?

A. No, just the drilling fluid explanation.

Q. Now, talk to me about the 45-7 chemistry.

A. Well, the total dissolved solids is 580 milligrams per liter. It's less than 1,000 milligrams per liter that is their freshwater source that they have in the area. So that would -- that would tend to discount the fact that that's drilling mud or drilling fluid that's causing a lower TDS.

Q. And in your second point, you say: "Chemistry of January 2012 is different after pumping and breakthrough of water across fault zone." What do you mean by that?

A. Samples, again. And the chemistry there -- I don't have that chemistry in front of me, but the total dissolved solids was in competition of 1,300 milligrams per liter.

And one way to look at that is, during the pumping of 45-7, you created a cone or depression or drawdown. And then injection into 55-7, which is just the other side, across the fault, you create a mound, which they did. And that pressure differential between those two may have been enough to pressurize and flow water across that fault zone. So when they did the chemistry in 2012, what they're sampling is water that's been injected into 55-7 and has flowed across 45-7 and is being reproduced.

Q. Now, your last sentence there, "Chemistry of January 2012." Explain that sentence to me.

A. Well, the January 2012 chemistry seems to show a higher total dissolved solids than the geothermal wells -- deeper geothermal wells out there show. And also the silica concentrations appear to be minor over the silica concentrations I've seen in most of the Lightning Dock waters. These silica concentration waters were -- I don't have the chemistry in front of me, but my memory says between 206 and 212 milligrams per liter. Most of the water -- hotter water is less than 170 milligrams per liter.

One way to interpret that is, this chemistry that they're looking at is water that has boiled and has concentrated the silica. They've set it out into a pond before they've injected it, and it increased the TDS of silica further, and then it was injected. Then it was pulled across the fault zone by 45-7, and hence the sample that was taken in the higher total dissolved solids.

Q. But the latter is definitely different from the first ones you saw in 45-7.

A. Yes.

Q. Talk to me about isotopes. What are isotope ratios?

A. Well, isotope ratios -- what we do is, we take a look at -- I'm just going to focus on three isotopes, these two up here and strontium isotopes. With stable isotopes like carbon, there are two, carbon-13 and carbon-12. And we can measure, with a mass spectrometer, ratio differences between those, and those are compared to a standard. In this case, with carbon, it happens to be an ammonoid fossil that's found in South Carolina, and everybody uses that worldwide. But the important thing here is that the carbon-13 is deficient compared to the standard carbon-13, carbon-12, compared to the baseline sample, which would be the ammonoid standard. So that's that.

Sulfur isotopes operate in a similar sort of thing. Sulfur-34 and sulfur-32, the ratios on that is the -- and that's all compared to a standard. The standard on that is the meteorite pyrite from the meteor that fell at Meteor Crater.

And that's where that strontium isotope -- you're dealing with a radioactive system. Rubidium-87 decays into strontium-87. And there we're comparing 87 strontium with the 86 strontium ratio, and that's direct -- that's a direct ratio that we're using there.

With all that said, that's not what is all that important. That's the stuff geochemists are worried about. What I'm really interested in here is the sulfur isotopes. One of the things that pops to mind here real fast is the variation there. That ratio between sulfur-34 and sulfur-32 is 8.84 to about 8.34. In isotopes geology, for sulfur, that's a fairly tight range of numbers, and I view that as that water has dissolved that sulfur probably from one mineral. And that mineral is probably pyrite that's oxidized, and it's contributed sulfur. And that ratio, 8.5, in there that's a ratio that you'd expect of sulfur that is evolving off of magma. And there's pyrite out there that occurs in granite and also in rhyolite, and those would have formed from magma that flowed up close to the surface or into the subsurface and cooled. So the pyrite would be, in that case, magmatic -- have magmatic sulfur in it. So that fits with that.

What it doesn't fit with is if you had flow of water through Permian or Pennsylvanian rocks or Paleozoic rocks of any of that. They have that completely different sulfur isotope and Paleozoic marine isotopic, plus 10 to plus 30, which are far higher than the eight.

For instance, if you were to go over to White Sands and take some of that gypsum and take it into the lab and measure the isotopic ratio of what that unit is, you're probably looking at stuff that would be over 15 or 14. And so that's -- that's information that tells you where that water has been, what kind of rocks have resided in there and what kind of rocks that water is chemically interactive with. And the sulfur isotopes tell us that water has never been through or stored in the Paleozoic rocks or Horquilla limestone.

Q. What does all this information mean to interpreting the reservoir, the water, no paths, et cetera of Lightning Dock?

A. Well, what it says -- and I'll go back to the 87 -- 86 ratio on strontium. That water also was never circulated through the Paleozoic limestone. A Paleozoic rock with a strontium isotopic ratio would be a -- Paleozoic would be down much, much, much lower, about

.710, and these are .7228. Very high. So this water, its residence time and storage and flow path is through Precambrian granite or mid-Tertiary rhyolite that is very high silica rhyolite. In other words, it has a high rubidium content. That's how you get a high ratio.
Q. Not Horquilla?
A. Not Horquilla. No way Horquilla.
Q. It's not pulling this water out of the Horquilla?
A. No.
Q. I'd ask you to briefly go through your Summary of Findings, just kind of summarize those for me; tell me what your opinion is.
A. Okay. Well, these are findings that were started in April 2009, and I haven't changed my mind on these with further work and other evidence that I've gathered.
The geothermal system out here is very small, and I don't think it's going to be sustainable of more than two or three megawatts.
And the nature of the upflow zone, we don't know really what that is. Is it a fault zone? Is there an intrusion? And it's probably a very small cross area. I don't think we have enough information to know one way or another on that.

The geothermal fluids, they don't flow across or originate in the Paleozoic carbonate rocks. The isotopes show that. The gross chemistry would show that also instead of sodium-rich carbonate and very high in chloride. They'd like -- more like oil field, mortars [sic] flowing through those carbonate rocks for very long, because there is that sort of thing that is still left in there.

The proposed injection and production wells, what I see, are located completely in structural and hydrological domains, and I think the characterization of this resource out there really is in an immature stage. It's not well characterized right now. If I was going to be spending lots of money building a power plant, I would like to know a lot more about what is out there, and we do not know that.

And certainly excessive production and improperly located injection wells with that, it has the potential to quench that resource and ruin that resource for anybody in the future and current users.

Q. Keep going.

A. Well, we've just seen the cross section that 45-7 is completed in the basin reservoir that is separate from the uplift reservoir that 55-7 is completed. They're in completely different structural domain and terrain. And we've seen that 45-7 chemistry is different, and it's consistent with basin fill or even fractured rhyolite.

The sodium sulfate chemistries and low TDS and the high silica in that water is probably equilibrated of heated fresh water with quartz that's flowed in next to that fault zone and been conductively heated by the heat in the horst block.

And 55-7, just to reiterate, they're completed in different reservoirs, and injection -- you would be injecting water taken out of the basin, or vice versa, from water that's in the horst block.

Q. Keen going. You're talking about the pump test?

A. Yeah. This is a comment that I have on the data that was presented by Dr. Shomaker.

Q. On the pump test?

A. The pump test.

Q. Which is AmeriCulture Exhibit Number 18. Okay. Go on.

A. The injection into 55-7 during the pump test shows the water level rising from an 80-foot depth to the surface between 1/16/2012 and January 24th, 2012.

I have to admit something. When I first saw that graph, I didn't understand what I was looking at. I initially thought I was looking at footages like you see in drawdown, and I didn't realize what it was. But what we are looking at here is, there is an 80-foot rise in the water level that took place there. The static water level in 55-7 typically is right around 50 to 48 feet. And so if you have that water rising for -- the pressure equivalent of water rising in feet, up to 70, 80 feet, that means that the head of the water that's in 55-7, after injecting it, is actually above the surface by probably 25 to 30 feet. And I'm not -- I'm not convinced that anything was equilibrium there. You know, it looks like, you know, it was flatten off at the end, but I don't know what was going on. If that water had been breaking through into the other side, things could have changed. I'm not sure how to interpret everything that I saw there.

What I also saw in 45-7 is that the drawdown in that well was showing in excess of over 110 feet, is one of the things I have a comment on. None of this data has been looked at in terms of any hydrogeology models that would allow you to calculate hydraulic conductivity or transmissivity or anything like that. None of this data was presented in any sort of -- a lot of times, data pump test -- log space one on the axis. You put in log space. You might plat it up as log time, and it straightened outside the curvatures and things allows you to see changes that may be happening.

For instance, 45-7 pumping, you have a fault zone here. If that fault zone is a contributor of water, then that's going to affect your curve after you pump that a while. If it's a barrier, that will also affect the pump in another way. None of this analysis has been presented. So all we were looking at the other day on this was just a collection of data and graphs, and there is no interpretation there.

Q. Did you see any data whatsoever about the reason for the tracer test and the results of the tracer test?

A. No. And that puzzles me. I'm not an expert on tracer tests. I understand the philosophy behind it, and I understand there are probably as many types of tracer methods and substances that you use for that as we have fingers and toes, and maybe more.

The thing that I don't understand is, if you're wanting to understand a reservoir out there and doing a pump test, why in the world would you put your tracer out on the very end of your outflow plume when that's the furthest away from the action that you're really interested in understanding? And that's the intersection between the producing well and the well you're injecting into. I don't understand that philosophy, and listening to this, I still don't understand it, why that was done.

Q. Did you see any data presented whatsoever about the geothermal productivity of the actual Lightning Dock reservoir? We heard a lot of that in Mr. De Rocher's testimony, but did you see anything specific to Lightning Dock?

A. Again, we haven't seen any analyses of any production data. And the data that has been collected over the years, that's held in confidence. Nobody can see it, yet it's very important to the neighbors and everyone else that's out there. And to answer the question, I haven't. Yeah.

Q. Going to last point of this slide, would you address that, please?

A. Yeah. If I'm going to sustain a reservoir and produce, you know, a system and, say, produce -- let's say we're going to produce five megawatts of electrical power, and I know that the total thermal heat loss on that system is less than ten megawatts thermal, I'm going to be very careful about how I develop that system, in gathering data, because I'm probably pushing the envelope on things.

I'm also going to be careful in trying to understand exactly where my upflow zone is and what the volume of that upflow volume reservoir is, because that is the dynamic storage of heat. That contains permeable rock. That allows me to store in that rock as time goes, because I'm going to be cooling that reservoir as time goes on.

These geothermal reservoirs, they're not equilibrium geologic creatures. They're always changing, and that's natural. And when you start tapping into them, you're just exacerbating that. So you really need to understand that. And so if that's not well understood, you could be harming your own project, and you could certainly be harming your neighbors, and especially neighbors who have water rights, when you don't have water rights.

Q. Now, let's go on. The next slide is the "AmeriCulture Federal Well Chemistry."

A. Okay.

Q. Did you compile this information?

A. I sampled that water and had that chemistry done.

CHAIRPERSON BAILEY: Mr. Lakins, you don't have that on your tab three.

MR. LAKINS: I'm sorry. This is the first

page of Supplemental 17, Madam Chair. When I put it together, that's the way it worked.
A. I can hardly read it from here, but go ahead.
Q. (BY MR. LAKINS) Let me see if I can make it bigger for you.
A. That works.
Q. Can you see that now?
Can you tell me what the fluoride level is there?
A. That's 90.2 milligrams per liter.
Q. No, flouride.
A. Oh. Flouride is 5.58 milligrams per liter.
Q. And that's the AmeriCulture's domestic well that we were talking about?
A. Yes. That would be -- the well that's shown is A-444.
MR. LAKINS: Madam Chair, move for admission of AmeriCulture Exhibit 3 and the first page of Supplemental Exhibit 17.
MS. HENRIE: No objection.
CHAIRPERSON BAILEY: It is admitted.
(AmeriCulture Exhibit Number 3 and Supplemental Exhibit Number 17 were offered and admitted into evidence.)
Q. (BY MR. LAKINS) Now, Mr. Witcher, if you would

turn your attention to the blue binder book, AmeriCulture Exhibit 12. Could you tell me what that is?

A. Okay. This is a table of water chemistry --

I have to get my reading glasses.

Okay. This is a table of water chemistry that shows Wells 45-7 and 53-7, 55-7 and 63-7.

