ORIGINAL

1	NEW MEXICO OIL CONSERVATION DIVISION HEARING
2	DOCKET NO. 41-08, CASE NO. 14246
3	LORDSBURG, NEW MEXICO
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8	TRANSCRIPT OF PROCEEDINGS
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10 .	On the 1ST day of DECEMBER 2008, the
11	matter came on for HEARING before the HEARING
12	EXAMINER, DAVID BROOKS.
13	The Oil Conservation Division appeared by
14	Counsel of Record, MS. MIKAL ALTOMARE.
15	The Applicant, RASER POWER SYSTEMS, LLC,
16	appeared by Counsel of Record, MS. OCEAN MUNDS-DRY,
17	Law Office of Holland & Hart.
18	The Opposing Party, AMERICULTURE
19	INCORPORATED, appeared by MR. DAMON SEAWRIGHT.
20	At which time, the following proceedings
21	were had:
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23	

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## MONDAY, DECEMBER 1, 2008, 9:10 A.M.

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3 HEARING EXAMINER: Good morning, ladies 4 and gentlemen. I'm David Brooks. I'm the 5 designated Hearing Examiner. Mark Fesmire, the 6 Director, is present here, but I will be presiding 7 over the proceedings. 8 This is a special docket, special

9 Hearing Examiner docket for the New Mexico Oil
10 Conservation Division, Docket No. 41-08. This is
11 being held at the Special Events Center in
12 Lordsburg, New Mexico.

At this time, we call case Number 13 14246, the application of Raser Power System, LLC, 14 15 for approval of a discharge plan pursuant to the New Mexico Quality Act, Hidalgo County, New Mexico. 16 17 Calling for appearances in this case. MS. ALTOMARE: Mikal Altomare, counsel 18 19 for the Oil Conservation Division. 20 MS. MUNDS-DRY: Ocean Munds-Dry with the Law Firm of Holland & Hart who are representing 21 22 Raser Power System, LLC. I have three witnesses.

HEARING EXAMINER: Okay. And you havetwo witnesses?

25 MS. ALTOMARE: I have two witnesses. VICKIE ISAACS, CCR/RPR

1	MR. SEAWRIGHT: Damon Seawright on
2	behalf of AmeriCulture Incorporated.
3	HEARING EXAMINER: Thank you. You have
4	how many witnesses?
5	MR. SEAWRIGHT: One.
6	HEARING EXAMINER: Okay. Would all the
7	witnesses who are present please stand? Go around
8	the room from left to right, you'll need to state
9	your name.
10	MR. PEERY: Roger Peery. I'm from John
11	Shomaker & Associates.
12	MS. WRIGHT: Jennifer Wright with Nalco
13	Company.
14	MR. HAYTER: Michael Hayter with Raser
15	Technologies.
16	MR. PRICE: Wayne Price, New Mexico Oil
17	Conservation Division.
18	MR. CHAVEZ: Carl Chavez, New Mexico Oil
19	Conservation Division.
20	MR. WITCHER: Jim Witcher, Witcher &
21	Associates.
22	HEARING EXAMINER: Okay. Would the
23	court reporter please administer the oath?
24	(Said witnesses were first
25	duly sworn, testified as follows:)

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1 HEARING EXAMINER: Be seated. 2 Some housekeeping matters before we 3 In order to explain where we are and proceed. what's going on, I'm going to have the Division 4 present its case first so we can all get the 5 6 background information we need. Then the applicant 7 can present its case, and then the protesting party 8 can begin to present its case. 9 Each of the parties that the division,

applicant, and protesting party will be allowed to cross-examine the witnesses called by the other parties. There are a number of members of the public, I believe, available, and we will give members of the public who are not testifying under oath an opportunity to make comments at the appropriate time.

The usual procedures in proceedings of 17 this character is that we give people an 18 opportunity to make comments prior to the luncheon 19 20 recess, and prior to the adjournment. I'm hopeful 21 that this hearing will not take more than one day. It is -- if the timing of the witnesses 22 23 follows the pre-hearing statement, it should take 24 about four or five hours. My guess is that it will likely take somewhat longer than that. 25

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But if there is anyone who has to leave 1 2 before the luncheon recess, we will give you an opportunity to make comments before you have to 3 We will give you an opportunity -- members 4 leave. 5 of the public who are present an opportunity to make comments prior to the luncheon recess. 6 Restrooms are back there behind the 7 grill on that side. I don't believe any 8 9 refreshments in any character are available here. We are operating a little bit with whatever we've 10 11 got here. I apologize for it being so cold here, 12 but maybe we'll warm up as the day goes on since the sun is shining. 13 Okay. Mr. Seawright, you indicated you 14 wanted to raise a procedural matter before the 15 beginning of the testimony? 16 MR. SEAWRIGHT: I do. Thank you. 17 Mr. Hearing Examiner, AmeriCulture 18 moves to strike the applicant Raser's direct case 19 That despite representation of 20 witnesses. 21 competent counsel and explicit instructions in your order of November 13<sup>th</sup>, 2008, Raser failed to supply 22 AmeriCulture with a copy of its pre-hearing 23 statement by 5:00 p.m. on November 21<sup>st</sup>. 24 25 Instead, Raser's pre-hearing statement

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was conveyed out of time on the afternoon of
 November 24<sup>th</sup>. As a result, AmeriCulture did not
 have the benefit of information contained therein
 until that time.

5 Furthermore, in the notice of public 6 hearing signed by Mark Fesmire, the submitted pre-7 hearing statements were instructed to provide a 8 summary or outline of anticipated testimony; 9 anticipated direct testimony of each witness.

10 Raser's pre-hearing statement is devoid 11 of any such summaries or outlines for each of its 12 five witnesses. In contrast, AmeriCulture's pre-13 hearing statement included a detailed summary of 14 direct testimony of its one direct case witness. 15 Therefore, until this time, Raser has

had the benefit of AmeriCulture's summary and direct witness testimony, while we have no idea of Raser's direct case witnesses, what they're going to say.

20 HEARING EXAMINER: Response.

MS. MUNDS-DRY: Mr. Hearing Examiner, we do understand that we were late, and we apologize to the Hearing Examiner, the OCD, and, of course, AmeriCulture. We did provide that pre-hearing statement on a Monday to all the parties, and I

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believe it was faxed to AmeriCulture on Monday. 1 2 The simple matter was that Raser and AmeriCulture were in discussion, negotiations, 3 until the very last minute, and we hoped, frankly, 4 5 to not have to come to hearing here today. When we realized that that was still going to happen, we 6 quickly got our case together and assembled 7 8 witnesses.

9 In terms of being devoid of a summary, 10 that's true. We did list the witnesses and their 11 particular expertise. Like I said, we did the best 12 we could in a short amount of time to try to 13 present as much information as we could to all 14 parties.

I don't believe that they've been prejudiced. They have had this entire week to prepare, and I wish this would have been raised earlier so we could have addressed it. We would have been glad to let them know and give them a summary before now.

HEARING EXAMINER: Thank you. The normal procedure of the Oil Conservation Division is to continue cases where a pre-hearing statement is filed late. However, because of the arrangements that had to be made to make this

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1 hearing occur, and what it did, that's not a very 2 feasible thing to do in this case. 3 Accordingly, we will -- I will overrule the procedural request that's been made here and we 4 will proceed with the hearing. 5 6 As I said, I think the Division -- it 7 is appropriate for background that the Division present its case first so we will know what the 8 9 Division has done in processing this application, and what the Division's recommendations are so far 10 11 as this application at this point. 12 Ms. Altomare, do you want to make an opening statement? 13 14 MS. ALTOMARE: I would like to make a brief opening statement. 15 16 HEARING EXAMINER: Okay. You may make 17 your opening statement, and then I will give other 18 counsel an opportunity, if they wish, to make their 19 opening statement now, or if they wish to preserve 20 it until the beginning of their case. 21 Go ahead. 22 MS. ALTOMARE: Thank you, Mr. Hearing 23 Examiner. 24 Just for clarification purposes, the 25 Division wants to be clear that our purposes in

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1 attending here are simply to advise the public and 2 parties as to what our role is in this particular 3 process.

As the Oil Conservation Division, we take on many different roles in regulating many different areas. We wear a lot of different hats, and each of those hats has many different steps in each of the processes that we engage in.

9 In this particular instance, we are 10 being asked to participate in a water quality control issue. We are regulating water guality 11 issues. We are in a particular stage in that 12 Specifically, an application has been 13 process. 14 submitted to our department, it has been reviewed by the Environmental Bureau, and it has been deemed 15 16 administratively complete.

What that means is, basically, that a dialogue has begun between an operator and our agency regarding water quality issues, and that dialogue is going to be continuing. Under that hat, we are going to be evaluating water quality issues.

23 What we are here today to address are 24 Water Quality Act issues, not Geothermal Act 25 issues, and not water rights issues. Even though

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production well information is included in the application that was submitted, and is relevant to some of the information that is evaluated in the context of the water quality issues for purposes of contacts, because it's important to consider where the water is coming from that is being re-injected.

It is not -- production wells
themselves are not the main purpose of this
application. It is the discharge permit and the
water quality issues that are the crux of what is
being evaluated at this point in time.

What our purpose is in this hearing is 12 to set out a framework within which the parties can 13 14 then work at this stage to evaluate and address Water Quality Act issues, so that we can get passed 15 16 this point, and then later on determine if and when there are Geothermal Act issues, and/or water 17 rights issues to be addressed. Those issues will 18 19 be addressed at a later time with the proper agencies, if and when it's determined that parties 20 have standing, and issues that have merit. 21

At this point in time, I'd like to call my first witness, who is Carl Chavez, who is going to go through what we have received from the applicant, what we have deemed to be

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administratively complete, things that we 1 2 anticipate that we're going to be needing 3 additional information regarding, and what that ongoing dialogue is going to look like as that 4 5 process proceeds, if the project goes forward. 6 So that we make sure that the Water 7 Quality Act -- the Water Quality Control rules are 8 adhered to, that contamination doesn't occur, and, 9 basically, that the ground water is protected, 10 which is the hat, so to speak, that we are wearing in this proceeding. 11 So at this time, I'd like to call Carl 12 13 Chavez to testify. 14 HEARING EXAMINER: Okay. First off, Ms. 15 Munds-Dry, do you want to make an opening statement 16 at this time or prefer to --17 MS. MUNDS-DRY: Mr. Brooks, I'd prefer to reserve it for our direct. 18 19 HEARING EXAMINER: Okay. Mr. Seawright, do you want to make an opening statement, or defer 20 21 it to the beginning of your case in chief? 22 MR. SEAWRIGHT: I'll make it now. 23 HEARING EXAMINER: Okay. Go ahead, sir. 24 MR. SEAWRIGHT: I'm Damon Seawright, 25 President of AmeriCulture, Incorporated, a 13-year-

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1 old aqua-culture company that grows fish on 2 property within a half mile of Raser's proposed power plant project. I have a vested interest in 3 4 the determination of this hearing because AmeriCulture grows fish in waters in hydraulic 5 connection with those Raser is proposing in --6 THE REPORTER: Mr. Seawright, I can't 7 8 hear you. 9 MR. SEAWRIGHT: Should I begin again? THE REPORTER: Yes. 10 MR. SEAWRIGHT: I have a vested interest 11 in this determination of this hearing because 12 AmeriCulture grows fish in waters in hydraulic 13 connection with those Raser is proposing to inject 14 15 into. We fully understand that the hearing is 16 limited to discussion of Raser's injection well 17 18 permit. Mention of production wells will be made as it pertains to the production of water for 19 20 injection. I would like to say at the outset that 21 AmeriCulture is not, nor has it ever been, 22 intrinsically opposed to the generation of power 23 used in geothermal energy. In fact, on two 24 separate incidences, AmeriCulture has investigated 25

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the possibility of building small power plants of
 its own.

Having done so, we know that geothermal power generation can be done in an environmentally benign fashion that protects the environment, protects correlative and water rights, does not result in the waste of geothermal resources, and does not threaten plant, animal, or human health or physiology.

We are opposed to Raser's proposed 10 11 injection permit as currently submitted for the following reasons: At its essence, Raser's proposed 12 injection permit includes two primary aspects, both 13 14 of which have the potential to pollute ground waters protected under the New Mexico Water Ouality 15 Act, and endanger plant, animal, and human health 16 17 for those relying on regional waters for business and personal sustenance. 18

19 The first aspect, which will be 20 elaborated upon by AmeriCulture's direct case 21 witness, Jim Witcher, is that Raser proposes to 22 inject of an unknown quality and chemistry into an 23 uncharacterized and unexplored geological stratum. 24 As such, neither the production nor the injection 25 wells should be permitted as such, but rather as

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exploratory wells until such time that a scientifically credible case can be built, that the production and injection scheme will have limited impact for New Mexico ground water, and those that rely on it.

6 The second aspect, which is buried 7 among hundreds of pages of application and related 8 materials posed on the OCD website, is a proposal 9 by Raser to inject a cocktail of more than a dozen 10 foreign, and in some cases, hazardous chemicals used for the control of algae, micro-organisms, and 11 scaling, into one of Hidalgo County's largely 12 untouched water resources. 13

14 AmeriCulture's fish are growing in a mixture of cold ground water and geothermal water, 15 16 and, therefore, the injection of potentially hazardous chemicals is of grave concern to 17 Americulture. Americulture even has a water well 18 whose production zone lies between 1,400 feet, and 19 2,100 feet below ground level which overlaps the 20 injection depth proposed by Raser. 21

As you will likely hear in forthcoming testimony, Raser's very own hydrogeological consultant firm has reported to them that Raser's project will likely, dramatically impair the water

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rights of surrounding businesses and persons as 1 2 indicated by projected drawdown in regional wells. This expectation is directly relevant 3 to water quality in that it would demonstrate to be 4 a direct connection between Raser's wells, and 5 6 those of AmeriCulture and Burgett geothermal. Fish tissue containing certain of the cooling tower 7 chemicals would likely be regarded as adulterated 8 by the Food & Drug Administration, and, therefore, 9 unsafe for human consumption. 10

As will likely come out in testimony, 11 no acute toxicity levels for the proposed chemicals 12 have ever been determined for the fish that we 13 grow, Nile Tilapia. Nowhere has the dispersal of, 14 degradation of at elevated temperatures, or the 15 inter-reactivity of the proposed chemicals 16 17 sufficiently well known to render a scientifically credible case for their use. 18

19 Therefore, injected chemicals should be 20 limited to those approved codeable water. The 21 anti-scaling, anti-microbial, and algicidal 22 chemicals listed in the application do not meet 23 this description. This concern is particularly 24 germane given the environmentally benign 25 alternatives to cooling towers exist.

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1 Lastly, AmeriCulture and many others 2 regard Jim Witcher, our direct case witness, as more expert than the geology and hydrology of the 3 of the Lightning Dock Geothermal area than any 4 5 other person. His testimony will be technical in nature because the resolution of any potential 6 problems or deficiencies in Raser's overall project 7 8 in general, an injection plant in specific, can only be resolved through sound signs. Thank you. 9 10 HEARING EXAMINER: Thank you. The 11 acoustics in here are not really good, so to make sure the court reporter hears you, if the court 12 13 reporter needs somebody to repeat something, we'll have to do that. 14

I have chosen not to limit time in this 15 16 case. As I said, it should take four or five hours if the pre-hearing statements are an accurate 17 18 reflection of the time that the witnesses will 19 testify. My guess is it will take longer than that. Hopefully, not that much longer, but as a 20 21 person can recognize when we have multiple parties, we either have to limit the time at the beginning 22 of the case, or else not limit it at all because 23 24 it's not fair if the hearing examiner allows one party to go on for an unlimited period of time, and 25

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1 then other parties have to put on their case in whatever time is left. 2 3 So we will proceed without time limits, but we ask everyone, each of the presenting 4 5 attorneys and parties, to make their cases, put on their cases as succinctly as possible. 6 Ms. Altomare, you may call your first 7 8 witness. 9 MS. ALTOMARE: Thank you, Mr. Hearing Examiner. The Division calls Mr. Carl Chavez. 10 11 CARL CHAVEZ, 12 (Having been first duly sworn, testified as follows:) 13 DIRECT EXAMINATION BY MS. ALTOMARE 14 Mr. Chavez, just for the record, would you 15 Q 16 state your full name and title? Carl John Chavez. I'm an environmental 17 Α 18 engineer with the Oil Conservation Division, 19 Environmental Bureau out of Santa Fe. MS. ALTOMARE: Is he speaking loud 20 21 enough? THE REPORTER: A little bit louder. 22 MR. CHAVEZ: Repeat it again? 23 THE REPORTER: No, just louder. 24 (BY MS. ALTOMARE) How long have you been in 25 Q

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1 that position?

A About three-and-a-half years with the Oil
Conservation Division.

Q As part of your -- do part of your duties in that position involve review of discharge permit applications?

A They do specifically for the underground injection control program, Class 1, 2, specialty wells, LPG storage, Class 3 brine wells, Class 5 sanitary, possibly, and Class 5, geothermal, and possible geosequestration for three years.

12 Q Again, you've led into my next question. 13 So a Class 5 well is what we're talking about here, 14 a geothermal injection well?

15 A Absolutely. Under Water Quality Control16 condition regulators.

Q And you prepared for us today a power-point recitation to summarize the Division's role in this process; is that right?

A Absolutely. We'll go over the process, kind of lay out the general scheming site, location of wells, and issues that we may have going forward into this process.

Q Okay. Let's go ahead and start with the recitation, and I may stop you from time to time to

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l ask questions.

2	A The application we received is Lightning
3	Dock Geothermal Number 1, a binary-cycle power
4	generation plant. As aforementioned, Water Quality
5	Control Commission discharge permit application
6	through the New Mexico Energy Minerals Natural
7	Resources Department, Oil Conservation Division.
8	I mentioned I'm an Environmental
9	Engineer, Carl Chavez, and my supervisor is the
10	Environmental Bureau Chief, Mr. Wayne Price, you
11	saw earlier.
12	I think this photo exemplifies the
13	basin and range province that were in here at the
14	project site. It's probably a recharge-fed Animas
15	basin, with recharge occurring along the mountain
16	ranges. A lot of the recharge occurs through
17	faults, north/south trending along horst/graben.
18	As we'll find out later on, we'll hear
19	more about the significance of the faulting and the
20	fracturing, and why we have heat in this area. Is
21	it a volcanic type of heat? Is it fractures that
22	extends 15- to 17,000 feet into the earth? We
23	have, basically, upwelling geothermal waters based
24	on geothermal hydrogeothermal gradings just
25	upwelling in the area.

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1 Preliminary assessment of seismic 2 activity in the area is virtually -- is nil. Which 3 would also indicate to me that perhaps we don't have a -- we don't have any type of rifting 4 5 situation here with the hot-rocks scenario. It's 6 probably more of a conventive-type conduction. Just to clarify, under our regulations, 7 the Administrative Code, "A geothermal reservoir 8 9 shall mean any common source of geothermal resources, whether the fluids produced from the 10 reservoir are native to the reservoir, or flow into 11 or are injected into the said reservoir." 12 13 Under our regulations, "Geothermal 14 resources shall be the natural heat of the earth" 15 16 HEARING EXAMINER: Okay. What we're 17 going to have to do, we have a lot of trains going 18 back and forth. We probably -- the witness probably should just stop and let the trains go by. 19 20 I don't reckon we're going to hear when the trains 21 go by. THE WITNESS: I'm sorry I have to read 22 23 this, but I just want to get this out on this and then I'll move forward rather briefly. 24 HEARING EXAMINER: Okay. I believe the 25

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train is fading, so you may go ahead.

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THE WITNESS: Thank you. "Geothermal 2 resources shall be the natural heat of the earth or 3 the energy in whatever form below the surface of 4 the earth, present in, resulting from, created by, 5 or which may be extracted from this natural heat 6 and all minerals and solution or other products 7 obtained from naturally heated fluids, brines, 8 associated gases and steam in whatever form found 9 below the surface of the earth, but excluding oil, 10 hydrocarbon gas, and other hydrocarbon substances." 11

Q (BY MS. ALTOMARE) Mr. Chavez, when you say, "Our regulations," what are you referring?

A To the Administrative Code. Geothermal Resources, Geothermal Power of the New Mexico Administrative Code.

The first power plant was in 1904 in 17 Larderello, Italy. Now, in New Mexico they may 18 have its first power plant. I say, "may" have its 19 first power plant, 104 to 105 years later. 20 Resources in the western part of the United States, 21 you can see New Mexico. We've got the dark orange. 22 There are power plant potential waters that exceed 23 250 degrees Fahrenheit for power generation. The 24 orange is more direct heat uses for office 25

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buildings, nurseries, like the nursery out at our
 project site.

3 It's important to note that as more exploration occurs in the geothermal field, we may 4 see more of these orange blips showing up, maybe in 5 the Southwest at different locations, as 6 exploration continues forward in New Mexico. 7 To get at these resources, it requires 8 drilling. We have to do some exploration drilling 9 using with mud rotary systems, cable tool systems, 10 and sometimes at significant depths. 11 The benefits of geothermal power, 12 courtesy of Geothermal Education Office, provides 13 clean, safe energy. That's true. These binary-14 cycle systems, as you'll find, are virtually air-15 remission free. The issues that we're wrangling 16 with are a lot of chemical storage, potential 17 discharges to nearby creeks and so forth. 18 This is a renewable, sustainable 19 It's a program that the State of New 20 energy. 21 Mexico wants to be involved with. It generates continuous, reliable, baseload power, conserves 22 fossil fuels, contributes to the diversity of the 23 energy sources, much like solar and wind power. 24

New Mexico has geothermal resources,

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and will provide a geothermal removable power as
 well. Avoids importing and benefits local
 economies, puts some people to work. Offers
 modular and incremental development and village
 power to remote sites.

The project area is located southwest 6 of Lordsburg. I think it's important to show you 7 guys with Google the general location of the power 8 I would note when I picked this little 9 plant. thumb-nail location, I think the power plant is 10 11 back to the south a little more. That power plant has now kind of moved up west of greenhouse number 12 13 3 at the Burgett nursery.

Up here is, I believe, the tilapia fish farm for AmeriCulture. You get to this site off of the County Road 338 to Cottonwood, and you veer off on Geothermal Road and head east, and it's south of Geothermal Road, kind of in this area right here.

Q So the location of the power plant as
originally proposed is --

A Has been moved north.

Q -- has been moved north?

A And more adjacent to Rosette, or thenursery.

25 Q Okay.

21

22

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A The Burgett Nursery.

2

1

Q Okay.

3 I think it's important to note as you can А 4 look here in this Animas Valley, you can see what appears to be a fault trending north to south in 5 Traces of that fault that extend north 6 this area. I think some of the technical witnesses 7 to south. that will be here later might talk about the 8 significance of these faults, and why we have such 9 a hot-wire situation in this location. 10

I wanted to show a little bit about 11 12 Cotton City and the agricultural area south of the I also note that the surface drainage is 13 location. generally from south to north. The water table 14 15 depths from records that I've read have been around 16 60 feet below ground level for water tables near the drilling of the wells that were drilled up by 17 18 the nursery.

A lot of these streams, therefore, are ephemeral-type streams that are fed, namely, during the rain storm events. You can see some of the break, the drainage, but nothing that's flowing all the time. Again, two-and-a-half, three-mile width of the agricultural area to the south, we might expect -- when we do background analysis upgrading

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from our project area, we might expect to find some pesticides in the water. I know in sites in Michigan, we were detecting DDT from residual background concentrations back when DDT was administered onto the farming, landscape for bugs and so forth.

Again, the project area, you'll see it 7 as up more in this area. You can see this drainage 8 9 feature. You can see the drainage that comes off of the nursery area. A lot of the effluent 10 discharge from these nursery activities directing 11 water discharges are actually -- you can actually 12 see them draining onto the landscape and moving 13 north. 14

At no time will we allow any type of discharge of untreated chemicals into any waters of the State will be prohibited under 20.6.4 NMAC. Looking east to southeast towards the nursery, as you drive in through Geothermal Road, you can see the Pyramid Mountains, I believe, in the background basin in range.

Looking southwest from the project area, you can see the southern parts of the Peloncillo Mountains off to the west. Again, a lot of the basic recharge of precipitation comes down

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off of those mountain blocks, recharges this Animas
 Valley.

3 Looking south/southwest across the project area, this location has kind of changed, 4 5 but I don't think the vegetation looks much different a little further to the north. 6 7 Approximately 2,592 acres of private land lease, this is according to Los Lobos, was located in 8 Section 7, 11-14, 18 and 23, township 25 south, 9 range 19 west. The BLM administers the geothermal 10 11 rights of approximately 2,500 of those acres under those lease numbers. I believe the other 92 acres 12 13 may be State land.

Looking east, again, towards the nursery, this is a road that's off to the east a couple of miles that runs north to south. This is the electric transmission of line where the transmission line will run over towards the south, towards Cotton City. They will link up to a power transmission line to be fed to Arizona.

Looking at the project site over from the east again, you can just see kind of in this area, the project area, it's flat, it's in the valley, some of the native vegetation that's there. Looking west, the close-up of the

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Peloncillo Mountains, you can see there's some
 agricultural cattle in the area. You can also see
 some of the various types of natural vegetation;
 some ocotillos, some typical cactus, some scrub
 oak. Again, basin in range province.

6 So as far as getting back to the 7 regulations that apply to high-temperature 8 geothermal reservoirs. Chapter 71, Energy & 9 Minerals, Article 5, Geothermal Resources 10 Conservation Act. The short term is "Chapter 71, 11 Article 5, New Mexico State Act of 1978."

I think it's important to note this 12 particular provision of the act where it states 13 that, "Exclusion: incidental loss or extraction of 14 heat. When the application of potable water to a 15 16 beneficial use involves the incidental loss or extraction of heat, and the water is 250 degrees 17 Fahrenheit or less, then that heat is not a 18 geothermal resource for which a royalty is due. 19 In such a case, the use is not governed by laws 20 related to geothermal resources, but is simply 21 22 governed by Chapter 72." I guess that's the low This kind of sets the tone for OCD's 23 temperature. involvement with reservoirs, geothermal resources 24 reservoirs, temperatures greater than 250 degrees. 25

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Q Again, that's not something that we're addressing at today's hearing. That would be something that -- if and when it would come about, it would be addressed at a late hearing, and in a different form, right?

A Although, this is why we're involved in
this permit process.

8 Q Right. But we're not addressing the 9 Geothermal Resources Conservation Act today; is 10 that right?

11

12

A That's correct.

Q I just wanted to clarify that.

I just wanted to lay the ground work. The 13 А Administrative Code that further elaborates on the 14 intent of the act, the Title 19 Natural Resources 15 of Wildlife, Chapter 14, geothermal power. The 16 short version, Title 19, Chapter 14, NMAC 1983, we 17 compiled in December of '01. Administrative Codes 18 elaborate further on the intent of the initial act. 19 20 It's enacted or becomes effective.

The Water Board Control Commission regulations that directly apply to this hearing are Title 20, Environmental Protection, Chapter 6, Water Quality Part 2, ground and surface water protection. The short version of that act is et

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seq for the various parts are provided.

The second Water Quality Commission Regulation that applies, Title 20, same Chapter 6, same part 4 standards for interstate and intrastate surface waters. This is the provision that we protect storm water, and any waters of the State with. We are concerned about any chemical drainage and run off from the facility.

9 EPA delegated OCD primacy over the UIC 10 program back in July of 1983. The OCD was later 11 delegated authority by the Water Quality Control 12 Commission over the UIC program in July of 1989. 13 The regulations were provided for you in the 14 previous slide that we administered based on that 15 authority.

This is the locations of these wells, 16 in Section 7, 12, and 18 in Hidalgo County. I gave 17 you the location already. You may note here is 18 that the power plant is actually located now 19 approximately 1,000 feet west of the Burgett 20 greenhouse number 3. A couple of the locations of 21 the Class 5 injection wells have been changed since 22 23 the initial public notice went out.

Q How much of those locations changed?A Two locations. I would just say that the

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42-18 location is the same. The five production
 well locations are the same; however, these other
 two locations have been changed to Section 12 and
 Section 7. I'd like to show you a slide that kind
 of represents those changes.

This is a map that I received, not this 6 7 last Friday, but the Friday before, from Raser or Los Lobos. I think the initial location of these 8 9 injection wells was along the south end here, kind 10 of in a line. The thought process behind that back then was that you would recharge the reservoir at 11 3,400 feet, and that that water would migrate to 12 13 the north, and these production wells in blue would pick up the water. 14

So here's the previous location of one of the injection wells. The second location was moved over to Section 12, and the other injection well was located west of the tilapia fish farm. I'm not sure why -- what the rational was for that at this time.

21 Q So, I'm sorry. We don't know what the 22 rational was of that at this point?

A I don't. I can speculate on what it's for. Q Again, we based the public notice for this hearing on the information that we had at that time

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1 in the original application, right?