Q. And on line number six, there is flouride. Do you know where this data came from?

A. This data came from a company that came out and sampled their well, ThermoChem out of Santa Rosa, California.

Q. I mean, was it provided by Los Lobos?

A. Yes. Yes.

Q. If you go down to line 6, flouride, can you read for me what the flouride level is in those various wells? Can you read it?

A. I can read it.

Q. Line 6.

A. Line 6. Okay. Thank you. Okay. The sample on 12/8, 45-7, single phase fluid, shows it as ten milligrams per liter. 45-7, sampled on 1/26/12, single phase fluid, that's 11.1 milligrams per liter. 45-7, the flash fluid, that shows 11.6 flouride per liter. And the total fluid is 11.

And on 53-7, it's 11.6. This is single phase fluid. Flash fluid on 55-7 is 10.8. Total fluid on 55-7 is 10.3. And the 55-7 flash fluid on August 5th, 2010, that's 9.37. And then 8.93 -- on August 5th, for the total fluid on 55-7, 8.93.

And then on 63-7, the sample is 14.2 for single phase fluid, on August 28th, 2012.

Q. Do those flouride levels and the other chemistry you've analyzed support your opinion that there was a fault that basically separates A-444 from the State well?

A. This could be used -- this chemistry could be used as evidence of a fault, yes.

MR. LAKINS: Move to admit 12.

MS. HENRIE: My witness?

CHAIRPERSON BAILEY: No. He's moved to admit --

MS. HENRIE: Oh, I'm sorry.

CHAIRPERSON BAILEY: -- Exhibit 12.

MS. HENRIE: We were looking at numbers.
No objections.

CHAIRPERSON BAILEY: It is admitted.

(AmeriCulture Exhibit Number 12 was offered and admitted into evidence.)

Q. (BY MR. LAKINS) Now, Mr. Witcher, if you would

turn to AmeriCulture's Exhibit 4, please. Have you seen that document before?
A. I may have, but I don't recall.
Q. Okay. Never mind on that one.
Do you recall the testimony of Mr. Shomaker about page 23 of your report and permeability?
A. (Indicating.)
Q. Could you address that?
A. Yes. Let me pull that out here.
Q. And we're looking at Los Lobos Exhibit Number 12.
A. Now, this would be on page 23, and it would have been Section 3.6, "AmeriCulture Federal Well." And I stated in here: "There is no doubt that a 'shallow and impermeable' boundary occurs between the AmeriCulture Federal Well and the AmeriCulture production well." And the other day during John's testimony, or Dr. Shomaker's testimony, I got a little red-faced on that. That's a very strong statement to make, and I don't have the evidence to show that John is not absolutely correct, the presence of impermeable boundary that there is. I can't defend that. That's a statement that I probably shouldn't have made in here, but --
Q. In your opinion, what would be more

appropriate?

A. More appropriate is that I believe there is a permeable boundary. I just wouldn't call it impermeable. It's -- it's -- the exact nature of the permeability boundary, one explanation is a fault zone. The other is lower permeability -- you've got isotopic conditions there where you've got higher permeability in one direction, say, north-south, than you do east-west. The important thing here, there was significant delay in time on the water-level change in the AmeriCulture Federal Well when doing the pump test than compared to the Burgett wells, which were located similar distances to the north.

Q. The remainder of this July 2001 report, Los Lobos report, do you stand by it?

A. Yes.

Q. Is this the report, to your recollection, that was discussed with Mr. Seawright about the possibility of the other Burgett wells being pumped at the same time?

A. I'm not aware of any other Burgett wells pumped except for the two we report in here. And I think one of the explanations for this is the time. I don't believe Mr. Burgett had permission to pump his geothermal wells on federal land. He was in a dispute with the Bureau of Land Management and the Minerals Management Service.

Q. Were you in communication with Mr. Burgett during the time this was done?

A. Yes.

Q. Were you aware of any other pumping of any other wells that was alluded to?

A. No. No.

Q. Now, one of the other comments that I think Mr. De Rocher was talking about was the time to reheat the Lightning Dock geothermal reservoir, and we heard something about the temperature and a couple of years to bring it back up. Do you agree with that?

A. If we had a very large reservoir, say like the reservoir geysers in California, then these sorts of things can be done. This is a very small reservoir, and we don't have another source of heat.

And I've seen studies -- and these are published studies published in the Geothermal Resource Council Transactions -- over the last four or five years, and they've done numerical modeling studies to show what would happen, say, after 30 years and you've basically quenched your geothermal system; how long would it take that thing to recover back to its original condition. And they're talking time frames of over 100 years, maybe 200, 300 years, depending upon the exact configuration of that reservoir. So, you know, if this is overproduced and quenched, it could take a substantial amount of time for it to reheat up.

And this goes right back to the point that these geothermal systems are either heating or cooling. And this system right now, even prior to any wells being drilled, was heating up, and the reason I know that is, I can take a look at the temperature logs out on the outflow plume. They have a distinctive shape, and it's a shape that tells me that this system is still in the process of heating up. In fact, the Lightning Dock Geothermal System may not be any older than 10- or 20,000 years old. So it's a very young system.

Q. I ask you to turn to AmeriCulture Exhibit 5, page 6 of that. I'll draw your attention to paragraph 30. Okay? You with me?

A. Yes.

Q. That paragraphs says: "The evidence in this case is not sufficient to demonstrate the characteristics of, or even the identity of, the injection formation, nor does it demonstrate whether or not hydrologic communication exists between the injection formation and other aquifers in the vicinity that are or may be underground sources of drinking

water." Do you agree with that?
A. Yes.
MR. LAKINS: Move to admit Exhibit 5.
A. Which exhibit?
MR. LAKINS: 5. No, not you.
MS. HENRIE: Is that the e-mail you keep trying to get in in there?
MR. LAKINS: No. This is Order Number R-13127, "Order of the Division."
MS. HENRIE: Oh. No objection.
(AmeriCulture Exhibit Number 5 was offered into evidence.)
Q. (BY MR. LAKINS) And I'd ask you to turn to AmeriCulture Exhibit 14, Mr. Witcher, last page, paragraph six, kind of the last sentence after the OSE report: "There also appears to be an upper geothermal reservoir indicating that a water table aquifer system is present and is documented to be in connection with the semi-confined aquifer or reservoir via fault/fractures with an upwelling thermal plume between reservoirs at the project location." Do you agree with that?
A. Let's read that again. I didn't get --
Q. I'm sorry.
A. Yeah.

Q. Starting at paragraph six there, sort of -- one two, three -- four full lines up from the bottom after the "OSE report" in brackets: "There also appears" -- if you read that to yourself.

A. I'm on page 3.

Q. Page 3: "There also appears to be an upper geothermal reservoir....."

A. Okay.

Q. Read that sentence.

A. "There also appears to be an upper geothermal reservoir indicating that a water table aquifer system (static well level: 75 to 85 feet below ground level) is present and is documented to be in connection with the semi-confined aquifer or reservoir system via faults or fractures with an upwelling thermal plume within the reservoirs at the project location."

Q. Do you agree with that statement?

A. Yes.

Q. Move up a couple of lines in that same paragraph: "However, the Horquilla Formation is known to exist at greater depth within the Animas Valley and not at the shallow depth described by Los Lobos." Do you agree with that statement?

A. Yes.

MR. LAKINS: Move to admit 14.

MS. HENRIE: Madam Chair, didn't we already have an Exhibit 14?

CHAIRPERSON BAILEY: Yes, we have. We admitted 14, all three documents.

MR. LAKINS: Okay. My error.

CHAIRPERSON BAILEY: But, yes, we do need to admit 5. You skipped over that.

MR. LAKINS: That's all I have.

CHAIRPERSON BAILEY: Cross-examination?

CROSS-EXAMINATION

BY MS. HENRIE:

Q. Mr. Witcher, on your resume, I didn't see your degrees. Would you please --

A. Yes. I have a master's degree from New Mexico State University.

Q. I meant in what.

A. Oh. In geology.

Q. A Master's in Geology?

A. Yes.

Q. And a bachelor's in?

A. Geology.

Q. Okay.

A. Yeah.

Q. I would have expected to see that on the resume.

Tell me about your company. How many employees do you have?

A. Me, myself and I.

Q. You don't have any interest --

A. No.

Q. Don't sit on the board of directors?

A. No.

Q. Not a shareholder?

A. No.

Q. Have you had clients in the past who are using geothermal to generate electricity on a utility scale?

A. No.

Q. And how about clients using electricity to generate on a personal scale, like AmeriCulture proposed to you, others who have --

A. I've done that, yes.

Q. How many times? A couple? Five? Ten?

A. Couple.

Q. Have you participated in drilling wells to bedrock --

A. Oh, yes.

Q. -- like AmeriCulture State 2?

A. Yes, and the well we talked about, the Wilcox well.

Q. There's a couple.

A. Yeah. And one of the deeper heat flow holes in Arizona looking at hot dry rock evaluation was a 4,500-foot core hole drill. I've drilled several continuous wireline core drills for the Army, went down to a depth approaching 4,000 feet; Radium Springs, the geothermal greenhouse there, drilled a couple of wells 800 feet in bedrock. And these were geothermal wells. So, yes, I have a lot of experience with that.

Q. Thank you.

You mentioned that you had worked for AmeriCulture since 2001, approximately?

A. Yes.

Q. So are you familiar with the greenhouse area broadly stated, including the Rosette, the AmeriCulture and the other activities there?

A. Yes, I am.

Q. Have the nonpumping water levels decreased over time in the shallow groundwater system?

A. I couldn't give you an answer on that. I haven't been out measuring that.

Q. You testified, I believe, that fluoride, boron and other constituents conservative in that, they don't change or precipitate out. Isn't it true that they can change depending on the temperature and pH of the water as well?

A. That is -- that is not something that's going to take place within a conservative system like that, because they're highly soluble. Changing the pH may change constituents, but we're talking about stuff that's highly soluble in water, and so changing temperature and pH -- it depends upon what your system looks like, but in a general sense, it's not going to grossly change those samples, and that's why they're useful for mixing sorts of calculations, because there's going to be no change if you're mixing cold water and hot water that's high in those constituents.

Q. And does age affect those constituents as well?

A. What do you mean by age?

Q. Let me withdraw that question.

So if we go back to the flouride, the boron and these other constituents that don't change or precipitate out, I believe is your testimony, the question was: Can they change depending on residence time in the aquifer? Does that affect them?

A. Oh, certainly. In the long flow path that I show on this geothermal system, where you have a chemical sweep and that sort of thing, that's how constituents are obtained and get into that water.

Q. So I want to kind of go through your slides --

A. Okay.

Q. -- and ask some questions about those. The slides aren't numbered, but what I did was, I marked them A, B, C, consecutively. So just for the record, the first slide is "A," and the second slide, "A Hot Spring System," would be "B." So I'm looking at slide B right now.

The Lightning Dock Geothermal is not a hot spring system, is it?

A. It would be if the water were stable at the surface.

Q. Right.

A. And it would be if Lake Animas was there, probably.

Q. Right.

A. Okay? And that's the only difference between a geothermal system like Lightning Dock and, say, a hot spring system, is that, one, the surface -- flow intersects the surface -- the flow regime intersects the hot springs. At Lightning Dock, it doesn't. That's the only difference really.

Q. These cartoons at the hot springs system, the one on top around the T or C area, what I'm seeing -- I think what you just described is that the recharge comes in from, let's say, the left-hand side of the diagram, and then it hits a fault. And does that fault act as a

barrier in this representation, or a conduit?
A. It can act as either one.
Q. So turn to the next slide, "Hydrogeology," slide C. These are very simplified cartoons. I believe you acknowledged that in your testimony.
A. They're purposely made to be simple, yes.
Q. And in these cartoons as well, I see the faults as a primary means for the surface to move. Is that part of the point of these diagrams?
A. Are you speaking of the three diagrams at the bottom?
Q. Yes. Yes.
A. That's the only one that shows a fault.
Q. But the fault is a path by which the water moves?
A. Not in this case.
Q. Okay.
A. In this case, the fault has separated the aquifer. When that fault -- if you move that fault back into position, that aquifer would form one purple unit all the way across. And with the faulting, it has opened up permeable ground across that fault. And, of course, the assumption here is that in this case that fault does act as a conduit and allows water across there, and so that's what you're looking at.

Q. Is the slide at the top applicable to the basin range or not?

A. Oh, absolutely. And in one way, I could have drawn another set of arrows down in the bedrock, but I didn't. And that particular diagram is really more suited to some problems that take place along the Rio Grande, and I included that because you do get thermal water at the end of these basins. And you also get chemistry increases at the end of those basins.

For instance, if you look at the Albuquerque Basin -- and you may be familiar with that -- that water flows south, towards Socorro. Down at the south end of that basin, water tends to upwell, and you get increases in higher heat flow. And you also get an increase in the salinity of the rift, and you also get an increase in the temperatures of the water. And you have geothermal systems that occur in these situations, and all the basins in the Rio Grande rift show that particular feature. That wouldn't be applicable to the Animas Basin because it's not a flow-through basin.

Q. Okay. Thank you.

Let's go on to the next slide, D, which is entitled "Reservoir." And I believe you testified that this slide is applicable to the Lightning Dock area?

A. Yes.
Q. And, again, it looks quite simplified to me.
A. It's done that way on purpose.
Q. And there are aquitards shown but horizontal and vertical, as I read this diagram. In other words, restricting the water from -- restricting the water vertically -- or horizontally, but also pushing that water into this upflow zone, a narrow upflow zone?
A. The aquitards, they're not an active component here. They don't push anything. An aquitard is a low-permeability unit that may be impermeable or may just have very low impermeability, so it acts as a barrier. And it also is not a storage area. It's not a reservoir. It's the opposite of a reservoir. And you could view that aquitard another way. You can view it as a caprock.
Q. And so at Lightning Dock, can you explain to me why you think those aquitards are there? What evidence do you have for those aquitards?
A. There has to be an aquitard there.
Q. Because?
A. Because otherwise you wouldn't have an upwell of hot water along a zone of structural -- of high vertical permeability.
Q. I'm sorry. Let me back up to this.

A. Okay.

Q. It's a structural feature that you are assuming because of the reaction of the geothermal fluid?

A. The aquitard is a caprock and the upflow zone and a vertical permeability zone that allows flow across that caprock. And that aquitard, it can also prevent recharge, but we happen to be on the discharge zone of this groundwater flow system. And so when you're on the discharge end of the ground waterflow system and you have a caprock, you have to have an upflow zone or zone of high permeability to allow that to flow to the surface. And these zones occur at high elevation -- I mean at low elevation and structurally high terrain.

Q. So how does faulting and fracturing fit into what we're seeing here on slide D?

A. The upflow zone, or the hydrogeologic window, that could be a zone of faults. It could be a fraud-intrusive body. It could be a variety of things. It's not -- that's not defined out there now.

Q. It's not defined?

A. Yeah.

Q. On the next slide, E, "Total Conductive Heat Loss," just a question. You've got some coefficients assumed here, and where are those coming from? What's the source of those?

A. What coefficients are you speaking of?
Q. I'm just asking for the source of things like, you know, k equals 1.8, k equals 2.2, things like that.
A. Oh, that's thermal conductivity. That can be found in any heat flow textbook. Those are numbers that are given for that. And also I have a very large thermal conductivity database for heat flow holes in New Mexico, and that coincides with that. And those are just given as examples right there.
Q. Examples.
You said that it's textbook. Do the textbooks vary in any of those coefficients?
A. Oh, I'm sure they do, yeah. It depends on the author.
Q. Of course. And that's what I have here, is several different authors who come up with different -- very different estimates about conductive heat loss. So yours is one theory among many. Blackwell and Wisian, in 2001, are you familiar with that?
A. Oh, absolutely. David Blackwell is good friend of mine.
Q. Okay. And my understanding is, conservatively estimated, the conductive heat loss was two to three megawatts. Does that --
A. Estimated what?

Q. Conductive heat loss was two to three megawatts -- in the range of two to three megawatts.

A. That's a low number.

Q. And another source is Blackwell and Leidig, from 2002.

A. Okay. I'm not familiar with that work.

Q. Kintzinger, 1956?

A. That's not heat flow state.

Q. Oh, okay. Okay.

Muffler, 1979? Are you familiar with that?

A. Is that a U.S. Geological Survey publication that looked at the regional assessment of the United States?

Q. That's it.

A. Yes, I'm familiar with that.

Q. That's it. Let's see. The electrical generation of the Animas resource was measured using a volumetric methodology, about 24 electric megawatts for 30 years?

A. Yeah. And let me explain what they did there and how that differs from what we're looking at. The U.S. Geological Survey stuff that was done in 1979, it was one of the first assessments of the -- regional assessments of the geothermal resource base in the western U.S., and they didn't detail information on reservoir sizes. All they could do is to make some assumptions, and they applied these same assumptions to every geothermal system in the western U.S.

And one of the assumptions that they made is, they estimated a reservoir volume, and then they made some assumptions on the average temperature of that reservoir volume. And those reservoir volumes that they used, as I recall -- it's been a long time since I've looked at that, but I think that the reservoir volumes that they were looking at were probably in excess of four cubic kilometers, and that is just not realistic for --

Q. You see that from reservoir volumes?

A. Oh, absolutely, I do.

Q. So, basically, I guess my point is, would you agree that electrical generation estimates are only as good as the assumptions?

A. They are as good as the data you're currently working with and the assumptions with that, yes.

Q. So you've answered my questions with regard to slides E and F. Let me jump up to G, which is titled "Lightning Dock Region." And the visual at the bottom, the colorful visual, is that a gravity map?

A. No. I'm sorry I didn't explain that, maybe. That is an aeromagnetic map.

Q. Okay.

A. Yeah.

Q. And you have located an elongated structure as a fault as a lineament; there is kind of a black line.

A. Uh-huh.

Q. Is that the only structure -- the only lineament or elongated structure that can be identified from that?

A. Oh, no. In fact, squint your eyes, and you can see -- squinting your eyes -- it takes experience to do this. But with the aeromagnetic map, you can see to the north another lineament north-northwest. And if you take the Lightning Dock -- and travel close to the north, there are some other linear features that are more northwest. So those are lineaments, and they may be expressions of real things, and they may not be. A lineament analysis is kind of an art. But the way I'm applying it is, I'm applying it to structures that we can place a geologic frame on, and that's what I'm doing here.

Q. So in context with the map above and some of the other --

A. Yeah.

Q. -- some of the other things that you observed or -- the well test, for example, will help with some of these?

A. No. Actually, the well test didn't, but, you know, certainly the deep well information in the oil test that was done to the north and 55-7 and the areas through this map up here, a lot of that is out of the literature. They're well-studied structural zones, and, in some cases, we've been sorting them out over the years. Some people really study them, so there is a bit known about it.

Q. Jump forward two slides.

MS. HENRIE: Thank you for putting the slides up, Charles.

Q. (BY MS. HENRIE) This would be the Diagrammatic Cross Section. This cartoon you've been using for quite sometime, since maybe 2000?

A. Uh-huh.

Q. Has any new data caused you to reinterpret this cartoon?

A. No. This is a very -- it's suspended -- it's a simplification. It's intended to show the relationships between those wells and also the regional stratigraphy, and that's really all it shows. If we were to get into the detail and actual faulting and even maybe a little bit of folding in there, that's a whole different story.

Q. Right. This is --

A. And really the only way to really understand that is that we might have to go out there and spend millions of dollars and do a 3-D seismic survey. Even if you could do a survey on this terrain, it's quite complicated. There are the Peloncillo Mountains to the west and also the Animas Mountains to the west, and Dos Cabezas Mountain in Arizona. We can see this same terrain uplifted in the -- three dimensional on the ground. And I've been in those areas, and I can tell you, this is a cartoon. It's an oversimplification, but the purpose of this is to show the relationships and how that geologic history is interacting.

Q. I have to give you a bad time because you gave my witnesses such a bad time, but I would read this to say to the left, south, and right, north, we've got this pyramid inserted north of the AmeriCulture State 2 and between AmeriCulture State 2 and Cockrell 1. How confident are you that that's where the pyramid is? And if you are confident, how is it that it affects the applications and what we're talking about in this proceeding?

A. That pyramid has relevance into what we're doing with on the geothermal. That's off the geothermal area, yeah.

Another way you could look at this, if you wanted to have fun, is, go home and get your scissors and cut along the faults and place everything and reconstruct and move it back and forth.

Q. Sounds like a great animated cartoon.

A. That's right.

Q. You've answered my questions about several of the other slides. Let me check my notes.

Let me go back to -- I'm jumping around a little bit, so forgive me, but you talked about the fluorite mines in the region.

A. Uh-huh.

Q. And I think our point is, and I just want to ask if you would agree, fluorite is naturally occurring within the groundwater within the Animas Valley area?

A. Fluorite occurs naturally in all faults within the Basin and Range province and the Rio Grande rift, but it's highest in geothermal systems; it's concentrated in geothermal systems.

Q. And how about in the Animas Basin, generally, the flouride is elevated?

A. Yes.

MS. HENRIE: Bear with me; I have a lot of notes.

Q. (BY MS. HENRIE) I'm on slide N, which is "Location Map of Wells, Faults and Cross Section Lines."

Mr. Witcher, I believe one of your conclusions was that this geothermal anomaly may be limited to ten acres. And I may have overcharacterized what you said, so please clarify if I did. But I wanted to ask whether this area characterized as "Hot Wells Uplift" appears to be more than ten acres.

A. The hot wells uplift is not a -- that's a geologic structure. It's a horst block. And the upflow zone would be embedded in that. It would be a much, much smaller area.

Q. And when we talked about this slide, you expressed concern about some of the logs and some of the detail in the drillers' logs and how they characterized different formations.

A. Uh-huh.

Q. And I just wanted to ask: Do you know who actually does that paperwork? Who does that paperwork for those drillers' logs?

A. The drillers do that, and sometimes their client does it. The driller signs off on it.

Q. Are they the same reports as detailed mud logs?

A. I'd hope not.

Q. I agree.

And is it possible that Lightning Dock, in creating its cross sections and its data, did not rely solely on the drillers' logs?

MR. LAKINS: Objection. Calls for speculation.

MS. HENRIE: He's an expert.

CHAIRPERSON BAILEY: Would you like to rephrase your question?

Q. (BY MS. HENRIE) Were detailed mud logs made available to you of the wells that we listed in our cross section?

A. No.

Q. Thank you.

Slide P, "Geologic Cross Section" on the 2. What is Well 36-7, which is the first well on the left side?

A. That is a well that Lightning Dock Geothermal drilled years ago as a temperature gradient hole. That's the origin of that hole.

Q. Okay. I wasn't familiar with it.

A. And Roger Bowers would have the data on that.

Q. Just a question on the AM development [sic]. You participated in the drilling of that?

A. Yes.

Q. And it went down to the Horquilla limestone, correct?

A. Yes.

Q. I'm just curious about the strategy, because if the Horquilla is acting as an aquitard, I think I heard you say, Why would you drill the well down into the Horquilla?

A. At the time, we didn't know that. And that was one of the goals of this test, was to get down there and see what was going on in the Horquilla, and we found out.

Q. So your interpretation is that it's an aquitard?

A. Yes.

Q. With that slide P, Cross Section Number 2, you testified to the sample drawn from Well 45-7.

A. Yes.

Q. And I want to --

MS. HENRIE: If I may approach the witness.

Q. (BY MS. HENRIE) -- ask you if this is what you looked at in Mr. Janney's office, because I think that -- I think the date is wrong in your slides, and I just want to clarify if this is correct.

MS. HENRIE: Madam Chair?

CHAIRPERSON BAILEY: Yes.

MR. LAKINS: May I see that first?

MS. HENRIE: Yes.

Q. (BY MS. HENRIE) The question, Mr. Witcher, is:

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Does that look like what you saw in Mr. Janney's office?
A. I don't recall seeing this sample. I saw what was sampled in January of 2012.
Q. I believe your slides reference March 2011.
A. That's a different analysis.
Q. It's the Turner Laboratories analyses.
MS. HENRIE: I'm sorry. If I may approach?
CHAIRPERSON BAILEY: Yes, you may.
A. Okay. Okay. I'm with you now.
Q. (BY MS. HENRIE) I just wondered, Mr. Witcher, if what you characterize as the March 2011 lab analysis could have been that January 21st lab analysis that you're looking at.
A. The date shows it to be -- the date shows it to be February 11th, 2011.
Q. Is that the date of the report or the date of the sample?
A. This is the sample collection that they show here.
Q. Is February 2011?
A. No. They show a sample-collection date of January 31st, 2011 in this analysis.
Q. And you're sure you're right?
A. That's what I'm reading on this particular document.