A Yes. The five production wells remain the same in blue. You notice that there's a reserve pit, and these reserve pits are going to be lined with 60-mil liners of high temperature-type liners. Instead of decommissioning those reserve pits, they will remain in use for annual well testing.

There's about eight of those reserve 8 pits, along with an evaporation pond up in, I 9 10 believe, the northwest part of the plant we'll see 11 The important feature to mention here is later. the -- there's a deep exploratory test well that 12 13 provides some good lithologic information for the 14 area. I think Raser and probably AmeriCulture can 15 use that well as a significant marker well for 16 lithology.

17 The well went down to about 7,000 feet. 18 It was plugged back, is my understanding. We have a water quality sample from around 1,200 feet or 19 20 so, water quality information that we received in the initial permit. They're proposing a couple of 21 make-up water wells in the shallow fresh water 22 23 table out here for make-up water for the cooling 24 tower.

25

So, again, this just basically shows

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you the layout of the nursery, the tilapia fish
 farm, and the locations of the wells.

Q So just to summarize on this map, the blue indicated wells that are the production wells, and the red ones are the injection wells?

6 A Yes. And the dark blue with these 7 descriptors here, section numbers --

8 Q Okay.

9 A -- red up here, section numbers. So the 10 locations are as we see them.

11The brief history of the project. The12application was received on May 13. The13application was deemed administratively complete on

14 May 28<sup>th</sup> --

Q Can you describe -- I'm sorry to interrupt. Can you describe for everybody what that means? I think "administratively complete" doesn't mean to the general public what it might mean specifically to our agency.

A We deem an application -- an application has various questions that are answered and provided and attached to the application in general, specifically, for new permits. What I do, as a permit writer, I go through and make sure all the questions are addressed and answered to deem it

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administratively complete.

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However, there may be some technical issues that need to be wrangled through as we go through the project. So the technical aspects of it continue forward, but as far as administrative completeness, they address the questions in the application.

8 Q So it doesn't mean the end of 9 communication, or the end of request for submission 10 of data and information, it just means that the 11 additional submission of the information that we 12 requested has been completed?

A Yes.

14MR. SEAWRIGHT: Mr. Hearing Examiner.15HEARING EXAMINER: Yes, sir.

MR. SEAWRIGHT: I move to adjourn this hearing based on the premise that this represents a radical and substantial change to that injection proposal that was originally submitted as part of their original application. That we have not had the opportunity to contemplate its impacts.

HEARING EXAMINER: When you say "this," what are you referring to?

24 MR. SEAWRIGHT: The changing of the 25 location of two of the three injection wells. One,

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what it appears, although based on the resolution 1 of that, would affect the image that was shown, I 2 can't discern it entirely but it's very close to 3 the AmeriCulture property, perhaps even under it. 4 We have not had an opportunity to 5 contemplate that proposed alteration of the 6 7 injection plant, and produce a technical rebuttal to it. 8 HEARING EXAMINER: First of all, it's 9 not clear to me exactly where the -- where the 10

11 change was from and where it's to at this point. Maybe that will appear from the testimony of the 12 In any case, I reserve the ruling of this witness. 13 until I've heard the completion of testimony of the 14 15 case.

16

You may proceed, Mr. Chavez. THE WITNESS: Okay. Public comments 17 were received from AmeriCulture on July 11<sup>th</sup>. They 18 were the only respondent or public commenter. OCD 19 issues a notice of public hearing on October 1<sup>st</sup>, 20 21 2008, for this hearing today. Pre-hearing statement requests to the applicant, public 22 commenter, and to the OCD went out on November 13<sup>th</sup>, 23 part of our pre-hearing statements for this 24 hearing. 25

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A little bit about the scope of the project. These portable binary-cycle power generation units, there's going to be approximately 50 of these units to start out with. Each one of these units generates approximately 225 kilowatts of energy each. These are portable units. They can be deployed to any location.

When we got the initial request for 8 this power plant, we were told it was 15 megawatt 9 of electricity. However, we see with these initial 10 50 units, we'll probably be getting around more 11 like 10 to 10½ megawatt. There are plans for an 12 additional 20 units to bring on line, and 13 approximately 4½ more megawatts to bring it up to 14 around 15 megawatts in the future. 15

Our injection zone target depth is 3,400 feet below ground level. These production wells and the injection wells target depth is 3,400 feet into a carbonate formation. It's probably highly fractured. It's known as the Horquilla formation.

The plant will produce, as I said -well, from the Albuquerque Journal article that we read on July 3<sup>rd</sup> of 2008, the plant will produce 11 megawatts of energy for the Phoenix market over a

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20-year purchase power agreement with the Salt
 River Project, an Arizona utility that's going to
 power 5,500 homes.

The statement was made, but the geothermal resource may allow production of twice as much, so they may be looking at doubling your capacity to the point of 22 megawatts. It's entirely possible with these portable binary-cycle units. We'll talk more about these later.

Q (BY MS. ALTOMARE) Mr. Chavez, this information is based on information obtained by the applicant or from resources to whom the applicant has made statements, correct? This is not information that we independently obtained?

15 This is information that was submitted 16 in the application or provided by the applicant 17 about their project?

A The 15 megawatt energy was about the application of spec, I think. Then this article in the Albuquerque Journal is kind of a little bit different. I do note, and you'll look at some of the drawings later, that they are planning to bring 20 more units on line to the additional 50 to bring that power generation up to about 15.

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This is an article from the Albuquerque

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Journal. I put it in there because it kind of shows where the power is going to be going, and how many homes it's going to power.

Production wells will produce 4 approximately 1,500 gallons per minute. That's the 5 five production wells of 250 to 300 degrees 6 Fahrenheit water. Again, that's estimated. 7 We don't know yet until the exploratory work is done. 8 9 TDS of water down from that deep test boring indicates that the TDS was about 13- to 1,600 10 11 milligrams per liter, again, from the Horquilla formation. The target depth is 3,400 feet. 12

I would just mention that that deep test well at 7,000 feet is the only well that appears to penetrate this injection zone. That well is plugged back above this formation depth.

17 So that map that you saw earlier of the 18 wells, is an aerial review-type map where we look 19 at wells in the city. The only well that 20 penetrated the 3,400 feet is that deep test well 21 that I'm aware of. Water will be routed in 22 parallel into the binary-cycle units. We'll see 23 more about that later.

Q Water with the TDS of that level, is that considered fresh water?

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A It is, under the Water Quality Control Commission Regulations, we consider waters at that TDS concentrate that lists 10,000 milligrams per Liter to be fresh waters.

5 Approximately 1,500 gallons permitted of shallow ground water make-up water with a TDS of 6 approximately 300 milligrams per liter will be 7 cycled into cooling tower units. It will help to 8 remove heat from the hot condensate water. This 9 makeup water is needed for the cooling tower to 10 make up for drift, any type of vapor loss, 11 evaporation that occurs in the process. And I 12 showed you a couple locations for the shallow wells 13 in the previous map. 14

Approximately 425 gallons blow down that fluid, with the remainder of produced water at 17 180 to 225 degrees Fahrenheit will be injected into 18 the geothermal reservoir at those three classified 19 injection well locations, via at approximately 4-20 to 5,000 gallons per minute.

The average surface injection pressure is estimated to be about 75 psi. You're probably wondering why the low pressure. It's my understanding from some of the technical experts that I've spoken to, the high fracturing that

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exists there, there's going to be no problem with
 this reservoir taking on any water.

3 A lined evaporation pond temporarily stores excessive cooling tower blow-down fluid 4 during emergencies. There is an evaporation pond 5 you'll see later that's located near the cooling 6 7 tower. Were any type of upsets to occur, the cooling tower blow down will be routed into this 8 evaporation pond that's lined, contained until 9 stored until it will move back into the system. 10 Cooling tower blow-down fluid is 11 diluted with spent produced water. This water must 12 meet the water quality standards before injection. 13 14

14 I think we'll talk later about what some of those 15 chemicals are.

Cooling tower blow-down fluid -- let me 16 Discharge permit addresses well construction, 17 see. 18 operation, monitoring, testing of the wells, associated surface facilities, and provides a 19 contingency plan in the event of accidental spills, 20 21 blow-out leaks, et cetera, to protect fresh water. Spent produced geothermal water is 22 routed into the injection wells to replenish the 23 24 reservoir and possibly be reused. As we mentioned initially, all three of those wells were initially 25

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located to the south in order to allow recharge or
 migration to what we think is flow direction to the
 north, and back into the production wells. Some of
 those locations have changed.

5 All drilling and well construction must 6 conform to OCD Geothermal Regulations, and it is 7 the Title 19, Chapter 14 NMAC that provides 8 detailed provisions of all of these requirements. 9 The nearest landfill to the facility is

at the Butterfield Trail Regional Landfill, 15 miles west of Deming. Our job is to make sure that -- Raser's job is to make sure they have waste disposal facilities to get rid of any type of geothermal waste, refuse, trash, that comes from the site.

This location may not be the only location for disposal. There are landfills that can accept special waste, industrial-type waste. The Rio Rancho Landfill comes to mind, the Southwest Regional Landfill near Thermo, or in Thermo, is one that may be nearby.

A little bit about the binary-cycled plant heat exchanger process. Hot geothermal water is brought in from the production wells into these small mobile binary-cycled units. That water will

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eventually go back into the injection wells.

You see where heat transfer occurs within these units. Binary liquids from the condenser that condense the vapor into liquid flows back over towards into the turbine area. The heat exchange, the heat transfer, then is given off to the process is what drives the turbine and provides the 225 kilowatts of energy.

9 This is a general site plan layout. 10 You can see the location of the 50 units that they 11 are planning to bring on line, the binary-cycle 12 units, the four-cell cooling tower.

Some locations of concern under Water Quality Control Commission is that they plan to store three tanks here with bleach biocide and a scale inhibitor in this area. This might be an area of concern.

They have a location here for cooling 18 tower blow down in the event of emergency release. 19 This is something that's kind of new to us. It's 20 our understanding that there will be no discharges 21 into any open systems that can migrate into the 22 23 waters of the State. That water shall be routed to 24 this evaporation pond in the event of upsets.

25

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Refrigerant storage is in this

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location. Chemical storage is over in this area. 1 So these are a couple of the areas of concern under 2 3 Water Quality Control Commission Regulations. A little close-up of the area, again, 4 the cooling tower. North is actually in the 5 6 opposite direction. It should be to this direction. Again, I wanted to show the plans for 7 the two-cycle, the two-cell cooling tower, and the 8 additional 20 units they are planning to bring on 9 10 line to bring the plant up to 15 megawatts. Again, just a bigger diagram of the 11 layout with the transformers that are located along 12 13 with the binary-cycle units. This is a cross section of those 14 binary-cycle units that contain the condenser, 15 evaporator, and turbines. About 11½-foot spacing 16 between them. 17 Now, to talk a little bit about the 18 19 application process and the WGCC process, these permits under 31-14 and the fees that we charge. 20 It's a five-year permit. They submit the discharge 21 permit application and the processing fee of \$100. 22 OCD reviews the application for administrative 23 completeness within 15 days. I think as I've 24 shown, they've complied with that. 25

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1Administrative completeness2determination starts public notice process with3draft permit issuance.

4 Q And we've done that as well; is that 5 correct?

A We did that back in May, approximately May
28<sup>th</sup>.

8 When we issue public notice, we like to 9 allow us a 60-day process for Raser, or the 10 applicant, to issue public notice in the local or 11 regional newspaper, and allow 30 days for comment. 12 We publish notice on our website in addition to 13 that. We do the same with all public notice.

14 Within 60 days, we like to have a final discharge permit. But in this case, we did have 15 16 some public comments that we received that 17 warranted this hearing, and that's why we're here today. At the completion of the hearing, and based 18 on the hearing examiner's conclusions, the Division 19 20 may, and I say "may," issue a final permit, which 21 may include additional additions.

In all probability, it will require additional conditions as we mentioned earlier, Ms. Altomare. This is an ongoing process, and our permit allows for flexibility needed as we move

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forward to make sure of the protection of fresh
 water.

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The discharge permit fee for this type 3 4 of permit is \$1,700. What does this discharger It's a pollution, prevention-type permit do? 5 permit. It prevents contamination of storm water, 6 resurface water, storm water, and ground water by 7 evaluating chemical process areas. I kind of 8 pointed out a couple of those areas of concern to 9 10 you earlier.

11 Relative to storm water, pollution prevention infrastructure, we'll make sure that 12 they are using 60-mil liners with high temperature-13 type materials that will be constructed properly 14 that will contain any type of high salt content, 15 fluids, et cetera. We'll look at the monitoring at 16 or near potential source areas where treatment, 17 18 storage or leaks may occur.

19 This permit will prevent the 20 owner/operator from discharging above water quality 21 standards to surface and ground water. One 22 important point to mention there is that the 23 natural background quality may be higher than the 24 water quality standard. There may be instances 25 where if they can discharge within background

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limits, that may be acceptable to the OCD.

2 0 What do you mean by "natural background quality"? 3

4 А We would do general chemistry upgrading from the facility to see what the natural water 5 quality is in the Horquilla formation in shallow 6 acquifer water table formation. 7

8 By getting the background evaluation of general chemistry, calcium chlorides, sulfates, 9 nitrates, stuff like that, we'll be able to get an 10 initial -- before industrial activity begins, we'll 11 get a shot of what the actual water quality 12 conditions were. 13

To your knowledge, has that been done yet 14 0 in this case? 15

Α They proposed three monitor wells, and the 16 answer to that is, no, we're not happy with the 17 monitor well locations that they've chosen. 18

But this will be something that will be 19 0 worked on in ongoing negotiations with the 20 21 applicant?

22 А Absolutely. It would probably come in the form of an additional requirement of the permit 23 that they submit in a monitoring plan, 24 comprehensive monitoring plan. It will address

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impacts to the environment from their operations,
 which would probably include shallow water table
 monitoring, as well as water quality information
 from the Horquilla formation.

5 It definitely will include water 6 quality information from the proposed discharge 7 effluent; the spent produced water with the cooling 8 tower blow down.

9 Q Okay. And, in any event, a base-line 10 chemistry will be done of the water on site to the 11 OCD's --

12 A To monitor for environmental impacts from13 this operation.

Q Right. To the OCD's expectations prior to
moving forward with the project; is that right?

A Absolutely.

16

17 Q And any kind of discharge would have to 18 meet with the OCD's and water quality standards 19 before it's permitted to occur?

20 A Absolutely. You can think of it similar to 21 oil and gas exploration and production. Basically, 22 this is geothermal. We're looking to identify 23 geothermal resources through exploration process. 24 Raser may find that through exploration

25 process and well testing, that this geothermal

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resources is a viable resource, sustaining resource, that will provide for a 20-year production, if at all. It's quite possible that this operation may go away after the exploration phase.

It provides for OCD inspection, with 6 the immediate modifications to the permit to 7 protect the environment as conditions warrant. 8 Our permits, I think, are so good that we can go on to 9 a site, spot a problem, and within a matter of days 10 we can modify this permit to insure additional 11 12 monitoring or additional treatment. We'll shut down the facility until that treatment is 13 implemented. 14

Now, the issues that we have, ground 15 16 water, surface water, fresh water, appears to be present from the water table to the depth of 17 I know that could be questionable now. 18 injection. I think the water quality information that we have 19 from Raser in their application was from the deep 20 test well, and that depth was more along the lines 21 22 of 1,200, 1,400 feet. It was about 13- to 1,600 milligrams per liter of TDS. There were suspicions 23 that this is a fresh-water reservoir, possibly from 24 top to bottom, because of all the fracturing as 25

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1 we'll see later, and the faulting going on. 2 This basin is just -- could be just one 3 gigantic fresh water acquifer connected through fracturing and so forth, upwelling through these 4 5 fractures from deep formation. Those deep formations will be tested, and we will see whether 6 the Horquilla is a fresh-water reservoir, 7 geothermal reservoir. 8

9 But right now, from the reports we've read, there is no caprocks or impermeable 10 formations of significant thickness that would 11 constitute a caprock formation where injection 12 wells are injecting down below a caprock formation. 13 14 It doesn't appear to be the case. That deep-test 15 boring that they drilled does have some good lithologic detail, and we'll probably hear more 16 about that later from the experts that you'll hear. 17 18 Consequently, the cooling tower blow 19 down, the spent produced water, may need to be 20 recycled, reused, or treated to meet water quality 21 standards before any injection is allowed. Raser is aware of that. The type of monitoring, we're 22

going to implement for that is such that we will 24 know right away when it does not meet water quality 25 standards.

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Currently, the applicant believed that the Nalco paper, the proposed biocide chemicals, the scale inhibitors, the bleach, and the dechloridization chemicals, they believe that this blow-down water diluted with the spent produced water will meet water quality standards and protect wildlife before injection.

The reason I put "wildlife" in there 8 was because aquatic organisms can be -- are very 9 sensitive to chemicals that are used. The Nalco 10 paper that was provided to us, they clearly show 11 the aquatic toxicologic information that they 12 provide, and concentrations that they're proposing 13 to inject are well below the limits that would pose 14 15 in wildlife, endangerment in the area.

Q But all of this would be confirmed in testing, and monitoring would ensue to insure all of this was okay and in compliance with water quality standards as this permitting process and the project goes forward?

21 A Absolutely. Especially downgraded from 22 potential point sources, and upgraded from well 23 locations that exist for drinking water and for 24 agriculture and nursery operations.

25

Q This is standard procedure in the course of

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eliciting permitting process or discharge of
 permits of this nature?

A It is. We have to insure the protection of fresh water, and for the underground injection control program. We're very concerned about drinking water, of course. Some of those monitoring locations may be nested within certain depths going down.

9 So any type of upwelling activity, any 10 contaminants that may be moving upward, might 11 provide provision for that in monitoring the 12 vertical gradients across this acquifer system.

Daily testing of the cooling tower blow down and produced spent water stream to characterize and verify the fluid, may be reused or that it meets water quality standards needs. Treatment before injection would be required. That's very important.

Again, the caveot is, is that the natural background concentrations are higher. They may need to only meet the natural background conditions.

As mentioned, again, to your questions, water table monitoring of seasonal flow direction and hydraulic gradient with upgradient and

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downgradient water quality monitoring from
potential point source location, would be required
to monitor for environmental impact. Focus of
hydrogeologic characterization and water quality
sampling of the acquifer or acquifers, if possible,
during the drilling and well developing activities.

7 One thing that we will do on the 8 production wells and injection wells when they're 9 down at 3,400 feet, we definitely will want to 10 collect static water levels, and survey any ground 11 elevations to determine ground water flow in the 12 Horquilla. We'll also want to get some water 13 quality information from that deep of formation.

Proper ASTM field geotechnical 14 applications must be applied during construction. 15 If they're constructing an evaporation pond, and 16 they're not using a sheeps foot, and it didn't 17 18 comply with ASTM standard field protocols, 95 percent compaction water to compact soils properly 19 insuring that there is no rocks underneath the 20 21 liner that would rip or tear the liner, looking at 22 the seaming of the liner and so forth.

23 Waste. The proper disposition of waste 24 will have to be addressed. You can't have an 25 operation that can't dispose of any waste from

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1 their facility.

Q Just for clarification, Mr. Chavez, a lot of the things that we've listed here are outstanding issues. Are these issues that would normally, routinely, be dealt with in the course of the permitting process as the project moves forward and the permit, draft permit, is issued and reviewed and processed?

9 A Absolutely. When we issued the final 10 permit, it will include many of these provisions 11 that are identified here. In addition to that, 12 these conditions are subject to change for 13 additional monitoring as we move forward and 14 address any other issues that may come up.

Q So even if we hadn't come to the point where we had a hearing, these issues would have been addressed as the permitting process moved forward and --

19 A Absolutely.

20 Q -- dialogue with the applicant occurred? 21 A Absolutely. It's my understanding that, 22 you know, Raser put together the locations of the 23 wells as part of their financial -- in order to 24 receive financing to fund a project. This project 25 hadn't come forward with well locations. Some

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people may view it as the cart before the horse. However, we view it as approving well locations for exploration, for potential production based on the exploration, if the exploration information verifies that there is a resource there that they can use.

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Q Thank you.

A This just kind of shows the Butterfield Trail landfill that will be open in the spring of 2009. Certainly, Raser will need to make sure that it is permitted to -- that landfill will be permitted to receive geothermal waste.

13 If not, they will probably have to go 14 to Rio Rancho or Corona, New Mexico, area for 15 disposal of their waste. They also have probably 16 disposal locations over in Arizona. There may be 17 some facilities there that they probably have 18 already researched.

Project going forward. OCD sends a final version of the discharge permit with public hearing considerations to the applicant for signature. It must be returned with the final fee and \$1,700. It must be signed.

24 Well bonds or financial assurance must 25 be approved by a letter from the OCD. No drilling

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can occur before a well bond is approved by the
 OCD. Once the bonds are approved, the OCD Artesia
 office may approve well APDs from the
 administrative record of the locations, the final
 locations.

Geothermal exploration, drilling and 6 well testing may begin with OCD geothermal forms, 7 documentation, or geothermal resource per well for 8 9 verification and documentation of well construction, hydrogeology, depth of the wells, 10 temperatures from well testing with verification 11 that a high-temperature geothermal reservoir or 12 reservoirs, in fact, exist above the 250 degree 13 14 Fahrenheit.

Geothermal production and injection Wells. If a high-temperature geothermal reservoir exists, the owner/operator wishes to produce the reservoir and inject, signed forms, the G-104 form, along with various attached forms from the well testing.

The G-105 through the G-107 forms must be attached before the OCD can approve a G-104. This form must also be circulated or sent to the USGS office, and the New Mexico Bureau of Geology and Mines in Socorro. In addition to that, a G-112

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must be submitted and approved by the OCD office in
 Santa Fe.

Other agencies. These are the 3 4 agencies that we must share some of our form information with. 5 It's important to note the GTHT-1 designation because all of our file information 6 7 on this project is available on line through OCD, 8 and the descriptor of the permit number is going to be Geothermal High Temperature 1. 9

10 Injection wells must comply with Water Quality Control Commission and OCD geothermal 11 regulations, while production and development wells 12 must comply with OCD geothermal regulations. 13 So 14 the classified injection wells are regulated under Water Quality Control Commission Rights, and OCD 15 geothermal regulations, while the production wells 16 fall under the OCD geothermal rights. 17

18 Our point of contact from the energy 19 minerals is Mr. Stephen Lucero. As I mentioned 20 earlier, New Mexico wants renewable power. This is one more renewable type of resource. New Mexico 21 has the resources. We just have to develop the 22 23 resource responsibly, protect fresh waters while we do it, and we will increase our portfolio of 24 renewable energy to add on to the solar and wind 25

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power plant. Stephen, you can contact him at those
 locations.

3 Whenever underground injection control wells involve temperatures less than 250 degrees, 4 5 it is the New Mexico Environmental Department that 6 gets involved with those types of applications 7 under the Water Quality Control Commission 8 Regulations. The same regulations that I mentioned earlier, except these people deal with the low 9 10 temperature, less than 250. Here's my contact information if you want to get ahold of me. 11

Down below I add, if you go to OCD on line, go to OCD Imaging, Administrative Order and type in GTHT-1, you'll have access to all the information that we have, that we scan into this system on a regular basis as we move forward into this project.

Q Mr. Chavez, knowing what you know about the permitting process that took place with the OCD, and in having reviewed the materials that you received from the applicant, are you competent that the process, as it moves forward for this project, will adequately protect the water quality in the area, ground water in the area?

A Absolutely. Absolutely.

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1 Do you have anything additional to add? Q I have nothing more to add. 2 А 3 MS. ALTOMARE: I'll pass the witness. HEARING EXAMINER: Ms. Altomare, Mr. 4 Chavez, whoever wants to respond to this. 5 Is a 6 copy of this power-point presentation made part of the record? 7 MS. ALTOMARE: We certainly can make it 8 9 part of the record. We can bring copies for everyone, but we can provide it after the fact. 10 11 HEARING EXAMINER: Okay. It would be helpful, I think, if it were made part of the 12 So we will reserve the number OCD Exhibit 13 record. 14 1 to be a copy of the -- Mr. Chavez's power-point 15 presentation. 16 MS. ALTOMARE: We have had a request from a member of the audience to post it on one web 17 site. 18 That might be one way to disseminate it. We 19 can also make it part of the record for the transcript. 20 HEARING EXAMINER: For purposes of the 21 way the OCD handles its hearings, we need to make a 22 23 printed-out copy. It doesn't have to be color. 24 Okay. Ms. Munds-Dry. 25 MS. MUNDS-DRY: Thank you, Mr. Brooks.

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## CROSS EXAMINATION BY MS. MUNDS-DRY

1

2	Q Mr. Chavez, just a few questions because I
3	want to make sure that I understand what standards
4	were followed here today in terms of water quality.
5	Ms. Altomare asked you when the OCD's
6	jurisdiction kicks in, if you will, when the TDS
7	levels are at a certain level. You responded that
8	protectable waters are 10,000 TDS or less; is that
9	correct?
10	A Correct.
11	Q You mentioned that's considered fresh
12	water? Is that the right definition for that? Is
13	it protectable water, or fresh water, or is it the
14	same thing? I want to make sure I understand that.
15	A Well, I think it's it's protectable
16	water.
17	Q Is that the same as drinking water
18	standards?
19	A No. Not necessarily. You can have water
20	that is protectable water, but it may be in
21	concentrations that may be protective of
22	agriculture; cattle. It may be at non-drinking
23	water preferred, either to aesthetics water
24	quality, taste, odor.
25	Q Sure. Are there a separate set of

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regulations, then, for drinking water standards? 1 2 А Well, the drinking water standards that we 3 would be looking at would be the water quality standards which are much more stringent. For 4 example, for total resolve solids under Water 5 6 Quality Control Division 30, Section 3103, the TDS 7 allowable would be 1,000 milligrams per liter. However, if the natural background 8 condition of the water is saying 16- to 2,000 9 10 milligrams per liter of TDS, that may be one parameter that they are required to meet that they 11 12 would need to be to the background. That's -- you anticipated where I was going 13 0 with that. Now, let me also make sure I 14

understand. In your presentation, you mentioned that the final permit may require additional conditions. Then you listed several area issues of concerns that remain with the OCD that would need to be addressed.

20 Are those the types of conditions that 21 you're looking at at this point?

A Yes. We would be focusing on those, and making sure we get a comprehensive water quality monitoring plant.

25 MS. MUNDS DRY: That's all the questions

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I have. Thank you, Mr. Chavez. 1 HEARING EXAMINER: Mr. Seawright, do you 2 3 wish to question the witness? MR. SEAWRIGHT: Yes. Thank you. 4 5 HEARING EXAMINER: Proceed. CROSS EXAMINATION BY MR. SEAWRIGHT 6 7 0 Mr. Chavez, during your testimony you stated that at no time will OCD allow the injection 8 of untreated chemicals into ground water. Will you 9 10 please verify for the record that that is the position of OCD? 11 That is the position of the OCD. Not only 12 Α ground water, it will also apply to any surface 13 14 waters, any type of discharges to arroyos, waters of the state in that area. It is not acceptable 15 and will not be allowed. It's a violation of 16 20.6.4. 17 18 0 Did you -- have you deemed the Raser application administratively complete? 19 T did. А 20 On what date did that take place? 21 Q I think it was May 28<sup>th</sup>. 22 А Did Raser's proposed modifications to the 23 Q location of two of their three injection wells 24 occur after the date of that determination? 25

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It did.

А

2 I reference Title 20, Chapter 6, part 2, 0 subsection 3108, Section A of NMAC. I understand 3 you probably don't have this in front of you. 4 5 However, it reads: "To be deemed administratively 6 complete, an application shall provide all of the 7 information required by paragraphs 1 through 5 of subsection F of the same section." 8 9 Paragraph 2 of that subsection states: "The notice," this is the public notice, "Shall 10

include the location of the discharge, including a street address, if available, and sufficient information to locate the facility with respect to surrounding landmarks."

Is it not true that since their proposed modification post-dated it, the date in which you deemed it administrative complete, it's, therefore, impossible for subsection F, paragraph 2 to be satisfied because by definition, is it not true that that location could not have been included --

22 MS. ALTOMARE: I'm going to object. 23 He's asking for a legal conclusion, and this 24 witness isn't able to answer that.

25 HEARING EXAMINER: Well, I'm going to

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overrule the objection because the witness knows
 where the location is, so he can answer factually,
 but not legally.

Go ahead. THE WITNESS: I would just say that in our process, and I worked closely with Raser to

4

5

6

7 identify the project location, I went out to the 8 project location in May, and then in putting 9 together the public notice for this process and the 10 location of the facility, that that was provided.