Q. I just want to clarify, where your slides said "March 2011," that it was actually the January 31st, 2011 analysis that you meant. Is that correct?

A. For me to sit here and compare tables, I don't know. The sampling that I was looking at that was reported on the OCD files, it was actually reported in a different format than this. That is what has me confused here.

Q. I apologize. I don't think I have the OCD file with me. Did we show that to you at Mr. Janney's office?

A. No. Actually, I pulled that off of the OCD Web site.

Q. Let's do a quick comparison.

A. It's a document on the similar thickness, yeah.

Q. So if we could go to slide R, which is entitled "Geohydrology and Thermal Regime of 45-7," this TDS of 580 milligrams, is that reflected in the Turner Laboratories analysis that you're looking at?

A. Yes, it is. It shows 580 milligrams per liter. Is that how they report it? Anyway, it shows 580.

Q. Are you aware that that sample was pulled before the well was completed and cased?

A. I don't have a record of the sample.

Q. So if it's a single sample collected --

hypothetically, in your expert opinion, if it's a single sample collected before a well is completed, would it be representative of the water in the well area?

A. Depends.

Q. On what?

A. Well, for instance, if this water were airlifted, certain constituents -- and it was cleaned and certain constituents, it would be representative. Like I say, it depends.

Q. Mr. Witcher, when 45-7 was drilled in that time period, in 2011, were you present on site?

A. No, I wasn't.

Q. I believe that you talked about the subsequent water samples from 45-7 and how they are different than that first water sample. And I believe you said that the water was basically pulled across the fault during pumping -- during the pumping injection test, and that's why the water changed. Is that a fair characterization of what you said?

A. That was one of the hypotheses for the water chemistry, yes.

Q. So there are several different hypotheses?

A. True.

Q. So in that hypothesis, the water that was pulled across the fault during the pumping and injection tests, wouldn't that establish that water on both sides of the fault is hydrologically connected?

A. Could you repeat that question again? I'm sorry.

Q. So this theory that the -- that water from well 55-7 or one of the other wells that's on the east part of the fault, the theory that water from one of those wells was pulled across the fault during pumping and injection and the sampling in 45-7 reflects that moving across the fault, wouldn't that establish that both sides of the fault are hydrologically connected?

A. In that case, it would, yes. But I would add the caveat that they're not connected naturally, and you don't know that they're hydrologically connected until after you create stress on the reservoirs and create enough hydraulic head to break through that barrier.

Q. Right. Which is part of any geothermal project, to -- it's going to happen, especially with a geothermal electricity producing project. Those faults are going to help those wells talk to each other, be connected. Is that part of what these projects do?

A. In the context of what?

Q. In the context of any production well and injection well that need to be in relationship to each other for something like an electricity power plant.

A. Now, that depends. These reservoirs could be highly departmentalized by faults, and if you were getting communication across the faults, it means you're not departmentalized in that sense. If you're not, then that sets up another problem.

Q. Right.

A. Does that answer your question?

Q. It does. Thank you.

Do you have any core data for the middle or lower parts of the formations?

A. Which formations?

Q. Let's say State Well 2. Do you have core information for the whole -- the whole well, all the way down to TD 2100?

A. No. We had drilling problems and had to stop the continuous wireline core drilling, and then went to rotary, but we have cuttings on all of the detail.

Q. And chips?

A. That's what I mean by cuttings. Yeah, drill chips.

MR. LAKINS: Madam Chair, at this time, I promised my wife I would keep her posted on whether or not I was going to be home for dinner. Could we take a break so I could make a phone call?

CHAIRPERSON BAILEY: Let's take a

ten-minute break. We don't want you to get in trouble; she may keep the door locked.

MR. LAKINS: Thank you.

(Break taken, 5:00 p.m. to 5:08 p.m.)

CHAIRPERSON BAILEY: We'll just go back on the record. We are missing our counsel, but she'll be here momentarily, I'm sure.

Did you have further questions of this witness?

MS. HENRIE: Yes, Madam Chair, I have a few more.

Q. (BY MS. HENRIE) I think we left off on slide P, and now if we could move forward to slide T. That involves the isotopes, "Isotopic Evidence for Reservoir and Flow Path." And, Mr. Witcher, these samples are all from relatively shallow wells, correct?

A. That's correct.

Q. And they're all in the upper, northerly part of the area there?

A. That is not correct.

Q. Oh.

A. The Burgett 11 [sic] and the Burgett 6, those wells are in the southerly part, in the middle of the greenhouse area down there.

Q. Okay.

A. Yeah.
Q. They are shallow wells?
A. But they're shallow wells, yes.
Q. As I look at this chart, what occurred to me is that all of this water is basically the same. What is your comment on that?
A. I wouldn't argue with that.
Q. As far as I know, isotopes are not -- not actually talked about in the water quality control regs at all.
A. I don't know.
Q. And going back to, you know, one of the contentions in this proceeding is that the water in one part of the geothermal reservoir is substantially -- has substantially different chemistry than water in a different part of the geothermal reservoir. And I, again, see this chart as reflecting waters that are very similar coming from different places in that geothermal reservoir. Would you comment?
A. Yeah. All of these samples are taken from the outflow-plume part of that reservoir.
Q. And all of that water looks quite similar?
A. Yeah, in terms of what we're looking at right here. Now, there are some differences, but it's -- it's similar, yes.

Q. So differences between an order of magnitude kind of differences?

A. The differences are much lesser than order of magnitude.

Q. And, again, AmeriCulture -- that means AmeriCulture Federal Well #1, which is the same as A-444?

A. A-444.

Q. So it's colder than probably these other wells?

A. Yes.

MS. HENRIE: I can't read David's writing (laughter).

Q. (BY MS. HENRIE) Going back to the isotope slide, we talked about sulfur. And that's the second-to-the-last column. Do you know the range of sulfur values in sedimentary rocks?

A. What age?

Q. In general.

A. Well, there is no general answer. You have to know the age, because sulfur isotopes change with time. They're like strontium isotopes. There is stratigraphy that can take place there, and it has to do with what the marine sulfate value is and the curves on that. For your strontium isotopes and sulfur isotopes, the absence of fossils -- a lot of times, this type of information is used to identify stratigraphic units. In the oil patch in the North Sea, they're using strontium isotopes a lot. And I don't walk around with these curves memorized in my mind. I have to go to the reference.

Q. Sure.

A. But I asked the question about age because that's very important.

Q. I just have a general statement here. According to Muffler, it looks to me this happened [sic] suddenly. And, again, it does not specify what the age is, as you had asked.

The range for sedimentary rocks is much wider than the range for granitic rocks. Would that sound accurate to you, in general?

A. I can live with that, yes.

Q. And a lot of it has to do with what the source of granitic rock is and the sulfur values that are reflected on this chart. According to Muffler [sic], the fault is outside of the range for the granitic rocks. And that's where my question is leading to. Can you comment to that?

A. We're not necessarily measuring the sulfur isotopic ratio of a rock. We're measuring the sulfur isotopic ratio of dissolved sulfur in water and what's the source of that sulfur in water. And my explanation of that is that it's accessory pyrite that is associated with the granite rock or rhyolite. And that sulfur that forms in a pyrite that forms a cooling granite or rhyolite that's magmatic -- so these ratios fit right in with that. So that's the explanation in more detail as to where I come up with that.

Q. Are there other possible explanations that other experts might have?

A. You'll have to ask them. That's my explanation.

Q. Fair enough. Fair enough.

So I'm on slide U, the next slide.

MS. HENRIE: Charles, thank you.

Q. (BY MS. HENRIE) "Summary of Findings." And these were the same findings presented to the OCD in the April 2009 hearing.

A. That's correct.

Q. The first finding is that Lightning Dock is a very small geothermal system and will not sustain power production greater than two or three megawatts. That's based on your conceptual size model?

A. Yes, that's my interpretation.

Q. Is it possible there are other interpretations?

A. You'll have to ask others.

Q. Okay. I guess my point on this slide is that the Division has already considered these arguments in the 2008, 2009 hearing; is that correct?

A. That's what I've heard today, yes.

Q. And these are all, again, based on -- I look at all these bullet points, and they're all based on your understanding of the geologic system out there at the Lightning Dock reservoir.

A. Is that a question?

Q. Is that correct?

A. Yes, that's what I think.

Q. On the next slide, "Summary of Findings 2 part 1," the first bullet refers to Well 45-7, and you say it is completed in a separate basin reservoir than 55-7. How do you define reservoir?

A. In this case, I'm defining that reservoir as in a structural-setting sense.

Q. So the geology determines the reservoir --

A. Absolutely.

Q. -- as opposed to flow?

Are you saying that the nature of the rocks on one side of the fault versus the part of the rocks on the other side of the fault creates separate reservoirs?

A. They certainly can, yes.

Q. They can?

A. Uh-huh.

Q. If there is flow between -- if that fault acts as a conduit and there is no flow between those two different areas, would it not be one reservoir?
A. Not necessarily.
Q. But it could be?
A. Could be, yeah.
Q. And the second bullet, "Well 45-7 chemistry." That will be the January 2011, Turner Labs?
A. I'm going to have to look at the analysis and date with what I was shown here. They may actually be the same, yeah.
Q. "High silica represents equilibration of heated fresh water with quartz...." I'm looking at the third bullet, and I just ask: None of this relates to water quality control constituents, does it?
A. I'm not talking -- I'm not discussing silica in terms of water quality control constituents. I'm using the silica concentration in an interpretive form to understand, either from a development standpoint or from an exploration standpoint, what the nature of the evolution of that chemistry is with respect to a reservoir and how that's operating. And that's how I'm using the silica.
For instance, if there is fresh water there and it was originally cold -- just forget about sources.

But if it's originally cold water from, say, a cold source and it comes in next to the fault and it is conductively heated by heat that's coming through from the uplift that we're looking at there, and that salt water, say, heated up to 250 degrees or 300 degrees Fahrenheit, that original water, with low silica in it, is going to immediately begin to dissolve in the quartz that's in the sand or the formations or the rhyolite, and it's just like dumping table salt into a boiling pot of water. So it'll increase the sodium chloride content of that water. And that's what I'm speaking of here when I talk about the high silica. This probably represents the equilibration of that water with quartz.

And there is another thing here. This water is very high pH, and water, when it's dissolved -- when silica is dissolved in quartz -- quartz is SiO2 solid, and when you are adding water to it, you form a thing that's H4SiO4. It's has no charge. But when you put it into high pH or when you disassociate and create a high pH situation, then you get SiO3. And so in the process, you can wind up dissolving even more quartz just because of that high pH with that reaction, and that's what I'm speaking of here.

Q. So I'm looking at the notice of this hearing and the issues to be addressed at this hearing concerning with whether the proposed injection will contaminate any underground source of drinking water or otherwise cause waters in the state of New Mexico to exceed applicable water quality standards and whether such injection will cause the waste of the geothermal resources or impair correlative rights. So does this issue apply to any of those points?

A. Oh, it certainly could. If there is fresh water in the basin that's been heated -- and I'm explaining the high silica in here. And that would -- because the high silica presents a problem, if it's just cold fresh water by itself, but you evaluate the temperature of that and expose it to that and get the high silica. So that's what this argument is.

Q. And would you agree that there is pretty well-known information in this area? With that plume of mix between geothermal water and the fresh water of the basin, there is sort of an understood boundary related to things like heat, things like TDS?

A. I've never plotted all that information up, and I haven't seen anybody else that's done that.

Q. The wells over in Section 12, the cold-water wells, would you consider those freshwater wells?

A. That's fresh water. But, you know, what you're speaking of is a demarcation between, say, the

AmeriCulture 2 well and the fresh water out here some distance away. You know, where you want to draw the line on your diagram here and these -- I don't have that information --

Q. You don't have it?

A. -- to tell you that.

Q. Fair enough. Fair enough.

And I think we already addressed the last bullet in our discussions about the first one.

And the last slide, W, "Summary of Findings 2 part 2," the first bullet I think you discussed in your testimony, how you read that chart in the Shomaker report and it may be different than how you initially read it. You now read it a little differently?

A. Yeah. When I first read it, I was looking at the vertical axis in terms of feet like you would -- like all the other drawings in that report. But this report added another little dimension to it, and it was pressure in feet corrected to 200 degrees Fahrenheit, but it didn't give a reference datum. Whereas, the others did. They started at zero for the surface and then gave a drawdown datum. On this diagram, it just showed a pressure change, but it didn't give a datum. It didn't show where a surface thing is. That's where I had misinterpreted originally.

Q. Fair enough.
A. That was my explanation.
Q. On the second bullet, do you still believe that those charts show a drawdown of over 110 feet?
A. I do.
Q. You do?
A. I do.
Q. It's my team's interpretation of that to be a drawdown of 70 to 80 feet. Would you disagree? I hope you have the chart in front of you to look at.
A. I don't, but we can pull it up. Is there a figure number that you're referring to?
Q. So we're looking at the Shomaker report, which is AmeriCulture 18, Figure 3B.
A. Okay.
Q. So my team interprets the static to be initially around 60 -- 55, perhaps, at that first blue dot, and there are spikes. But then when we talk about total drawdown, 55 down -- I don't know -- 125.
A. You know, the information that is provided here before 25 January -- looking at this chart, I have no idea what's going on there. It's just noise.
Q. Fair enough.
A. Okay? What I look at here is, after January 25, we see a curve that starts at 30 feet of the

drawdown and ends -- and starts to tail off down here at 120. And so 120, we're looking at 90 feet, I suppose. So 110 feet is probably too much, but we're certainly looking at 90 feet.

And then that other curve that I see on the right, I interpret that as a recovery after the pumping has stopped, and that's what that curve is.

But the stuff prior to that, I don't know what that is.

Q. So your interpretation is about 60 feet of recovery?

A. No. The recovery would be from 120 feet up to 30 feet in the time frame that we're looking at this.

Q. So your interpretation is about 90 feet?

A. Yes. Yeah.

Q. The final bullet, "sustainability of constant mass and energy flow from reservoir for commercial power and no impact to current use of geothermal heat and water rights holders." I'm wondering where this "no impact" standard comes from.

A. That's not my assumption. It seems to me that it's Raser's assumption, and I was just parroting that back.

Q. If we could turn briefly to the 2001 report that you've reported from the pumping test, and your testimony earlier, I believe, is that you were not aware of any wells -- Burgett wells being pumped except the wells that you were in communication with Mr. Burgett about. And I'm looking at page 20. Page 20 is talking about the drawdown in the Burgett A well. And the second paragraph on that page, the third sentence is referring to different slopes in the -- you know, plotted with regard to that well, and it talks about slope 5. And the sentence here says: "The slope 5 drawdown gradient probably reflects unreported pumping of wells at the Burgett Greenhouse south of the AmeriCulture 1 State well soon after the weather cold front passage." So maybe his recollection at the time might have been different?

A. Yeah. I don't agree with those wells.

Q. But if there was unreported pumping, that could have affected some of the results in this report?

A. Yeah. I don't have any recollection of them recording wells down there. In fact, I think, at the time, he wasn't allowed to pump.

Q. Out of his deep well, at least, 55-7?

A. No. I'm thinking out of his shallow well down there.

Q. Dale was pretty good at following the rules?

MR. LAKINS: Objection.

A. (No response.)

MS. HENRIE: Madam Chair, I'll go ahead and pass the witness. Thank you.

CHAIRPERSON BAILEY: Mr. Brooks?

CROSS-EXAMINATION

BY MR. BROOKS:

Q. Mr. Witcher, good evening.

A. Good evening.

Q. You have obviously done a great deal of study and work in this area, of the geology, in the Lightning Dock area, correct?

A. Yes, sir.

Q. I do not have a set of -- a copy of your slides.

MR. BROOKS: And I was wondering if someone has a copy that they could loan me for purposes of brief examination here?

Q. (BY MR. BROOKS) First of all, you said something, and I forget how you phrased it. But I gathered something about immaturity, and I gathered that it had -- it was your opinion that there has not been enough exploration work done on this reservoir to be able to reasonably define it. Would that be a correct statement?

A. I believe the term was "immature" stage of exploration.

Q. That's basically what I remember you saying.

Now, when I go through here, on the slide you entitled "Total Conductive Heat Loss," you have a bunch of equations, and I never was good with equations. But the cartoon you have here shows that there is a stem going up from the deep -- deep confined reservoir, and you label that "Convective Heat Upflow." And then you have a branch going off -- mostly in one direction. I see it's up there. Okay.

You said something that suggested that if you produced within the upflow area, that that might be something like producing a gas cap from an oil and gas -- from a oil and gas reservoir -- in other words, it might reduce the amount of heat that you could eventually produce. And, of course, I don't know enough about geothermal reservoirs to judge that at all, but is that a correct summary of the opinion you gave?

A. Yes and no. If you overproduce that upflow zone, then it would have the same effect of what you're --

Q. In other words, it would reduce the total amount of the heat resource that can be produced there?

A. Yes. The amount of the heat and also the amount of the fluid, which would be the equivalent of pressure draw with your --

Q. I was analogizing it with something I have more experience with.

Now, do you have an idea of how deep the deep confined reservoir is in this area?

A. I could say something about the temperature of the geothermal fluids at their hottest point, and that would probably give you an idea of the depth. And this temperature would probably be around 160 C based upon silica -- that temperature water would be flowing upward. And at that depth, it would have to be buried at least that depth, background temperature gradient for the area and -- which you could use a number of, say, 35, 40 degrees C per kilometer, add that mean annular air temperature and backtrack a depth out of that. But just to give you a number that people can work with, we're probably looking at depths of 10- to 12,000 feet.

Q. Have any of these been indicated for that reservoir, to your knowledge?

A. I'm not aware of anybody that's drilled that deep, and while there is water down at that temperature, there may not be a reservoir to tap.

Q. Now, I would like to first clarify a few details, and then I want to kind of relate what opinions you've given to what I see as being the ultimate issues in this case.

First of all, you talked a lot about the 55-7, and this is two separate applications for injection permits for the 55-7 and the 53-7.

Now, I would judge from their proximity geographically that those two wells are going to be in the same portion of the reservoir, as you've defined it, versus the 45-7, that you say is on the other side of the fault. Would that be correct?

A. I believe the 53-7 is actually -- no. The 53-7 is actually a well in the basin. It's in the basin structure --

Q. Same structure as the 45-7?

A. Yes. It's on the other --

Q. As opposed to 55-7, which, in your opinion, is a different geologic structure?

A. Yes.

Q. Now, you talked a lot, also, about AmeriCulture State #2. If I understood what Mr. Seawright testified to correctly, AmeriCulture State #2 does not produce water; is that correct?

A. Not currently.

Q. What he is producing from is the AmeriCulture State #1?

A. Yes, sir.

Q. Is there any significant difference in the geology between the location of those two wells?
A. No.
Q. That was sort of what I assumed, but I wanted to verify.
A. Yeah.
Q. Now I'm going to be talking about the ultimate issues. And Ms. Henrie read the notice, and I believe that that correctly states, one, that we talked about water quality; two, we talked about waste; and, three, we talked about correlative rights.
Now, Ms. Henrie asked you about water quality, and I'm going to reiterate a little bit differently. So what I'm going to ask you is: Can you give an opinion as to whether or not the injection of water from the 45-7 into the 53-7 or the 55-7 will cause the water quality at any known place of actual or potential withdrawal to exceed water quality standards or any particular water quality standard or the background, whichever is highest, for any particular constituent?
A. You know, I can't give a definitive opinion on that that I would hang my hat on. I don't have the information.
Q. Now, let's talk about correlative rights.

Since you talked about the immaturity of exploration of this reservoir, I would tend to assume that you do not have an opinion as to the actual surface extent of the part of this reservoir from which geothermal heat would be producible. Is that an accurate statement?

A. In part, yes. I could give you some boundaries on where that production is probably going to be located, and it would be in that higher area of heat flow.

Q. So you're going over to your next slide, which is labeled "Lightning Dock Heat Flow," right?

A. Yes.

Q. And when you say higher, are you talking about higher geologically, or are you talking about further north?

A. I'm talking about higher in terms of the heat flow that you see on that.

Q. Well, if I interpret your color scheme correctly, it would be toward the south end of what you believe to be the structure where the higher heat would be; is that correct?

A. Yes, sir.

Q. To get us oriented to that, where is -- in what general area of that heat flow diagram is AmeriCulture State Number Well 1 located?

A. I'm thinking that we're probably about in this area right in here (indicating).

Q. You're in the squeezed-in portion of the ray?

A. Yes.

Q. So Los Lobos' acreage is further south of that; is it not?

A. That is correct.

Q. So if we look at your diagram, it's pretty clear, isn't it, that Los Lobos has the right to produce in a part -- a significant part of what you consider to be the producible part of the reservoir? Would that be accurate?

A. For the electrical part of it. I'll put that caveat.

Q. And right now, AmeriCulture is producing from this reservoir, and Los Lobos is producing zero, right?

A. That's the current situation, yes, sir.

Q. So wouldn't it be a fair conclusion from that that Los Lobos can produce at least some without impairing AmeriCulture's correlative rights?

A. I think that's information that we need to find out, yes.

Q. But you don't have an opinion as of now that they can't produce any of that?

A. Oh, no.

Q. Do you have an opinion that this proposed production and injection -- production from 45-7 and injection into 55-7 and 53-7 -- do you have an opinion whether that would draw down the water level so that AmeriCulture would not be able to continue to produce water from its well?

A. I'm not sure that drawdown would be the issue, but it could be heat, yeah.

Q. That was the last thing I was going to get to, because you gave an opinion that -- which I wasn't totally clear on what you were talking about. You said overproduction from this reservoir could quench the reservoir, right?

A. Yes, sir.

Q. And I think we would all probably agree that if you quenched the reservoir by overproduction, that that would be waste of a geothermal resource. You know, you're not telling us that any production from 45-7 and injection into 53-7 and 55-7 would have that affect, are you?

A. In terms of quenching the resource?

Q. Yes.

A. If production --

Q. Yes.

A. No, I'm not saying that right now. We don't know what the final production numbers are going to be. The final construction of the power plant and what its size is going to be, we don't know that now. And this is where I'm concerned. This is all open-ended, and we need to -- we need to know something more about that before a blank check is given to --

Q. Would it be fair to say you're more concerned about how much is going to be drawn out of this reservoir than you specifically are about how much is going to be injected into it?

A. Well, in terms of degradation of the heat, both those processes can play a role, yeah.

Q. Okay. But you don't have an opinion at this time as to what quantity would be critical in this respect?

A. With the information I have, it would be hard to give a quantitative answer on that.

Q. Now, if you don't have enough information to come to a conclusion, would it be logical to do more testing?

A. That would certainly then provide some of that sort of information.

Q. What kind of testing do you think ought to be done?

A. Well, certainly traditional flow tests;

monitoring water levels in all of the wells; thorough chemistry, including some isotope information, and also putting together information that's already been gathered. I think there is a lot of information that's not on the table right now that might provide a lot of information that would be applicable to this. It's my understanding, over the years, that there's been several electricity surveys done. There has been detailed gravity information collected that I don't have or haven't seen. It's proprietary. I even think there are as many as three seismic surveys that have been done out here, and I think two of those surveys were seismic reflection profiling, and there may have been even more interpretation in terms of a 3-D model. I don't know. And all that information ought to be applied to taking a look at the geothermal potential and the planning and engineering to put in a power plant, and I haven't seen that referenced in any of that sort of information.

Q. Thank you.

I'm going to ask you one more question that I've been requested to ask, and then I'm going to let you go or leave you to the mercy of the Commissioners.

Do you know what the temperature is of the water that comes out of the 45-7?

A. I don't.

Q. Okay.

MR. BROOKS: Pass the witness.

CHAIRPERSON BAILEY: Commissioner Warnell?

COMMISSIONER WARNELL: Thank you.

CROSS-EXAMINATION

BY COMMISSIONER WARNELL:

Q. Mr. Witcher, I'll try to keep this short. We've been here all afternoon now. But I do need a little clarification from you, if you could, please.

On one of your slides -- I'm not going to reference that slide because we've looked at them several times up here. You mentioned a ball with a bar on it.

A. Yes.

Q. Can you explain that a little bit more?

A. There is a geologic system for normal fault, and it's basically a line with a short bar coming off of right angles. And on the end of that, there is a ball, and that's the bar and ball. And that is -- basically, that symbol shows the downside of that normal fault. So that's the way that works, Commissioner.