11 Q (BY MR. SEAWRIGHT) Being quite familiar 12 with the content of that public notice, in 13 subsection F of the same section it states "the 14 notice," referring, again, to the public notice, 15 "Shall include the location of the discharge," 16 which it did not. What is your position on this?

A I don't think that the affluent stream that we're talking about is a discharge because if it meets -- it's more of an injection. It's not a disposal if they can meet the water quality standard.

22 So your use of the term "discharge," 23 it's probably -- we don't -- will not consider it a 24 discharge because they will be meeting water 25 quality standards when they reinject into the

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geothermal reservoir. It's not a disposal well, 1 2 per se. It's an injection well into the reservoir, 3 and it will be at water quality standards. So I'm not sure when you're saying, 4 5 "Where is the discharge?" There's not going to be any discharge location because anything that is 6 7 injected, is going to meet water guality standards. 8 There is no disposal well, per se, at this facility. The geothermal disposal well would be at 9 a disposal zone outside of the geothermal 10 reservoir, and it would be for the disposal of 11 wastes into a high brine formation. 12 In our situation, there should be no 13

discharges occurring. It should be simply a
recirculating of water that meets water quality
standards, and is protected, or maybe even better
than the actual background water.

18 MS. ALTOMARE: Mr. Hearing Examiner, we 19 have a witness that's on next that would be better 20 equipped to answer this who actually signs off on the permit, the administrative completeness. I 21 22 think that we would ask that if Mr. Seawright can reserve these questions with the Environmental 23 Bureau Chief, who is more appropriate to answer 24 these questions, I believe. 25

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HEARING EXAMINER: Some of the questions are extremely general in character and somewhat argumentative. Let's go on to the next question, and then we'll try to rule between question and the answer on the objections so that we get a proper sequence here.

Q (BY MR. SEAWRIGHT) You mentioned in your
presentation, there's a certain amount of
flexibility allowed with the OCD to insure the
protection of the ground water.

My question is: How might moving the location of injection wells closer to AmeriCulture, in your opinion, somehow insure the protection of the ground water more than being in a more distant location?

They will be injecting in a deeper zone, 16 А and I don't know the reasons behind that. I really 17 can't speculate on that. One thing that comes to 18 mind is they may be concerned about the water 19 20 resources, insuring that there is plenty of water. 21 HEARING EXAMINER: I need to interrupt The witness should not speculate if you 22 here. 23 don't know the answer.

24 THE WITNESS: It's outside of my25 purview.

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MR. SEAWRIGHT: That's all my questions. 1 2 MR. WITCHER: I have a question I'd like to ask. 3 HEARING EXAMINER: Would you consult 4 with Mr. Seawright? We need to have one presenter 5 6 for each party. We'll pause for a few moments 7 while you all discuss what you want to ask. 8 Are you ready to proceed? 9 MR. SEAWRIGHT: I am. HEARING EXAMINER: Go ahead. 10 11 0 (BY MR. SEAWRIGHT) Mr. Chavez, in the Raser 12 injection well permit, they state an estimated TDS level of 1,300 milligrams per liter from the 13 14 Horquilla formation. Has the Horquilla formation actually been tested? 15 It's my understanding it has not. 16 А In verification of the analytical results, that deep 17 test well is apparently plugged back, and that's 18 where the water quality sample came from. 19 20 0 So is it true to say that it's theoretical? 21 А That the water quality in the Horquilla is theoretically at 1,300? 22 That estimate is theoretical and not 23 0 Yes. actual? 24 25 At this point, yes, I would say that the Α

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1 water quality could be better, it could be worse.

2 Q Will you please verify the depth 3 assumptions that are made in the estimation of that 4 water quality level? What depth assumptions are 5 used?

In fact, what we're asking is, what depth level is this level of 1,300 milligrams per liter assumed to be tied to?

9 A I've been told by Raser that that was the 10 deep test well that I showed earlier, and it was 11 plugged back to a depth of 1,400 feet or so. 12 Again, that sample is from that approximate depth, 13 and not from the Horquilla formation.

Putting forward that public notice that specified that water quality information, I was working with Raser closely on some analyticals they had sent me. They were going to get back with me with specific locations of those analyticals.

19 So I guess there may have been a 20 communication error between Raser and the OCD on 21 final public notice, and that water quality 22 specification and depth.

23 MR. SEAWRIGHT: Those are all the 24 questions I have.

25 HEARING EXAMINER: Thank you, Mr.

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1 Chavez. I just want to get a few things -- I want to clarify a few things here. 2 EXAMINATION BY HEARING EXAMINER 3 4 Q How many injection wells are there? 5 А Three injection wells. 6 Okay. I was under the impression, for some Q 7 reason, there were five. There are only three on 8 your exhibit so there are only three injection 9 wells, right? 10 А Correct. 11 Okay. Now, two of those injection wells, Ο the location has changed? 12 А Yes. 13 14 Do you have that Exhibit? Do you have the 0 locations on it? 15 16 This is one that did not change. А The 17 others were over -- I believe over to the east in a 18 linear pattern. 19 0 Right. 20 However, they moved one over to this Α 21 location --22 MS. ALTOMARE: Carl, can you make that 23 any bigger by any chance? 24 THE WITNESS Is that any bigger? If I 25 zoom in at 50 percent, I'm going to have to really

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1 bad --

Q (BY MR. BROOKS) Okay. You had a list that had footage locations. Now, was that the original footage locations, or is that the currently proposed? A Those are the currently proposed.

Q That's on one of your slides that will be8 part of your power point, right?

A Yes.

9

23

Q Now, could you show us, and because we're making a record here, you'll need to be descriptive as well as pointing, where the original locations were and where the new locations are?

A I probably -- you know, I had a map. I don't know where that's located now. It's probably -- it will be presented by Raser later. They will probably be better able to tell you the exact locations.

19But from recollection, Mr. Brooks, they20would be somewhat in a linear pattern off to the21east --

22 Q Okay. Now --

A -- greater than 1,200 feet apart.

Q On this map, is north to the top on this map?

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A

Yes.

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So you are running your -- you were running 2 0 3 your pointer down south of the -- now, the white 4 triangles there, is that the fish farm? 5 А This is the nursery. The Burgett Nursery. Okay. We use that as a point of reference. 6 0 7 You were running your pointer along the green line 8 that's down south of the nursery, right, and a 9 considerable distance south, apparently? 10 А Yes. 11 Okay. Now, what is the scale on that map, 0 that green line? How far is that south, 12 approximately, from the nursery? 13 14 That's about within a three-quarter mile to Α a mile. 15 Okay. Now, where are the new locations? 16 0 17 А The new location is several feet off to the 18 west. A mile to a mile-and-a-half to the northwest. 19 20 Okay. So they've moved the proposed 0 21 locations. Now, one of the locations is off to the 22 west, and one is to the north; is that right? This is the one to the north. 23 А 24 Okay. One of them is more or less due Q north from the nursery, about maybe a half mile, is 25

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that an accurate scale?

2 А That's a good approximation. Less than 3 half a mile, quarter mile. It's west of the tilapia fish farm. 4 5 Okay. The tilapia fish farm is in the 0 northwest corner of the darker portion of the map 6 there? 7 The northeast corner where you're pointing? 8 Is that the tilapia fish farm? 9 Α Yes. 10 MR. SEAWRIGHT: The well is 11 approximately 800 feet to the west of our farm. 12 (BY MR. BROOKS) Okay. So the well is west Ο 13 of the fish farm, a short distance, and it's maybe half a mile north of the nursery? 14 Yes, within a half mile. 15 Α 16 0 And the other one is off to the west how 17 far? 18 А About a mile. 19 0 Very good. That gives us some general idea, and I assume we're going to get footage 20 locations from the applicant for both the original 21 22 and the present location? They've submitted new forms for the new 23 Α locations. 24 The footage locations that are in your 25 0

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power point, those are for the new locations,
 right?

3 A Yes, sir.

4 Q I asked you that before. I forgot the 5 answer.

6 A The footage is from the north line and 7 southwest lines are accurate to the current --

8 Q Okay. Which one of those three wells is 9 the one where the location has not changed?

10 A 4218.

11

12

16

Q Okay. 4218.

A It's south of the nursery.

13 Q 4218 has not changed. The other two, the 14 locations that you have there, are the locations 15 that are presently proposed?

A Yes, sir.

17 Q Okay. Thank you. Now, you said this 18 formation was about 3,000, 3,400 feet?

19A3,400 feet. And the deep test boring also20corroborates that depth.

21 Q You said there were no other wells that 22 penetrated this formation within the area; is that 23 correct?

A Only one well that I'm aware of, the deep test boring. The deep test boring, it was just to

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1 the east of the plant location.

2 Q Now, is there -- are there shallower ground 3 water aquifers in this area, or is this the only 4 relevant water formation?

A Well, there could be, depending on more detailed lithology documentation. There could be different aquifers, but from the papers that I have read of the area, and due to the faulting and the ---

HEARING EXAMINER: I guess we have towait for the train again.

12

Q Go ahead.

A Well, there are domestic water wells within 14 150 feet of ground surface. There are nursery 15 wells that are within 400 feet of ground surface, 16 and then the AmeriCulture, certainly they have 17 wells. They have one well that is significantly 18 deeper as mentioned by Mr. Seawright earlier.

19MR. SEAWRIGHT: We have a domestic --20HEARING EXAMINER: I'm sorry. You'll21need to present your testimony at the appropriate22time.

23 Q So there are wells --

24 A Right now it's very interesting because 25 when I read through some of the reports from the

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1 Department of Energy --

2 0 I guess we need to wait again. That train is continuing to make noise. They must be passing 3 two trains. 4 5 А This will give me time to focus in a little bit better. 6 7 Okay. I believe they've passed. Go ahead. 0 I think this better exemplifies the 8 А 9 location of some of the wells in the area. 10 Q This is just a --Yeah, I'm trying to tie it in to 11 Α 12 approximate well depth. 13 Certainly you saw some of the photos. 14 There are some domestic housing in the area, from what I can recall, from looking at logs and reading 15 through some of the depth. 150 feet below ground 16 level is perfectly typical of any domestic drinking 17 water well in the area. 18 19 The tilapia fish farm has a series of 20 water wells, 33, 34, and 34, 35, and 36 up by their 21 operations, and those wells are approximately 500 22 feet deep. I'm not sure where the deepest one is located. It may be off to the west. 23 24 Okay. Well, they are present, and they can 0 25 put on testimony to that effect.

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A The Burgett Nursery, those wells are within 400 feet of ground surface, just from recollection. Q So the presence of all those wells indicates that there is fresh water available in much shallower temperatures, right?

A Absolutely.

6

Q You said that the Oil Conservation has not completed its technical review of this application, correct?

10 А No, because we'll be requiring a more detailed monitoring plan that will require the 11 placement of monitoring locations. We weren't 12 satisfied with some of their locations. You can 13 see one of their proposed locations, two. There is 14 another one off to the west. There are three 15 16 proposed locations that they propose.

17 Q Would it be correct to assume that the 18 OCD's continuing review of this application will 19 include a review by the OCD's hydrologists?

20 A Absolutely.

HEARING EXAMINER: Okay. I think that'sall I have for now.

23 Redirect, Ms. Altomare?
24 MS. ALTOMARE: I think the additional
25 questions that I have would be best directed to the

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1 bureau chief.

2 HEARING EXAMINER: Okay. Does anybody have anything further? 3 MS. MUNDS-DRY: No further questions. 4 5 HEARING EXAMINER: Mr. Seawright. 6 MR. SEAWRIGHT: Mr. Chavez, for the record, I would like to confirm that public notice 7 did not include these modified locations for the 8 9 injection wells? 10 THE WITNESS: They did not. MR. SEAWRIGHT: Thank you. 11 HEARING EXAMINER: Very good. Let's 12 take a 10-minute recess. 13 14 (Recess.) 15 (Back on record.) 16 HEARING EXAMINER: The hearing will come to order. Order in the hearing room, please. 17 18 Ms. Altomare, you may call your next witness. 19 MS. ALTOMARE: The Division would like 20 21 to call Wayne Price. 22 WAYNE PRICE, 23 (Having been first duly 24 sworn, testified as follows:) 25 DIRECT EXAMINATION BY MS. ALTOMARE

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Mr. Price, can you state your name and 1 0 title for the record? 2 3 А My name is Wayne Price. I'm the Environmental Bureau Chief of the Oil Conservation 4 Division of the State of New Mexico. 5 6 0 How long have you held that position? 7 А Approximately seven years. How long have you worked for the Oil 8 0 9 Conservation Division? 10 About 15 years. А 11 Mr. Price, you've heard some testimony 0 12 regarding the moving of the location of two of the three injection well sites since the deeming of 13 administrative completeness of the application? 14 15 Α Right. You've heard testimony regarding that 16 0 earlier? 17 18 I did hear that. Α 19 And did that cause any concern at this 0 20 point? 21 It really does cause a lot of concern. Α 22 Can you explain to the attendees and the Q 23 Hearing Examiner why that causes you concern? Well, one of the most important things 24 А 25 about any discharge permit application is public

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notice. We're bound by law and also by regulation
 that requires that the public be given the proper
 notice of the application.

It certainly appears that something has changed, and, therefore, proper public notice has not been given. So it would be my recommendation, at this point in time, that that's going to have to occur.

9 Q So what you're saying is that at this 10 point, we would have to reissue public notice 11 regarding the new well site locations?

12

A That is correct.

Q Do you think that it's still worth while to proceed with the presentation of testimony, nonetheless, given that we've all convened here and have valuable information to present given the project?

A Oh, absolutely. Because one of the opportunities that we do not want to miss is for everyone here to hear what everybody has got to say, and how the system could or may work and so forth. Yes, I think we should continue.

Q Were you consulted in any way, shape, or form regarding the relocation of the two wells? A No, I was not.

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1	Q After the original application was received
2	by Raser Power System, do you recall receiving a
3	letter from AmeriCulture dated 7-11-2008?
4	A Yes.
5	Q In that letter there were a number of
6	concerns raised?
7	A Yes.
8	Q I believe one of the concerns that was
9	addressed in that letter was regarding
10	overproduction of deeper geothermal I'm sorry
11	overproduction of deeper geothermal reservoirs
12	resulting in rapid thermal depletion of shallower
13	reservoirs relied upon by nearby businesses, and
14	causing a threat to the State's water interest, and
15	impairing existing water rights in geothermal
16	users?
17	A Right.
18	Q Are these issues that you think fall within
19	the purview of today's hearing, or within your
20	evaluation of Water Quality Act issues, Water
21	Quality Control Water Quality Control Commission
22	regulation issues at this point in time?
23	A Not at this point in time.
24	Q Can you explain why or why not?
25	A Well, it's just under I think Carl did a

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pretty good job, pretty well spelling out there are two regulations. One is water quality, and the other is geothermal resources. We are here for the water quality part of it. So, therefore, this particular concern would probably be -- will be addressed later on.