Q. That's the dip angle?

A. It doesn't show the dip angle. It shows the direction of dip, yeah.

Q. Okay. Thank you.

You had mentioned continuous wireline coring. I've never heard that term before.

A. Yes, Commissioner. In the oil field, you hear about conventional coring, where they'll go down with a core bit, and they will fill up their drill pipe with this (indicating), and then they will trip everything out of the hole or remove the drill rods and everything out of the hole and then recover their core.

With continuous wireline core drilling, what we do is, we mount -- behind our bit, we have a core barrel down there, and we fill up -- we drill and shoot and fill up that core. And then there is an overshot on that core barrel, and we go down with a wire line and grab it, and bring that out of the hole. And we leave the drilling rods in the hole. We don't trip everything out. So it saves a ton of time. And it's technology that geothermal borrows from the mining industry, because they use continuous wireline coring a lot.

Q. Wireline. You mean slickline?

A. Yes. Yeah.

Q. All right. Thank you.

And on these typical hole size, what size bit are we looking at?

A. For core drilling or for --

Q. Yeah, for the core drilling.
A. This is a very typical drilling size (indicating). This is HQ core, and so that's a very typical size. The larger would be a PQ size.
Q. So a relatively small bit?
A. Small bit.
Q. You talked about geophysical logs. Are you referring there to drilling logs, mud logs?
A. I'm referring to wireline tools by a company, say, like Schlumberger. Put in a hole, and they measure the properties of a rock. And one of the logs I like to look at on a routine basis is a log called the gamma-ray log. And on that wireline, they have a tool in the subsurface that they lower at a continuous rate, and they measure the natural gamma radiation that comes off of rock. And all rocks have a little different concentration of uranium, thorium and potassium gamma emitters, because radioactive material is in there. So that's an example of a geophysical log.
Q. Do you generally run a gamma log on a geothermal well?
A. Temperature log, gamma log and maybe even electrical logs.
Q. When you refer to the driller's logs, he's just going out and catching samples at the pit or --

A. I think driller's log reference -- this would be the log reporting on the State Engineer forms, on the well completion form that they sign off on. In a typical case, if you're drilling a water well, the driller log would be the log that the driller compiles while he's out drilling, and he goes over and looks at the blue line and sees what kind of samples are coming out.

Q. So he is a geologist, then, the driller?

A. No. No, not at all.

Now, the other thing that was referred to today was the mud loggers, and they do geologic logs. And those vary in quality, also. They could be as poor as a driller's log. It all depends on who you have sitting there doing it, or they can be very good. It all depends upon who is doing it.

Q. Are they better -- would you say a mud logger log is better than a driller's log?

A. I would say so, yes, in general.

Q. A driller's log could be pretty sketchy?

A. Drillers' logs are interesting to interpret because they have their own language for stuff and usually bring their own experience to a local area. I may not know what they're talking about, but they do.

Q. One other question: You've had that core in front of you all afternoon. I was wondering if there is something you wanted to share with us that you didn't get a chance to.

A. I brought it in to show how distinctive the Hell-to-Finish looks in the Bisbee. I'd be happy to pass it over if you care to look at it. It's very distinctive rock. It's conglomerate, and it's a unit there that represents the erosion of a mountain range, just like in the mountain ranges we see today forming alluvial fans. So this is a Late Jurassic alluvial fan deposit. And it's a -- yeah.

Q. Thank you. That's all I have.

CHAIRPERSON BAILEY: Commissioner Balch?

CROSS-EXAMINATION

BY COMMISSIONER BALCH:

Q. Good evening, Mr. Witcher.

A. Good evening, Commissioner.

Q. For full disclosure: I'm a geophysicist.

A. All right.

Q. Did you say you saw geophysical logs, gamma-ray logs for one of these wells, although it was on a poor scale?

A. I saw a gamma-ray for -- well, we had gamma-ray logs for the AmeriCulture Number 2 well. There are gamma-ray well logs available for 55-7. And then there was a gamma-ray log that I was just able to look at briefly, and it wasn't scaled to the point where it was easy to view in terms of looking at different formations and lithologies.

Q. To your knowledge, any of these new wells additional logs SP, like you said, deeper shallow radio resistivity?

A. Yes.

Q. Are there any FMIs?

A. I don't know if they've run FMI or not. Those would be fantastic to look at if they have.

Q. You mentioned that geothermal -- that those were transient, either growing or fading away, essentially?

A. Yes, sir.

Q. And then later on you made maybe an interpretation. I'm not sure if I'm putting words in your mouth. This appeared to you to be a young anomaly that would be grown?

A. It appears to me to be a very young anomaly in that the ground around there is still heating up, and I base that on the temperature logs on the outflow plume. And I could draw you a picture of how I interpret that if you'd like to see that.

Q. So there's -- I'm probably going to misuse the term. The thermal flux [sic] is greater deeper, and it's increasing, as you go through time, upwards?

A. It's the same flux in the convective part of the system, but around the margins and underneath the outflow plume, it's still heating up.

Q. Right.

A. The outflow plume you see in a temperature log. If you see temperature increasing to the right and you see depth, you'll see the temperature with a high gradient. And you get to the water table into the geothermal outflow, and then it goes isothermal. It doesn't change in temperature. And then it'll -- you'll see a reversal, and then it'll -- it'll slowly increase with depth. And that reversal and that increase, that is the part that shows the disequilibrium. In other words, that system hasn't been operating long enough for all that ground underneath there to be heating up.

Q. It's heating, but we don't know the actual rate that might be?

A. You can model that sort of thing from the curves and determine an age when that may have initiated.

Q. How about a duration of that impulsive heat?

A. You'd have to look at other phenomenon to return to that.

Q. Is that something you could prepare? That may be something we want more information on to make a good comparison.

A. Yes, sir. Yes, sir.

COMMISSIONER BALCH: If we can bring the slides back again.

MR. LAKINS: Yes, sir.

COMMISSIONER BALCH: Go back four or five slides.

Q. (BY COMMISSIONER BALCH) The history of -- conductivity does not introduce excessive error. That's one of the assumptions you want to make. And I think it was pointed out, there could be a range of thermal conductivity. I'm not sure how you do your analyses. Do you apply any sort of sensitivity analysis when you're looking at equations like this, trying to figure out the range of possible solutions depending upon the input range or the input variables?

A. Oh, yes, Commissioner. With the basin-fill sediments, I have several hundred thermal-conductivity measurements that have been measured in an apparatus that measures the thermal conductivity. And these separate out the sand and clay from the sandy clay, and it allows you to make some estimate. And if you look at the lithology logs in a well, you can match up the thermal conductivities.

Now, there are error measurements you do in a laboratory.

Q. Right.

A. And if you've got a real good measurement in a laboratory, you can be under ten percent, and a great deal of the measurements are three to five percent. In the real world, if you have a stack of sand and clay, with higher and lower thermal conductivities, that error will tend to cancel itself out.

Q. What about this situation?

A. This situation, when we're applying the basin-fill sort of thing, I'm not getting into that kind of detail. So I'm thinking our error could be as much as 20 percent overall.

Q. For that one variable?

A. For the thermal conductivity. But the temperature gradient of the error on that is very, very small, and so a 20-percent error with the thermal conductivity would translate into, you know, some error into the heat flow calculation.

Q. Right.

A. But the error wouldn't be embedded in the temperature rate.

Q. My potential field is a little bit more sized -- module sized on geophysics, but the thing that I always remember from potential-field studies is that there is ambiguity in interpretations of an anomaly. Basically, a smaller anomaly in one depth could look like a larger anomaly at a different depth. So there is an inherent -- when you're looking at the potential fields, there is an inherent -- I hate to use the term "artistry," but there is some interpretive component of picking where a boundary is. So when you --

If you'd go forward another slide.

MR. LAKINS: (Complies.)

COMMISSIONER BALCH: One more. Keep going. Again.

Q. (BY COMMISSIONER BALCH) This was your gravity map.

A. Yes.

Q. Did you perform the Bouguer analysis?

A. Yes. I pulled that data off of a site from the University of Arizona, Randy Keller.

Q. Yeah, I've used his data.

A. I used data they had and compiled a spreadsheet.

Q. Did you collect any data yourself?

A. For this, I didn't collect any of the data. Actually, some of the data that you see on the anomaly, I collected as a unit. I collected data further up the road.

Q. Did you do a second root of the --

A. I did not. This is just a complete Bouguer contour map. I didn't try to interpret the data. But your comment on there that there is no unique interpretation on these things without any other geology in there was exactly right.

Q. Right. So if you go to the next slide, I think it is.

COMMISSIONER BALCH: One more.

MR. LAKINS: (Complies.)

COMMISSIONER BALCH: Here we go.

Q. (BY COMMISSIONER BALCH) Where we start to define the horst block, which I think you're interpreting where the heat anomaly is actually located, there is some ambiguity about where those bounding faults are and exactly the size of the anomaly. You think it's pretty small. Is that based on -- I guess when you interpret data, do you tend to be conservative, or --

A. I tend to be conservative.

Q. You tend to be conservative?

A. Yes.

Q. I tend to agree with that interpretation.

However, if you think about a cylinder [sic] priority and it has a constant height, if you change the rate radius of that, you can pretty quickly increase the volume compared to the diameter and the volume, really looking for material that would provide a heat source, an anomaly. So a small change in the size of your anomaly would make a large change in your available heat source.

You mentioned recharge of the system and in the range of 300 gallons per minute to 1,200 gallons per minute. How did you define those boundaries?

A. What I did was, I took 160-degree C and used that as the temperature of the fluid, and then I used -- because that's not going to -- my assumption sorry that modeling something like that just back on the envelope. You have to make gross assumptions, and I just was trying to look at it in terms of a simple model that could be looked at and in order of magnitude. So the assumption is that on the margins of that heat anomaly, or the world out there that's insulated, we're not losing any heat off the sides, and the only heat coming into that system is the regional background heat flow, plus a -- a flow of a particular temperature of water that comes up. And then that heat is lost in the outflow plume. And that outflow plume, you'd almost have to think of it as infinite outflow plume. In reality, it's not, but think of it in terms of a model like that so you get all the heat loss above your geothermal system out of the way. And then that's what I used the heat -- calculate just a mass and energy balance, is the way I worked that.

Q. Could be a little larger; could be a little smaller?

A. Exactly.

Q. That kind of range is based upon your analysis?

A. Yeah. And what I was looking for there is 300 gallons per minute or 10,000 gallons per minute, and those are the sorts of things I was looking at. And I routinely do that sort of thing just to see if I'm, you know, not fooling myself into thinking about something in a -- mode. It may be too simplified for the real world, but it gives you an order of magnitude framework to play with.

Q. Mr. Brooks was asking you questions about what sort of testing you would do. Is one of those kinds of testing that you would do to try to determine the extent or value of heat that you could extract from the pump test?

A. That would certainly be one of the things you would want to do.

Q. That's what they're hoping. If your interpretation is correct about the offset nature, you think it might be more valuable to, say, inject 53-7 from 45-7 and 63-7 from 55-7? Those would be producing and injecting into wells that were on the same side of that --

A. That would certainly be a testing scheme that should be considered, I would think, yes.

Q. One thing that also occurred to me right at the end of your cross-examination with the Applicant: It appears there is a lot historical data out there that you don't have access to, the seismic lines, maybe a 3-D survey, maybe better geophysical logs, maybe more core data that you don't have.

A. I think there may be a lot of information.

Q. This would be data that would be collected by Los Lobos as part of their development plan?

A. I think so. The reason I know that there may be data or studies is that the DOE funded surveys out there, and I've never seen that information.

Q. If DOE funded it and its public-domain segue files were done by a company, obviously it's proprietary. I'm just wondering if some of this additional acceleration [sic] is work that you think is information that may have actually been done by the

Applicant, just without publishing or telling you.

A. That, I don't know.

Q. Important to us, of course, is correlative rights, and that you think the proposed test, the way it's designed, is very likely to impair -- in and of itself impair AmeriCulture's correlative rights to the heat?

A. I think -- the test in and of itself, I can't say that it would.

Q. But it would supply more information?

A. It certainly would, yes, sir.

Q. Thank you very much.

A. Thank you.

CHAIRPERSON BAILEY: I'll thank Mr. Brooks for asking many of my questions, but I do have my own set.

CROSS-EXAMINATION

BY CHAIRPERSON BAILEY:

Q. If we can go to what is labeled, at slide P, "Geologic Cross Section 2," it shows State Well #2 on that far northeast area of the cross section, and it shows that this well is TD'd in the Paleozoic limestone, which is the Horquilla limestone?

A. Yes, Chair.

Q. That well would contribute to thermal waters?

A. In AmeriCulture 2, the silicified QTgc, the orange unit. And the part of the purple unit Tv, those would be the main producers of water, and that's true for the outflow.
Q. What is the source of all the carbonate that we saw precipitated on all the pipes?
A. There was a small amount of carbonate, and all of these fluids have a little bit of calcium carbonate. And when you bring it up and you're working in a fish farm, you end up dissolving CO2, or emitting CO2, so it puts the calcium carbonate out of equilibrium. You get precipitate and a little bit of hardness on the piping.
Q. And why is it on the inflow pipes, because that was the picture, was of an inflow pipe --
A. Okay.
Q. -- that had the precipitant on it that turned pink.
A. Okay. That may have been degassing as the water was coming out of the flow. I really don't know for sure on that, but the chemistry of these waters -- they're low in calcium carbonate.
Q. Right, which is why I questioned the precipitant. And you're saying that is not coming from the limestone?
A. No. I'll explain that. Water that is charged

up with high carbon dioxide from rainfall, as it is recharging and interacting with soils, it'll dissolve minerals, like feldspar. Feldspars have sodium potassium and calcium in them. So what happens is, you created a solution of calcium and sodium and potassium, and then you create a bicarbonate, dissolved bicarbonate, and you also release scale in the solution. That's how the chemistry evolves with shallow groundwater. That's the source of that. You don't have to have limestone to do that.

Q. The reservoir volume has not been calculated because you don't really know the size of the horst block or the volume of the waters contained within?

A. We don't know the volume of the upflow zone that would form the hot reservoir out there. And that's the volume calculation that would need to be done.

Q. Is there a recharge zone?

A. The recharge would be down -- this goes back to Mr. Brooks' question as to what depth that this water is coming into, and that would be your inflow zone, down there. And economically that may not be accessible. And so the zone that's of interest in your reservoir would be shallower, and you'd have to make some decision as to how deep you would want to include your production zone there.

Q. But you don't see any recharge zone for the fluid -- water that is present or is taken out?

A. It recharges at the base of the system, and so -- and the ultimate recharge is going to be tens of miles away --

Q. That's what I'm looking for.

A. -- at a higher elevation. In fact, it's flowing through the Pyramid Mountains, through that caldera complex, and then it squirts upward in that horst block out there.

Q. You implied that there was potential for quench of the geothermal resource.

A. Yes, Chairwoman.

Q. Do you have any theory on how long, by what volume, by what length of time or production or anything to put a calculation on that?

A. I don't right now. I don't have the information to do that.

Q. Those are all the questions I have, then.

CHAIRPERSON BAILEY: Do you have redirect for those questions that have been asked of the witness?

MR. LAKINS: Yes, Madam Chair, just a few.

REDIRECT EXAMINATION

BY MR. LAKINS:

Q. Now, Mr. Witcher, when you were asked about the impact of correlative rights, I just want to make sure of your answer to the question. Was that related just to the short-term-duration pump test or the long-term duration?

A. Yeah. My answer on that is, I do not know the short-term or the long-term of what the impact would be for correlative rights.

Q. We've heard about mounding throughout this. And if there was mounding to occur in the neighborhood of the Well A-444, is it your opinion that water could flow into the formation where Well A-444 exists?

A. It could, yes.

Q. Now, if that were to happen and the higher flouride water were to go there, would that not exceed the existing background of the flouride in Well A-444?

A. If it's geothermal water with high flouride content, it certainly could.

Q. Now, one of the questions you were asked about was on your isotopic slide, with all the water being the same. That was a slide about all the water in the reservoir being the same, or the source of that water. Do you understand my question?

A. Actually, I don't.

Q. Because your isotopic slide, when that was being discussed, the question basically was: Is all that water the same? Do you recall that?

A. Yes.

Q. And your answer was yes.

A. (Indicating.)

Q. Now, does that mean that your interpretation is that all the water in the whole Lightning Dock Geothermal Reservoir is the same, or is it just pertaining to those samples that you took, that they came from the same source?

A. I was answering in terms of samples that we were looking at on the table.

Q. And just to make sure, those samples didn't all originate in the Horquilla, which is the proposed injection formation, correct?

A. Yeah. In fact, no.

Q. Now, one of the things that you had talked about, that you were asked about, was breaking through a fault. Okay? Do you believe that breaking through a fault is what's contemplated in these pump tests to actually create new faults, or is it more to find out what is there?

A. To answer the question, you'd want to find out what is there, but in the process, you could create enough hydraulic head with a fault that normally doesn't transmit water across it. That would then start transmitting water across.

Q. Would that be an alteration of the natural geology, then?

A. Yes, it would be an alteration of the natural flow.

MR. LAKINS: No further questions, Madam Chair.

CHAIRPERSON BAILEY: You may be excused.

THE WITNESS: Thank you, Chair.

CHAIRPERSON BAILEY: Do you have any other witnesses?

MR. LAKINS: No, Madam Chair. We rest.

CHAIRPERSON BAILEY: Did you want to put on rebuttal?

MS. HENRIE: I would. If I could ask for maybe a five-minute break just to get my team organized.

MR. LAKINS: Was the OCD going to put on a witness?

MR. BROOKS: We had designated a witness. I would like to speak with counsel briefly. If I could have a brief recess, and it may be that we will not call our witness.

CHAIRPERSON BAILEY: Let's reconvene at 6:30.

MR. BROOKS: Okay. That will be acceptable.

(Break taken, 6:22 p.m. to 6:30 p.m.)

CHAIRPERSON BAILEY: We are back on the record.

MR. BROOKS: Madam Chair, Honorable Commissioners, counsel have agreed that OCD Exhibit A and OCD Exhibit B, which are the OCD's proposed Conditions of Approval to be attached to any permit issued for injection for Well 53-7 and 55-7, respectively, could be admitted without a sponsoring witness. And based on that, we do not intend to call Mr. Chavez.

It is my understanding that Mr. Lakins would still like to call Mr. Chavez. However, Mr. Chavez has taken the train back to Albuquerque, so he is not available this afternoon. We can make him available at the Commission's pleasure, should the Commission wish.

However, Mr. Lakins, from my understanding of our conversation, wishes to call him to inquire of an area that we have already objected to as irrelevant and the Commissioners already ruled as irrelevant, so we would again object. If the matter is going into the notice of water quality regulations, we would continue to object to any attempt to elicit testimony on that subject.

And with that, we will, at this point, offer into evidence OCD Exhibit A and OCD Exhibit B that I believe was made during the break.

CHAIRPERSON BAILEY: So admitted.

(OCD Exhibit Letters A and B were offered and admitted into evidence.)

MR. LAKINS: And really for purposes of the record, I think Mr. Brooks pretty well summarized my objection. I don't think that the public notice is irrelevant. I believe that I can elicit testimony; I'm allowed to elicit pertaining to that point, and I can't because, of course, Mr. Chavez had to go home.

That's all, Madam Chair.

CHAIRPERSON BAILEY: Would you care to respond?

MR. BROOKS: I'm sorry?

CHAIRPERSON BAILEY: You may respond if you care to.

MR. BROOKS: Okay. I believe that that issue is irrelevant. And if it will help to focus the record on the subject, the Division would be willing to stipulate that the Division did not give notice of this hearing in accordance with the requirements that would apply for a permit under the Water Quality Act, Water Quality Control Commission's regulations, and the reason being is that we do not believe that it is required for a permit being issued under the Geothermal Conservation Act. And I'd refer the Commission to our brief that we filed prehearing.

CHAIRPERSON BAILEY: Your objection is sustained. Mr. Chavez does not need to become a witness.

MR. BROOKS: May I approach the court reporter to present these exhibits?

CHAIRPERSON BAILEY: Please do.

MR. BROOKS: Thank you.

Madam Chair, the Division rests.

These are two separate documents identical to the Division's prehearing statement.

CHAIRPERSON BAILEY: Okay. We do have the material here, then.

MR. BROOKS: The Division's second amended prehearing statement, and the Division rests.

CHAIRPERSON BAILEY: Do you want to present rebuttal?

MS. HENRIE: Madam Chair, we have prepared our comments for the Conditions of Approval that you have just received from Mr. Brooks. I would like to call David Janney just to walk through what those proposed changes, or what our reactions are, and I think we can do it pretty quickly. But I would like the Commission to have that information when it deliberates, and that's all I intended to do.

CHAIRPERSON BAILEY: All right.

MS. HENRIE: So we would like to call David Janney, please.

CHAIRPERSON BAILEY: You're still under oath.

DAVID JANNEY,

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

MS. HENRIE: And, Madam Chair, if I may tender Exhibit -- oh, gosh -- 15. I believe it's Applicant's Exhibit 15, which are the proposed changes to the Conditions of Approval.

CHAIRPERSON BAILEY: Any objection?

MR. LAKINS: I'm confused. This is your 15, but also what OCD --

MS. HENRIE: There are many comments on the first page, but you can see more of the red-line items on the second page.

MR. LAKINS: Oh, I see. I gotcha.

MS. HENRIE: I started with Mr. Brooks'

prehearing statement, and my team took a look at that. And largely we agree that these are appropriate Conditions of Approval for the pending applications.

MR. LAKINS: No objections, Madam Chair.

CHAIRPERSON BAILEY: Then that's admitted as Exhibit 15.

MS. HENRIE: I believe it's 15, and to be clear, 15A and 15B. There are two parts of Exhibit 15. Up in the top, left-hand corner, you will see "OCD Exhibit A" and "OCD Exhibit B."

(Los Lobos Exhibit Numbers 15-A and 15-B were offered and admitted into evidence.)

DIRECT EXAMINATION

BY MS. HENRIE:

Q. Exhibit A, Mr. Janney, concerns Well 53-7.

A. All right.

Q. Do you have that in front of you?

A. I do.

Q. And the first proposed change is down at paragraph three. So would you be able to explain why the team felt that changing the specific reference to Well 45-7 to "any well" -- why you thought it was a good idea?

A. We felt we needed a broader approach to sampling any production well prior to injection into any injection well, and we didn't want to limit it strictly to the 45-7. If we want to produce at another well at some point in time in the future, then we felt it would be more applicable to sample "any Production Well" at that time.

Q. So in other words, if this is a permit that's issued for Injection Well 53-7 and the plans change in the future and Well 63-7 serves as the production well, is it your position that this permit should apply equally with regards to 63-7 or any other producer?

A. Correct, or any other producer.

Q. That's what that change was intended to do.

How about the change in paragraph four? Is that similar?

A. It is. It's basically the same change.

Q. So let's turn to page 2, paragraph five. Again, similar?

A. Yes.

Q. And paragraph six actually looks different. The change is to insert the words "commercially reasonable" into the last sentence, so the last sentence would read: "The operator shall implement commercially reasonable efficient geothermal engineering power generation design, operations, and environmental best management practices to address applicable regulations and to prevent pollution"?

A. Correct. In the overall picture, it still has to be economically feasible for us to do.

Q. Paragraph seven has to do with waste, and in that first sentence, the word "unfiltered" was replaced with "high turbidity." Could you explain why that would be so? The subportion of that will read: "Prevent the reinjection of high turbidity cooled geothermal reservoir fluids" -- and an additional addition -- "treated and/or stored at surface back into the reservoir." Just sort of explain what the point of this requirement is and then what the specific guidelines are to that.

A. It would be extremely difficult to filter any -- for prior to injecting. In addition, it would not be reasonable for Los Lobos to inject anything with high turbidity. It would basically seal our own well, and we're not in business to do that. We want to maintain as much injectability and producability from producing wells as possible. So we would not want to inject high-turbidity water into our wells. Therefore, we have changed "unfiltered" to "high turbidity," to remove the requirement to filter before we inject. We acknowledge -- not inject high-turbidity water into our injection wells.

Q. If I could ask this: The idea that there would be any geothermal water treated and/or stored at the surface, in what situations would that occur?

A. That would only occur during the proposed tests. It would not occur once power generation has commenced, because that part of the process would be entirely closed loop. The only reason that we have to temporarily store surface element [sic] is because we don't have enough pump capacity at this point to inject at the same rate we produce from the 45-7, or we may not.