Q So issues of thermal depletion of a reservoir relate to water rights or geothermal resource conservation issues, and not to water quality issues, in your opinion?

11

A Correct.

Q Again, issues relating to the State's water inference or existing water rights of neighboring property owners, again, would not relate to water guality issues?

16 A No. This agency does not have the 17 authority for oversight of water rights.

18 Q Regarding overproduction of the shallow reservoir, reservoir creating a pressure gradient 19 20 in the shallow geothermal reservoir and ground water acquifer and inducing mixing, again, is that 21 22 an issue that falls in the scope of water quality concerns that are being addressed by today's 23 24 hearing or by the discharge permit and application 25 process?

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None of this looked at, certainly, from the 1 А 2 standpoint of water rights or geothermal rights. Regarding the issue of the fact that 3 0 testing conducted to date suggests that continuous 4 5 production on the reservoir exceeding or approaching 2,000 GPM may result in, quote, 6 7 "significant long-term drawdown and effect adjacent 8 shallow ground water rights in the basin." 9 There's concern expressed that 10 reservoir currently produced in excess of 1,000 GPM 11 during colder periods of years suggests additional testing, geochemistry should be done to determine 12 the sustainability of a resource for power 13 production in excess of one to two megawatts. 14 15 How would you address that concern? Well, once, again, it appears that that's a 16 А water rights issue, and, also, it's geothermal 17 resource right issue. So it probably should not be 18 19 addressed in this particular hearing. 20 So, again, that's not something that is Ο 21 going to fall within the scope of water quality 22 issues, in your opinion? 23 А Correct. 24 What about the concern that --0 HEARING EXAMINER: I think we have 25

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1 another train coming.

MS. ALTOMARE: Oh, okay.
HEARING EXAMINER: I believe we can
resume.

5 0 (BY MS. ALTOMARE) What about concerns regarding the overall size of the geothermal system 6 and sustainability of that system, and adverse 7 8 impact on direct-use operators in the area? 9 Are any of those concerns issues that relate to water quality issues now being addressed 10 11 by this hearing or the discharge permit process? I would say not. I think that issue 12 А 13 relates strictly to the Geothermal Resource Conservation Act. 14 15 Concerns have been expressed regarding the 0 proposed injection wells located in areas with 16 17 unknown subsurface geology and hydrogeology, and 18 the fact that the plan currently has no mention of 19 confining or caprock and reservoir units in the 20 depth ranges and thicknesses, and that the drilling

program, as currently proposed, is currently too
generic as to subsurface conditions.

23 How would you respond to that concern? 24 A Well, I think -- I think that is a valid 25 concern, and particularly for water quality. So we

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1 agree with that concern.

Again, those are things that would be 2 3 routinely dealt with as the permitting process goes forward and the project -- the Division ascribes 4 conditions to the permit -- for the permit to go 5 forward? 6 Yes, but notwithstanding the fact that the 7 А 8 public notice is still an issue. 9 Right. This is all with the understanding 0 that we still need to back up and correct the 10 notice issue? 11 12 А Right. That's correct. What about the issue of the thickness in 13 0 depth of fresh water zones as stated in the permit? 14 15 There's been some assertion that that's That the permit conductor casing, as 16 not correct. specified in the permit, doesn't agree with the 17 18 casing program in the drilling plan. How would you 19 address those concerns? I also think that could be a water quality 20 А 21 concern. 22 0 As it applies to the injection wells? The injection wells, right. 23 А But at this point, we're not addressing the 24 0 production wells; is that right? 25

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A In this hearing, that's correct. Now, that doesn't mean under the Geothermal Resources Act, and I know that particular act of rules and regulations, we are concerned about the casing programs, but just not in this particular hearing.

6 Q Issues regarding casing in the production 7 wells would be addressed by the Oil Conservation 8 Division; is that right?

9

A That is correct.

10 Q But it may be done at a different time and 11 in a different venue?

12 A That is correct. I'm sure we'll have the 13 assistance from our engineering bureau and the 14 petroleum engineers to help us on that aspect of 15 it.

Q There's also been a concern expressed that all the well applications submitted by the applicant have the same proposed well design, even though they are located in different areas, and with different subsurface geology. Basically, that they are too generic in nature.

How would you address this concern? A I totally agree with that. I think that it's too generic, and that they should be more specific.

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1 Q Again, this is with regard to the injection 2 wells only at this point?

3

A That's correct.

Q A concern has been expressed that reservoir properties are unknown because there's been no well testing in the designated area, and that this is problematic because the injection wells have the potential to destroy the resource and cause thermal breakthrough on existing production wells.

How would you respond to that concern?
A I, once, again, think that's probably a
geothermal resource issue.

Q So it's not an issue to be addressed at this time or place because it doesn't fall under the Water Quality Act issues that we are at task with addressing at this hearing?

17

A Correct.

Q What about the concern that reservoir properties are unknown because no well testing --ZO I'm sorry.

Questions have arisen regarding the erudition and accuracy and reliability of the TDS value provided in the notice of publication regarding the Horquilla formation.

25 I think there was some testimony and

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some questions by Mr. Seawright earlier about that regarding the basis for the TDS that was provided in the public notice?

4

A I agree with Mr. Seawright on that.

5 Q So further testing would need to be done on 6 the Horquilla formation to ascertain the total 7 dissolvable solid value?

8

A Yes. Right.

9 0 Additional concern has been expressed that the plans submitted by the applicant is deficient 10 11 and missing a number of parts. Specifically, that there has been no plans submitted for evaporation 12 pond design and location, no monitoring plan 13 establishing protocol, monitor locations, or 14 15 monitor well designs, and no geotechnical data presented or referenced for evaluation of the 16 site's subsurface conditions of hydrogeology. 17

How would you address each of thoseconcerns?

A I believe that's a concern. I know Carl Chavez has worked hand and hand with Raser, and has expressed to me a number of times that information is coming along rather slowly. However, this is a prototype, an experimental project, so we kind of understand that, but it is a concern.

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Q At this point, we have now, since the -since a lot of this information was put out in the public notice and whatnot, we've received the additional plan information regarding the evaporative pond's design and location; is that right?

7

A That is correct.

8 Q And the remaining information regarding the 9 monitoring plan and sampling and the geotechnical 10 data is still outstanding?

11

16

A That is correct.

Q But the OCD will continue to work with Raser to make sure that those pieces of information are acquired, and to meet with OCD, and that it includes the OCD's standards?

A We will work with them and all parties.

Q Another concern was expressed that nearby shallow geothermal wells are in direct communication with the deep-seated geothermal waters, and that there was concern regarding the injected chemicals.

I think that Mr. Seawright indicated this in his opening statement regarding the algae, the anti-algae and anti-scaling chemicals in particular with regard to the fish farm. How would

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1 you address this concern?

A Well, we're concerned about that. I know that Carl has been concerned from day one about that. It's not something that can't be -- it can be addressed, but we are definitely concerned about it.

We want to make sure that whatever goes back in to those formations, and that those formations are interconnected or they're in communication with each other. We want to make sure that there's no degradation to the existing ground water.

Q So just to reiterate and clarify something that was stated by Mr. Chavez, anything that is reinjected in the course of this project in any of these three wells, will be made -- OCD will make sure that it complies with the water quality standards?

19 Α Right. It is considered a discharge. Τ'đ 20 like to clarify, maybe, what Carl was trying to say 21 there. Under the Geothermal Resources Act and the 22 rules and regulations, it points out the difference 23 between disposal, and the difference between reinjecting for reuse. 24

However, under the Water Quality Act,

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there's no difference for us. It's still a
 discharge. That's why you have to have a discharge
 permit.

And if, for instance, it became known that 4 0 5 a particular chemical that was being used in the project might be toxic to neighboring business 6 owners, for instance, Mr. Seawright, is there the 7 ability to impose a condition for testing for that 8 9 particular chemical to make sure that what's being re-injected doesn't contain that kind of 10 contaminate that could put his business in 11 12 jeopardy?

13 Is there additional monitoring, additional conditions that the OCD can impose that 14 would allow the OCD to provide for additional 15 monitoring and additional testing that is 16 contaminant specific or chemical specific to make 17 sure that the water or the substance that is being 18 re-injected are not posing specific risks to the 19 20 neighboring businesses?

A There certainly is a way to monitor and a way to test. Some of the concerns I have is if some of the chemicals are not on our ground water quality protection list, and we're not really sure how we're going to handle that. So that's going to

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be an issue that -- that's another broad issue that
 we're going to have to think about.

For example, if the cooling tower blow down water has certain toxic chemicals in it, and it's not on our list of ground water protection, how do we handle that? So that's something that we're going to have to really do our homework on.

8 Q But it is something that the OCD is willing 9 to work with all parties for --

10

A Oh, absolutely.

11 Q -- to insure that it does go back into the 12 ground, and is not going to pose a risk to wildlife 13 or ground water in the area?

14

A Absolutely.

Q Is there anything additional that you would like to add or clarify regarding the permitting process for this particular project?

A Well, first of all, I think it's a great project. It would be New Mexico's first geothermal power plant. I think, from that standpoint, it's wonderful. But we want to make sure any time that we do something, we're going to protect the people. That's what we're here for. So we're going to do both.

25

MS. ALTOMARE: I'll pass the witness.

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1 HEARING EXAMINER: Very well. Ms. 2 Munds-Drv. 3 MS. MUNDS-DRY: Thank you, Mr. Brooks. CROSS EXAMINATION BY MS. MUNDS-DRY 4 5 0 Chief Price, I know there's been some focus 6 on the Horquilla formation, and I think that's because Raser's proposed APDs indicate that they 7 8 will be attempting to complete in that formation. You were discussing the TDS and that formation and 9 wanting to obviously confirm that. 10 11 You would want to know the TDS for whatever producing zone Raser will ultimately 12 produce in, wouldn't you? 13 14 А That is correct. 15 0 Okay. And I just want to make sure, I think Ms. Altomare had asked at the end, but I want 16 to make sure that I understand the OCD's charge. 17 18 It's not as though you are being 19 protective of offsetting business owners, but you 20 are insuring the guality of water for wildlife in 21 the area is protected; is that correct? That is absolutely correct. 22 Α 23 MS. MUNDS-DRY: Thank you. 24 HEARING EXAMINER: Mr. Seawright. 25 CROSS EXAMINATION BY MR. SEAWRIGHT

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Chief Price, I just have one guestion, and 1 0 2 I just ask you to confirm the -- will you please confirm the intent of the OCD to go through the 3 4 public process once again? 5 А Yes. I think the answer is a simple "yes." MR. SEAWRIGHT: Thank you. 6 7 HEARING EXAMINER: Is that all you have? 8 MR. SEAWRIGHT: Yes, sir. 9 EXAMINATION BY HEARING EXAMINER 10 Mr. Price, how long did you say you have 0 been the Environmental Chief at the OCD? 11 12 А I thought I said I've been at the agency 15 Five in district -- I think it's -- I'm 13 vears. Did I say something wrong? 14 sorry. 15 0 I think you said you'd been Environmental Bureau Chief for seven years. 16 17 А I'm sorry. I don't believe that's true. 18 0 19 А No, I'm sorry. 20 MS. ALTOMARE: It probably just feels 21 that way, Mr. Brooks. 22 THE WITNESS: I do feel that way. I'm sorry. It's probably a little over three years, 23 going on four. 24 25 0 (BY HEARING EXAMINER) From what you've

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said, and, also, from what Mr. Chavez has said in 1 2 his testimony, it is my impression, and tell me if 3 this is correct, that the Division anticipates that it will receive a significant amount of additional 4 evidence or information from the applicant before 5 it will be in the position to make a recommendation 6 to the director as to whether this application 7 should be granted, and what conditions should be 8 placed on it; is that a correct statement? 9

10 A That is, but I'd like to add to that. Not 11 only received, but request.

Q Okay. So you anticipate that you will make specific requests for additional information, and that that information will be supplied and will be evaluated in addition to whatever information you already have before you make your final

17 recommendation to the director?

А

18

That's correct.

HEARING EXAMINER: Okay. Thank you.That's all I have.

Anyone have any follow-up? Very good.
You may stand down, Mr. Price.

23 We're getting close to the lunch hour 24 now. Before starting the applicant's testimony --25 we'll see how the timing goes, but before starting

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the applicant's testimony, I would ask at this time if there are any members of the public who want to make comments at this time?

Is there anyone present who wants to
make comments at this time? Okay.

6 Could you please come up here to the 7 witness stand. We will not require that you be 8 sworn in order to make comments, but we do need you 9 up here where the court reporter can hear you and 10 take down what you say.

MS. PETERSON: Thank you. I'm Louise Peterson. I've lived here all my life. We farmed down in the Cotton City area. I'm now the chair of the Hidalgo County Commission, and I want to tell you that, as a person, I support this endeavor that Raser is doing.

To me, it's great to have renewable 17 energy, and I'm so glad that you people are there 18 to protect the water quality because we don't want 19 to compromise good water with anything. 20 I want to 21 voice my support for the project. Thank you, sir. HEARING EXAMINER: Thank you. 22 Is there any other member of the public 23 24 that would like to make a comment at this time?

25 Very well, hearing none, and having some time left

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before the noon hour, Ms. Munds-Dry, you may call
 your first witness.

MS. MUNDS-DRY: Thank you. Mr. Brooks,
may I give a brief opening?

5 HEARING EXAMINER: Yes. I forgot you 6 reserved your opening statement. You may proceed 7 to do so at this time.

8 MS. MUNDS-DRY: Thank you. Mr. Hearing 9 Examiner, this area we're talking about today is 10 one of the most studied areas for geothermal in the 11 United States. It has over 25 years of study. Ιt doesn't mean that the studies and the information 12 13 that we need to complete this project are done and 14 conclusive. However, that is something of interest. 15

What Raser is proposing today, or at least part of the proposal today, is clean and green and environmentally friendly. Raser has every intent of meeting every water quality standard proposed by the Division, whether that be through its regulations, or its own conditions that imposes through the permit.

Let there be no mistake that Raser has no intent to impair the quality of the water in this area. This proposal, in fact, will insure

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that that water quality that is injected back into the formation will be the same or possibly better as that formation.

We know more about this area than Mr. Witcher's report indicates, and the testimony today will show that. We also want to note that contrary to what AmeriCulture is asserting, standards are not quotable water standards, they are the water quality standards, and I just want to keep the focus there.

We plan and have every intention of continuing to provide all the information that the Division requests, and I believe the testimony today will show that we can meet all those standards, and request that that discharge permit be approved.

17With that, I'd like to call my first18witness.

HEARING EXAMINER: I'm sorry. What wasthe witness's name?

21MS. MUNDS-DRY: I would like to call22Michael Hayter.

HEARING EXAMINER: Okay. Ms. Munds-Dry,
 you may proceed whenever the witness is ready.

MS. MUNDS-DRY: Thank you. We can at

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1	least get started while that's warming up, and
2	hopefully that will come up shortly.
3	MICHAEL TODD HAYTER,
4	(Having been first duly
5	sworn, testified as follows:)
6	DIRECT EXAMINATION BY MS. MUNDS-DRY
7	Q Would you please state your full name for
8	the record?
9	A Michael Todd Hayter.
10	Q Where do you reside?
11	A I reside in Highland, Utah.
12	HEARING EXAMINER: I'm sorry, I didn't
13	hear you.
14	THE WITNESS: I'm sorry.
15	HEARING EXAMINER: Your response?
16	THE WITNESS: Highland, Utah.
17	Q (BY MS. MUNDS-DRY) By whom are you
18	employed, and what is your position?
19	A I'm employed by Raser Technololgies, and my
20	position is Director of Geothermal Development.
21	Q Have you previously testified before the
22	New Mexico Oil Conservation Division?
23	A No, I have not.
24	Q Would you please provide to the Hearing
25	Examiner a brief summary of your education and work

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1 experience?

2	A Sure. I graduated from Washington State
3	University in 1994 with a degree in foreign
4	languages and business. My career was I began
5	my career in high technology consulting. I spent
6	several years working domestically and abroad in
7	South America and Europe at various project
8	management, project development rolls.
9	Several years later, I came in touch,
10	through the venture capital community, with
11	renewable energy projects and technologies. I
12	started a company, a geothermal development. I
13	founded a small company, and ran that company for
14	some time, and then joined Raser Technologies a
15	little over a year ago.
16	Q I'm sorry. How long have you been with
17	Raser?
18	A Just over a year.
19	Q What are some of your responsibilities at
20	Raser as Director of Geothermal Resources?
21	A I'm responsible for identifying and
22	acquiring all geothermal resources, domestically
23	and internationally, and then bringing those
24	projects or those resources to a point where we can
25	build and construct power plants. At which point,

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I turn most of my responsibilities over to our
 engineering and construction.

HEARING EXAMINER: I'm advised we're going to have some distractions during the remainder of the hearing, so we're just going to have to ask everybody to shout. That's the only way we're going to get this done.

8 MS. MUNDS-DRY: Mr. Brooks, at this 9 time, we would tender Mr. Hayter as an expert in 10 business management in geothermal resources.

11HEARING EXAMINER: Is there any12objection to that tender?13MS. ALTOMARE: No objection.

14 MR. SEAWRIGHT: No objection.

HEARING EXAMINER: Very good. He is soqualified.

MS. MUNDS-DRY: Thank you.

Q Mr. Hayter, would you briefly summarize
what Raser seeks in this application here today?

20 A Yes. We're seeking approval of our 21 injection wells as part of our well fill 22 development plan, and part of this overall 23 geothermal power plant project development. 24 Q This is only for the discharge plant

25 application?

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A That's correct.

Q Would you please provide the examiner with a brief explanation of what Raser's background and expertise is in geothermal power?

This is where my slides came in, but 5 Α Yes. I'll just go ahead and talk you through it. Raser 6 Technologies has two primary business units. 7 We're a publically traded company on the New York Stock 8 9 Exchange. We're a pre-revenue company, meaning that most of our projects thus far have not been 10 producing revenue. We've been in a development 11 12 stage, and we have --

Q If I can ask you just to speak up just a little bit. It seems like we've got a little bit more background.

A Okay. I'll speak louder. I'll raise the volume. So we -- can you bring me back on to the guestion that you were discussing?

19 Q Raser Technologies.

20 A The Raser Technologies. So Raser 21 Technologies has been acquiring projects throughout 22 the western U.S. and also Indonesia. Over the past 23 several years we've acquired over 350,000 acres of 24 known geothermal resource areas through primarily 25 leases and concessions.

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1 We're currently developing nine 2 projects that we've announced. This will be this is foreseen to be the second project. Our 3 first project that we've completed, or just 4 completing commissioning of our first power plant 5 6 in Thermo, Utah, which is an 11 megawatt net output It's identical in terms of its -- generally 7 plant. speaking, in terms of its engineering and its 8 function to what will exist here. 9

10 In fact, that's part of our business 11 strategy. We are attempting to take geothermal from a very long lead time development activity, 12 and try to shorten that through modular, small 13 modular units that we use for power generation 14 which enabled us to shorten the engineering and 15 construction-time cycle. And, also -- that's okay. 16 17 I'll move forward with this.

We are also working through rapid deployment methodologies to develop. So we've been able, for example, to take what typically requires five to seven years to develop a power plant, we've taken down to approximately a year to 18 months, which we've just accomplished it in Utah.

24 Our attempt is to do the same here, and 25 carry that out where we have a known geothermal

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resource. We have some data, but we need more data 1 as we -- and then part of our -- what we're 2 3 proposing is to be able to proceed with the project 4 so we can gain that data and work on that information, and incorporate that into the plan as 5 6 we cooperate with the agencies, and with our 7 neighbors to produce a renewable -- clean renewable 8 power plant.

9 Q Mr. Hayter, I would ask you to turn to 10 what's been marked as Exhibit No. 1, which is this 11 large document here. Review this to the examiner, 12 and if you could review Raser's proposal for the 13 power plant?

A This is actually the same map that was used earlier by Mr. Chavez.

HEARING EXAMINER: I do, sir.

16 Do you have a copy of it there, Mr. 17 Brooks?

18

19 THE WITNESS: What you see here in the 20 green outline is the boundaries of the Federal 21 geothermal lease. One correction is that it 22 actually -- we have a second lease that we've added 23 to it to the south. It's not really covered very 24 well by this map, but it's a total of 3,100 acres, 25 rather than the 2,500. That's a rather recent

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development.

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2 But it is a split-estate resource. We have private landholders on the surface, and a 3 Federal geothermal lease underneath. 4 That, 5 obviously, is provided for some challenges, and 6 being able to develop the resource. This particular map, if you see the 7 circle around it, is a mild diameter in order to 8 9 help facilitate what you can see in terms of the 10 other facilities, their operations. 11 Thank you very much. Let's see if we 12 can get a map up. (BY MS. MUNDS-DRY) Is this what the 13 Ο Division calls its "area review," that's this 14 circle diameter here? 15 Yes. I'll bring it up here on a bigger 16 А picture so everyone can see that. 17 18 Thank you very much, Mr. Chavez. So what we have here is the overall 19 If I might stand, if that's all right, 20 proposal. 21 and point some things out to you? 22 HEARING EXAMINER: That will be 23 acceptable. THE WITNESS: All right. We have -- as 24 has been discussed, we have several well locations, 25

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proposed well locations throughout this particular 1 2 Each of those well locations are accompanied area. 3 by an evaporation pond or pit. We'll discuss that a little more later. 4 HEARING EXAMINER: These are injection 5 wells or production wells? 6 7 THE WITNESS: The red are injection wells, the blue are production wells. 8 9 HEARING EXAMINER: Thank you. 10 THE WITNESS: We are currently leasing 11 -- we have the 3,100 acres we're leasing from Mr. Burgett at Rosette Peak, a 20-acre parcel here 12 where the plant will be located, and all the 13 14 mechanical facilities except for well heads and pipes to those particular well heads. 15 16 As you can see, that's off to the west, Mr. Burgett's operation, and to the southwest from 17 18 Mr. Seawright's operation. Those well locations were chosen because of existing data that we have. 19 20 There is information that we have about faults. There is the Animas Valley Fault, which 21 kind of runs up along this side here. 22 There's another bounding fault, the western -- what we're 23 calling the western fault. This is all information 24 that's been verified by GeothermEx. 25

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GeothermEx is the recognized leader in the world of geothermal consulting, resource analysis reservoir estimation. In fact, they're typically hired by the lenders in these projects. These projects that are typically tens of millions, hundreds of millions of dollars to verify and analyze geothermal resources.

8 So they've taken a look at some of the 9 data, some of which is more up to date than what 10 Mr. Witcher has, and they have shown and drawn out, 11 as best we can tell at this point, some of the 12 other fault locations.

So we have a western fault here, and you have, through this area, if you kind of imagine an oblong circle here going up and going up to that northeast corner there where Mr. Seman's -- excuse me, Mr. Seawright's location is, you have an area of shallow upflow, hot geothermal fluid anomaly. So it's an area where -- and that's

20 been evidenced by 25 years or more of drilling, and 21 wells have produced it there at temperatures as 22 high as 325 degrees for the deep well, which is 23 located right here. It's a 7,000-foot well that 24 was drilled in 1984, 1985. So those wells, 45-7, 25 was chosen because it's very close to that original

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deep well.

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GeothermEx, when they analyzed that 2 3 well based on recent flow data, by "recent," I mean in the 2003 to 2005 range, they analyzed that data, 4 5 past data, and decided the well was capable of producing between 3 and 6 megawatts net of power. 6 (BY MS. MUNDS-DRY) Mr. Hayter, that 45-7, 7 Ο 8 that's a blue -- it's says it's a production? 9 Α That's a production, yes. The injection wells, originally, as we've discussed, were located 10 in this area here. Those -- I think it's important 11 to address why those were moved. 12 Those were actually moved because of 13 discussion that we had with our experts, Mr. John 14 15 Shomaker, had with Jim Witcher, and with the State Engineer over concerns of water impairment that Mr. 16 Seawright had raised. 17 18 So we, in an attempt to cooperate, had our experts meet and try to define a solution that 19 would work for all parties. 20 21 HEARING EXAMINER: This gentleman that worked on this, is he going to testify today? 22 THE WITNESS: John Shomaker is not here. 23 He was -- he is out of the country, but he has Mr. 24 25 Roger Peery, the CEO of the company is here

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representing him.

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2 HEARING EXAMINER: Continue. 3 THE WITNESS: So the proposal is to have the five production wells and three injection 4 The injection wells, again, we're trying to 5 wells. find a balance between injecting back into a 6 7 resource for long-term resource development to 8 insure that the resource is recharged, and you have 9 as many years as you can get out of that resource. 10 Indefinite, actually, is what the goal is. 11 Then, also, trying to insure that we're cognizant of the various uses of water from our 12 13 neighbors there. So we're trying to find that balance of resource management and water usage 14 around us, which is why we have moved. 15

In fact, I would propose we'd be happy to move them back to the original location if that would make our neighbors happy.

19 Q (BY MS. MUNDS-DRY) Mr. Hayter, before we 20 leave this map, could you also point out to the 21 examiner, for the record, where the proposed 22 monitoring wells are located?

A Yes. So we've proposed three locations currently. Again, I want to state that we've been very careful in attempting to work with the State

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agencies. This, as been talked about, is the first commercial geothermal power plant that will be in the State of New Mexico.

So we've, very early on, sought out the 4 5 agencies, and sought out our neighbors to try to figure out how to make this all work. We've been 6 7 on a path together, but we've decided after 8 conferring with some of our hydrology experts, to 9 place a monitoring well here, which is on the site 10 near the primary evaporative pond to monitor water quality at that location. 11

We have also -- I must say that this map is a little bit incorrect. We don't want to put a monitoring well on State -- I think that's State land where it's currently located. It should be a little bit closer to, but the attempt at that particular well in the northeast is to monitor water quality at Mr. Seawright's location.

Then we placed another well, monitoring well, up to the west and between production and injection wells to, once again, monitor the quality between a producing zone and an injection zone, and to see what kind of communication, if any, we're getting.

25

We're proposing to monitor at three

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levels; a shallow level, an intermediate, and a
 deep level so that we can insure that we're getting
 accurate and consistent measurements at different
 zones, and that we're being careful to insure that
 we're not harming any of the water quality.

6 Q Mr. Hayter, will Raser be calling a 7 hydrogeologist to discuss that monitoring plan in 8 more detail?

9

A Yes.

Q In fact, we discussed this a little bit, but I want to make sure that the examiner understands why this location that's been proposed by Raser is ideal for accessing the geothermal resource?

A Well, it's primarily because the -- in the geothermal business, the greatest risk is in drilling. It's where every project, even with considerable data, has always had drilling risk. It's where we have to put our own money forward. Very few companies will finance the drilling, and it's very expensive capital.

22 So, in this case, a well will cost us 23 in the neighborhood of 3- to \$5 million we 24 estimate. So it's an expensive venture to find 25 those producing zones. So you want to be very

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careful in terms of where you go and where you're
 drilling.

3 We have enough data from the past 25 4 years to indicate, and more recently from some studies that were done in the 2003 time frame, that 5 6 indicate that there is a zone. I mentioned the 7 oblong area. There's a zone that is kind of down by 47-07, a little bit south of that, and then 8 9 continues up north and is a shallower reservoir. 10 In drilling, the deeper you go, the more expensive it is. 11

12 So our attempt is to find those 13 temperatures at a depth of, hopefully, no deeper 14 than 3,400 feet, which is what we requested in the 15 permit. Cost gets quite a bit more considerable 16 after you go deeper than that.

So we found what is the geology, the flow data from the existing wells. We have two other wells that give us an idea about temperature gradients, so we've taken all that data and made our estimate at where a well would go.

I want to point out here now that -because it's come up before, that we have been attempting to get an approval from an overall permitting package, we call it. Because our

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lender, Meryl Lynch, in this case, when they look
 at a project, they will not finance a project until
 we have taken out as much risk from the project as
 we can. One of those risks is permitting.

So what we attempt to do is as much 5 6 work as possible to get the permits done with the 7 idea that as soon as we drill our first well, we'll learn more about that resource. We'll understand 8 more about communication of fluids between 9 10 reservoirs, the lithology, and everything else that 11 goes into determining what a resource can and 12 cannot do.

As we do that, I would predict we'd probably learn something we don't know today about the resource. So it's possible that we will approach, again, the OCD and others about moving locations. If a particular well doesn't make sense there anymore, a future proposed well, we would want to do the right thing and move that location.