Q. So the idea is, what comes out of the ground you want to go back into the ground?

A. It's temporarily stored at temporary holding ponds located at 55-7.

Q. Thank you.

Let's go down to condition number eight, the first paragraph. Again, we're on page 2 still, "Water Evaporation." And, again, can you explain when water evaporation will occur in connection with this project?

A. It only occurs during testing. It only occurs when water is temporarily stored in the 55-7 centralized ponds. In addition to some evaporation at that point, we will also expect to lose due to flashing [sic].

Q. In this plant operation, would there normally be any evaporative losses?

A. Not through the binary cycle.

Q. So there is a change here in the first paragraph of Section 8: "Surface fluid management operations may include production well testing, well work over, repair, maintenance, and/or anytime geothermal resource fluids are exposed to ambient air conditions." So this sentence seems to be defining the phrase "surface management operations." So can you explain why "may" was added and "annual" was stricken? Do you recall?

A. Actually, I don't recall. I apologize. It's been too many days since we've gone over this. We may not annually test our production wells.

Q. Right. Okay. And could there possibly be other types of testing in the future that would entail evaporative losses?

A. During well work over? That is correct, or any other repair and maintenance operations.

Q. So does the addition of "may" possibly indicate that this list is not exhaustive?

A. Correct.

Q. Let's move on to the second paragraph in condition number eight. And the very last sentence --

you know, this has to do with monitoring inflow, outflow, fluid levels in the pits and the ponds to maintain adequate free board and to prevent overflow, et cetera; the operator needs to record evaporation fluid losses. And the very last paragraph -- I mean the very last sentence, can you explain the addition there?

A. It seems that this requirement should only be necessary "during well testing." That would be the only time we temporarily store water in 55-7 and the centralized pond. So it's just clarification.

Q. And the last paragraph in condition number eight -- let's see. Jumping down to the middle of the paragraph: "The operator shall conduct annual production well testing as specified in GTHT-1" as used in this draft permit.

A. I believe it's a reference to the discharge permit.

Q. And why does -- why do these changes suggest that annual production well testing should be as specified in the discharge as opposed to how it was written here in the Conditions of Approval?

A. Because that permit or that testing requirement is on a five-year basis.

Q. So it's just making this condition consistent with the discharge permit?

A. Correct.

Q. Let's move on down to Conditions of Approval number nine related to mechanical integrity testing. The first paragraph in condition number nine, the proposal is to strike the requirement that OCD witness the MIT tests. So these are the case and integrity tests, as well as the cement bond log.

A. Correct.

Q. Why would that change be appropriate?

A. Well, in the past, we've provided notice to OCD of an upcoming test, and they have chosen not to travel to witness the test. However, we have extended the visitation to witness the test.

Q. So it would say continue to give OCD notice to witness, but it's not a requirement? We can't --

A. Correct.

Q. For example, we wouldn't be foreclosed from doing the test if OCD did not attend?

A. Correct.

Q. Turning over to page number 3, down to condition number 11, and this, again, relates to the OCD discharge permit, which is styled GTHT-1. "The operator shall ensure that any OCD approved G-104 and G-112 permits...."

A. That's for a permit to produce and permit to inject.

Q. Those are the OCD forms?

A. Correct.

Q. So any OCD-approved G-104 and G-112 permits with the discharge permit -- "the operator shall request" -- and here's the insertion -- "a minor 'Modification' to the permit for any changes to its permit to include any new and/or removed existing UIC Class V Geothermal injection/disposal well(s) prior to commercial power production operations and/or as needed," et cetera. Why was the word "minor" added?

A. We believe precedence has already been set using 51-7 located on the AmeriCulture property as an injection well, and that well location was changed to the 63-7. The bonding was changed to a company, that physical change, and there was no objection to injection into the 63-7 on the part of AmeriCulture.

Q. So the OCD has already shown us how to proceed?

A. Do a minor change in well locations.

Q. Under the discharge permit?

A. Correct.

Q. And paragraph 12, it looks like a lot of this has been stricken. It looks like all of paragraph condition 12 has been stricken. Condition number 12 related to a water replacement plan. And do you recall

why this section was removed from this permit. If it's still a requirement under the statute, why was it taken out of this permit?
A. Because this is a permit to inject, so there is no production from the 53-7 or the 55-7 for injecting into those wells.
Q. So the idea that a water replacement plan, which is -- are you familiar with water replacement plans?
A. To some degree.
Q. So the idea of a water replacement plan is, if the water table drops, whoever causes it to drop has to do something to make sure there is not harm. Is that an accurate summary?
A. That is correct.
Q. And so Statute 71-5-2.1 is the requirement relating to the water replacement plan; is that correct?
A. I believe it is.
Q. So by taking this out of the permit, is Los Lobos suggesting it is not going to do what the statute requires, or is it simply suggesting this is not the place for this requirement because it's an injection well, not a production well?
A. Correct. It is not a place for this requirement because it is an injection well, and there

will be no production.

Q. And so there are no other comments here on form 53-7.

Mr. Janney, could you look quickly at Exhibit B, which is 55-7, and just compare the proposed changes and see if there is anything different.

A. I don't believe there are any differences.

Q. And I have one last question. Is it Los Lobos' understanding that this permit is not limited to testing? Let me ask the question differently.

In your experience with the OCD for this project, has OCD handled injection well test permitting differently than placing a well permanently on production or injection? Are there different permit paths or requirements for well testing as opposed to permitted operations?

A. I believe we're subject currently -- under OCD guidance, that treats them equal.

Q. And so if these Conditions of Approval are accepted, they would be Conditions of Approval not only for the testing but for operations as well?

A. Correct.

MS. HENRIE: Thank you, Madam Chair. I have no more questions.

MR. LAKINS: Madam Chair, Commissioners, I have no questions of this witness on this.

I'd just like to make one point here. We weren't even given this until right now, so I haven't even had an opportunity to evaluate it to even know what questions, realistically, to ask. But I hear a couple of things that are extremely disconcerting here.

Primarily what I'm hearing is that what Los Lobos is asking for is a permit to just do the project, not a permit to do a test, which seems to be the impetus of this hearing, was all about a test. A test. That's what we've heard. And now what I'm hearing, what they want this approval to be, is not limited to testing. That's a problem.

Further what I hear is, on this Section 8, they want to eliminate a one-year testing requirement that the OCD saw fit to require and make it five years. In other words, they want this permit to control, and they don't even need to do testing but once every five years. That's a problem.

I don't like this change that an MIT has to be approved by the OCD to, all of a sudden, oh, well, the OCD can come out and watch, but if they don't come out and watch, we get to do it anyway. I don't like that.

But the biggest problem with what I just heard is the elimination of Section 12 entirely and the interplay of NMSA 71-5-2.1. It's kind of what I asked at the very beginning of this hearing. What regulatory authority it is that applies here and controls?

And what we have been told every step of the way is what this project is all about is taking water out of the ground and putting it back into the ground through the same source, which is exactly what 71-5-2.1 is all about. And under 71-5-2.1, there are two things: One, that the Division has to get all this information, give it to the State Engineer to find out about impairment, and then if there is some sort of a impairment, then a plan of replacement is specified.

That's what the OCD saw fit to put in here, and the Applicant is now saying, Well, we're not going to do that at all. We'll do that because the regs say it. But it only, to me, demonstrates the confusion and the hide-the-ball when I see this going on here, because there is -- all of a sudden, they're wanting to change what I have all along understood this hearing to be about, a test; test, test, test.

But what I would ask is to reserve the right to make written comment, because, as I said, I haven't gotten a chance, with my clients, to sit down and analyze the proposals as far as it applies to the

GTHT permit, and that's patently unfair.

CHAIRPERSON BAILEY: Mr. Brooks?

MR. BROOKS: Madam Chair, Honorable Commissioners, we generally object to the changes that are proposed. However, inasmuch as we don't have a witness and in order not to prolong this proceeding, we will leave it to the discretion of the Commissioners to adopt these conditions in such form, if at all, as their judgment directs.

We will, however, agree to two specific changes here in paragraph nine. We would object to the -- we would agree to the change of paragraph nine provided that -- and this is because of the distance from Artesia to Lordsburg -- provided it be changed to read "and OCD shall be given three business days' notice and an opportunity to witness" -- "three business days' prior notice and an opportunity to witness the MIT."

Second, this is a mistake which is a miscommunication between me and some of the OCD staff, but obviously it occurred on my watch, so I'll take responsibility for it. A portion of condition paragraph 12 is legally erroneous, and we would therefore agree to -- the second paragraph of paragraph 12 reads: "This information shall include the information specified by The Office of the State Engineer and shall be submitted to the OCD in order that OSE may render an opinion...." And then we would agree to striking everything from the word "opinion," in the second line of the second paragraph, up to the word "pursuant" -- well, up through the abbreviation "OCD" in the third-to-the-last line of the same paragraph. So it would read: "OSE may render an opinion pursuant to NMSA 71-5-2.1," with everything in between deleted. That's, in my opinion, inserted material that correctly describes the opinion the OSE is called upon to render by that statute.

We would otherwise object to striking paragraph 12.

We note there is some -- there is some reason to Ms. Henrie's argument. However, at the same time, 71-5-2.1 requires us to provide information to the State Engineer, and it doesn't require the operator to provide information to us; and we have limited means of enforcing any request we make. If we make a condition to a permit, that gets us away from a problem we would otherwise have in terms of getting -- getting -- being able to implement the State statute, since the only way we have to get the information to the State Engineer is to get it from the operator.

Thank you.

CHAIRPERSON BAILEY: The Commission also

has not seen these suggested changes. I agree with Mr. Lakins that there needs to be a time for us all to review and to determine the necessity of these changes. So if the Commission agrees, I do not think that we can make a decision concerning Exhibit 15 until we have an opportunity for comments to be tendered by all parties for the reasons why these suggested changes should be made or should not be made.

COMMISSIONER BALCH: Is this really in the form of what we typically ask for, which is basically findings from each party to assist the Commission on writing the order, if there is an order?

CHAIRPERSON BAILEY: This is new material. This is not a summation of material that has been presented to us for review prior to the hearing or for decisions that were made during the hearing. None of us have had the opportunity to digest the implications --

COMMISSIONER BALCH: Right.

CHAIRPERSON BAILEY: -- or any of the suggested changes, and so at this point, we are not able to even deliberate on this exhibit to reach any decisions on this case.

Counsel, do you have words of wisdom?

MS. BADA: I would allow the others an opportunity to respond.

CHAIRPERSON BAILEY: So at that point, we can have written closing statements to go with --

MS. BADA: Yes.

CHAIRPERSON BAILEY: -- the response to Exhibit 15?

We would be able to get a transcript within a couple of weeks, but it would be possible for us to deliberate this case --

COMMISSIONER BALCH: April 16th.

CHAIRPERSON BAILEY: -- on April 16th. So that would be the date by which we would need to have closing arguments and evaluation of Los Lobos Exhibit 15.

(Discussion off the record.)

CHAIRPERSON BAILEY: So they could be due April 9th. Is that a Monday?

COMMISSIONER BALCH: That's a Tuesday. That's the week before -- one week before our next hearing on the 16th.

CHAIRPERSON BAILEY: That would give us a week to review closing arguments and the documents so that we would be able to deliberate on the 16th on this case.

MS. BADA: Yes.

CHAIRPERSON BAILEY: Yes.

(Discussion off the record.)

CHAIRPERSON BAILEY: Okay. The close of business on April 11th will be the deadline for submittal of closing arguments and evaluation of Exhibit 15. Then we will deliberate this case at the normally scheduled OCC hearing on April 16th.

With that, we will recess this case until April 16th.

Is there any other business before the Commission tonight?

Then we are done for the day.

(The proceedings recessed, 7:04 p.m., until April 16, 2013.)

STATE OF NEW MEXICO

COUNTY OF BERNALILLO

CERTIFICATE OF COURT REPORTER

I, MARY C. HANKINS, New Mexico Certified Court Reporter No. 20, and Registered Professional Reporter, do hereby certify that I reported the foregoing proceedings in stenographic shorthand and that the foregoing pages are a true and correct transcript of those proceedings that were reduced to printed form by me to the best of my ability.

I FURTHER CERTIFY that the Reporter's Record of the proceedings truly and accurately reflects the exhibits, if any, offered by the respective parties.

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.

Mary C. Hankins

MARY C. HANKINS, CCR, RPR
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