20 So what I'm trying to do is --21 developing a geothermal resource requires some 22 flexibility. I think you've heard the OCD talk 23 about their flexibility. It's a project where you 24 have to move along together, and not be hemmed in 25 too tightly to a specific plan. You have to be

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willing to let the data guide you as you go along.
 That's always been our intent to understand the
 data in terms of water quality, our injection
 permits, and make adjustments as we need to.

5 Q Mr. Hayter, you mentioned that all drilling 6 gives us more information. This would include the 7 drilling of monitoring wells initially; is that 8 correct?

9 A Every hole that you sink into that area 10 would give you new information about the hydrology, 11 about the geology, about the reservoir and 12 temperatures, and what kind of -- ultimately, what 13 kind of size of power plants you can have.

Q Thank you. Can you please turn to what's been marked as Raser's Exhibit No. 2, and identify this for the examiner?

A This is the discharge -- originally, the discharge plan application for our permits that we submitted. It is an overview. In the first page, what it describes is the overall plan of having it. We originally estimated a 10 megawatt plant.

As we finished our first plant, we've now identified that we can actually get 11 megawatts of net production out of that plant. So the remainder of the plan talks about some of the

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chemicals, lubricants, other types of fluids that
 we'll store on-site for plant operation for
 geothermal operations.

What we will do, in order to store 4 5 those safely and according to regulations, and 6 exceeding regulations even, we're also -- we 7 discussed transfer and storage of some of the fluids and solids that come about from typical well 8 9 drilling and well fill operations, as well as chemicals that will be used in the plant, and 10 11 generally how we plan to deal with those.

Q Mr. Hayter, I believe there's more to this application than what we've presented here today; is that correct? We've just presented the main body of the application?

16 A That's correct. There's quite a bit more 17 data that supports what you see in this particular 18 application.

19 Q And the Division and all interested parties 20 have received copies of the full application, do 21 you know?

22 A They have received everything that we have 23 up until now.

24 Q What is the discharge plan proposed in 25 terms of the depth that you plan to inject into?

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A Well, we have requested a permit for a depth of 3,400 feet. As -- again, as we drill, we will determine whether it's 3,400 feet, or what level that ends up being.

5 Typically, what you will want to do is 6 inject into an acquifer that has the same or worse 7 quality of water. In other words, the TDS 8 measurement should be the same or worse so you're 9 not, again, contaminating an acquifer that has a 10 higher water quality. So that could change. It 11 could be shallower.

12

Q What is Exhibit No. 3?

13 A Exhibit No. 3 came about as we cooperated, 14 and have been working very closely, with the Oil 15 Conservation Division. There have been several 16 requests for additional information.

17 So as we have proceeded to work on 18 getting this permit, we've had some specific 19 questions asked of us of the OCD, and this is our 20 attempt at this point to answer all of those 21 questions and provide additional information.

22 Q And what follow-up information was asked 23 for and was included in this packet?

24 A Well, some of that's been mentioned. We've 25 had request, specifically, for regarding the

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evaporative ponds and pits, the type of lining that we would, for example, have. I think the requirement calls for a 40 millimeter lining, and we're actually exceeding that with a 60 millimeter lining. We discussed the design of the pits and how they'll be used.

Those pits, for example, will not be in constant use. They'll be in use during drilling, and in use in annual flow testing, and in emergency situations where a well may need to be -- or pipes may need to be drained, for example.

So any fluids, any geothermal fluids that are released into those ponds will be evaporated. They will not be discharged, they will not be disposed. Any contaminants or any solids left over will then be disposed of according to the appropriate regulations.

18 Q This packet includes the specifications for19 the proposed pond liners?

20

A That's correct.

Q This packet also includes information on the chemicals being used. Will Raser call an expert to talk about those specific chemicals from Nalco?

25

A Yes. We'll have Nalco here to talk about

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1 specific chemicals and their dilutions and particular fluids that we're --2 3 THE REPORTER: I can't hear you. 4 THE WITNESS: I'm sorry. The solutions 5 that will be injected. 6 (BY MS. MUNDS-DRY) I want to go back just 0 7 for a minute to follow-up a little bit on the 8 change in the location for the injection wells. 9 You mentioned that for two of the 10 wells, the locations changed because of a meeting 11 between AmeriCuluture and Raser; is that correct? 12 Α Yes. I'll take you back into late April, approximately the 29<sup>th</sup> or 30<sup>th</sup> of April. I contacted 13 14 Mr. Seawright in an attempt to have our first 15 meeting and discuss our plans, and open up a 16 dialogue about how to work together. So we met at 17 that time. 18 In May, we submitted our application to In June, I continued to make some 19 the OCD. 20 additional attempts to contact Mr. Seawright. 21 At that point, there was very little 22 contact. I don't know why. It was shortly 23 thereafter that the protest or the response from AmeriCuluture submitted to the OCD with regard to 24 25 our drilling operations and discharge plans came

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out.

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After following that, I, again, 2 3 contacted in July Mr. Seawright and suggested that 4 if there were differences, that we ought to put his 5 expert, Mr. Witcher, together with our expert, and come up with a solution that would work in an 6 attempt to, again, invite their input into our 7 8 project. We've been very open about that, both with AmeriCulture and with the agencies that we've 9 been involved with. 10

11 So that meeting, it took some time to 12 put that meeting together. It was finally 13 accepted, and Mr. Shomaker and Mr. Witcher met. I 14 was not present at that meeting. We felt it would 15 be best if we weren't there. On our side, we felt 16 it would be best to let the outside consultants 17 meet, and to come up with a solution.

Now, our goal, I think, is obvious. Our goal was to find a way to give AmeriCulture the opportunity to give input as to what they felt was best in our plan, and to try to accommodate as best we could whatever input was coming.

After that meeting, I had a report from Mr. Shomaker that one of the suggestions would be -- that would make this more palatable to

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everybody, would be to move injection wells between
 -- from the south to the north because there were
 complaints about water impairment issues.

4 So in attempt to try to alleviate water impairment, we moved the location of the wells and 5 6 submitted that just recently to the OCD. I would point out that is not our -- we're not interested 7 8 in creating more work for ourselves or the OCD or 9 anybody else. If the plan that we submit is 10 acceptable, we'll proceed. But at the same time, we're willing to make adjustments as necessary. 11

So that's what's behind what we were trying to -- it was our attempt to alleviate concerns of AmeriCulture.

Q Thank you. Let's turn to what's been marked as Exhibit No. 4. Is this the notice of publication that Los Lobos or Raser proposed to the Division?

19 Α Yes. This was published. I'm not sure 20 what paper. It was published in the paper. It was published in the local, regional newspaper. 21 We 22 also posted signs at the site, according to the 23 regulations. We took photos of those and sent 24 those to the OCD to verify that.

Q Were you present for Mr. Price's testimony?

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25

1 A This morning?

Q Yes.

A Yes.

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Q And you understand his concern about republishing notice to correct the location of the injection wells?

A Yes, I do understand the concern.

Q Is that acceptable to Raser?

9 A It is acceptable if, again, our intent is 10 to find well locations that will satisfy the 11 protestants. If they're satisfied with those well 12 locations, then we're satisfied with those 13 locations. But that's our intent. If moving them 14 back to the original location is satisfactory, then 15 we'll do that.

16 So we're ready to do what it takes to 17 both scientifically, and in a good neighborly way, 18 find a solution to this matter.

19 Q And you understand that the Division may 20 have an opinion about, also, where those wells 21 should be?

22 A Yes. Absolutely. We've made every attempt 23 to solicit the input from the OCD, from the State 24 Engineer. We've also involved Mr. D'Antonio, State 25 Engineer, appointed one of his hydrologist to also

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collaborate with our hydrologist and Mr. Witcher.

1

Again, that's what we're trying to do is find a solution that protects the water quality, and also allows us to proceed with the project.

Q Mr. Hayter, I'd like to switch gears now. Raser's proposal also includes this cooling water system which is part of the subject of this hearing today. Can you explain what that is, and why that's important to the power plant proposal?

10 Α Yes. I had a great slide for that, but 11 I'll talk you through that too. That doesn't seem 12 to be working for me. In a binary system, a binary plant, as you saw in an earlier discussion, in an 13 earlier slide, we pull hot water from a depth, we 14 15 run it into the plant, at which point it runs through a heat exchange. So some of that heat, the 16 fluids don't mix. 17

18 There's a secondary fluid called R245A, 19 it's inert, non-polluting proprietary refrigerant. 20 It boils at approximately 59 degrees Fahrenheit, so 21 when it comes into contact through the -- when the 22 heat is transferred through the copper tubing, it immediately flashes to a vapor. That vapor then 23 travels through a pipe into a turbine, you have 24 electricity. 25

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1 It continues into a condensing tube, 2 which is the top tube of the particular units, and 3 then we bring in -- to answer the question, we 4 bring in cold surface water into that tube, and it 5 condenses the working fluid, again, the 6 refrigerant, so that it can be recycled through the 7 process.

8 None of those three fluids come in 9 contact with each other, although we are proposing 10 to -- once we've recycled through some of that 11 cooling water, once it's cycled through several 12 times, it goes through an evaporative cooling 13 tower.

So that takes out the heat that it's 14 15 pulled out of condensing fluid, but it evaporates, and then you have a higher solution of a higher TDS 16 or salinity in the water that develops over time. 17 18 So after a few cycles of running through that, you have to do something with that 19 water, and we're proposing that it will be a lower 20 21 TDS than the geothermal production fluid will be, and we'll mix it into a solution with the 22 geothermal fluid and re-inject that, still 23 protecting the water quality. 24

25

Q How will this system be monitored?

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A There will be a system provided by Nalco that will be constantly in real-time monitoring the chemical attributes of the make-up water, the cooling water, the blow-down water.

5 We'll also monitor the water quality at 6 each of the injection wells, and we'll be 7 monitoring constantly the water quality at the 8 particular monitoring wells that we've proposed.

9 Q You mentioned -- this in Exhibit No. 3, I 10 believe, that the plant will be -- as designed, 11 will be using evaporation ponds. What purpose will 12 those ponds serve? At what point will you use 13 them, if, at all?

A We'll use them -- initially, we'll use them during the drilling phase because as you drill a well, fluids -- you'll draw fluids out and perform flow tests, and you'll have to dispose of the water into those evaporative ponds.

19 So they'll be used during the drilling 20 phase, during operational phases. They may be used 21 in an emergency situation where something might 22 need to be shut down and the pipes drained. 23 Occasionally, a well might need to be tested, taken 24 off line from the system and tested, and will flow 25 into that.

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Of course, as I mentioned, we'll 1 2 evaporate the fluids and then deal with any solids 3 that are left. And will Raser continue to work with the 4 0 5 OCD to provide them all the additional information 6 or data that they request or require? 7 Yes, it is our intent to work with the OCD А 8 constantly. 9 In your opinion, will this application be 0 protective of ground water? 10 Absolutely. 11 А Will it be protective of surface water? 12 0 13 А Yes. In your opinion, does the proposal comply 14 0 with the WOCC ground water standards? 15 16 Α It does. 17 Were Exhibit 1 through 4 prepared by you or 0 18 compiled under your direct supervision? 19 Yes, they were. А MS. MUNDS-DRY: Mr. Brooks, at this time 20 we move the admission of Exhibits 1 through 4 into 21 22 evidence. HEARING EXAMINER: Is there any 23 objection? 24 25 MS. ALTOMARE: No objection.

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HEARING EXAMINER: Any objection, Mr. 1 2 Seawright, to the exhibits? 3 MR. SEAWRIGHT: No. HEARING EXAMINER: Exhibits 1 through 4, 4 5 Applicant's Exhibits 1 through 4 will be admitted. 6 MS. MUNDS-DRY: Mr. Brooks, that concludes my direct-examination of Mr. Hayter. 7 8 HEARING EXAMINER: Very well. Ms. Altomare. 9 10 MS. ALTOMARE: I just have a few 11 questions. 12 CROSS EXAMINATION BY MS. ALTOMARE I'm sorry about the technical difficulty. 13 0 I'm sure you worked very hard on your presentation. 14 15 I'm going to jump around a little bit. I have a 16 couple of random questions. 17 You talked a little bit about changing locations. You mentioned that you didn't attend 18 19 that meeting. To your knowledge, was that just Mr. 20 Shomaker and Mr. Witcher that attended that 21 meeting? 22 А To the best of my knowledge, that's what was reported to me by Mr. Shomaker. 23 24 And then he met with you after the fact to 0 discuss what was spoken about? 25

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A We had a telephone conversation. Q And then his recommendations were that the wells be moved to the present locations as designated on the map in Exhibit 1?

5

A Yes.

Q Who all was in on the discussion that ultimately made the decision to make the well change locations, well location changes?

Well, we acted on advice from Shomaker & 9 Α 10 Associates, and together with myself and with our 11 permitting consultant, Mr. Jay Hamilton, Hamilton 12 Engineers, and our site manager as well as our 13 engineering construction manager, operations manager, his name is Jim Roser (Phonetically). 14 Ιt was made by several of us. 15

Q Okay. Just to clarify, you indicated that there was a error on the map that the monitoring well located closest to the AmeriCulture site, as indicated on the map, appears to be on State land, but that it's your understanding that it is supposed to also be on that Federal lease?

22 A Yeah. Our intent is not to place any wells 23 on State land, or any surface area that is not, I 24 guess, underneath or is not on our particular 25 Federal lease.

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1 Q Okay. So the basis for not going on State 2 land is because you want to stay on the Federal 3 lease?

4 A We have no rights on State land, so we're 5 staying within our rights.

Q What if the OCD were to require that you
move any kind of a monitoring well onto State land?
8 Would you be willing to work with the OCD --

9 A Yes.

10 Q -- to do that? Okay. Could I ask that you 11 submit an updated map with the correct proposed 12 location as soon as possible so that we have 13 correct, current data?

14

A Yes, we'll do that.

15 You indicated that it's your understanding 0 that once the general overall permitting package is 16 approved, and you move forward with your lender and 17 the project is moving, that with each new hole 18 that's drilled, more information is acquired. You 19 understand that that information is also important 20 to the OCD, and with that information may come 21 additional conditions that the OCD is going to 22 impose on Raser? 23

A Yes, it's our plan and our intent to submit that information to the OCD and any other agency

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that either has interest or jurisdiction.

2 Q And that those conditions could include 3 initial monitoring plans, casing-type things and 4 those kinds of things?

5 Α Yes. If I may add, part of the reason that 6 our plans are somewhat generic is that there is not enough information yet to make them more specific. 7 8 So it's our intent, as we go along in drilling more development in exploration, to be able to share 9 10 that information and have a more specific plan for 11 that.

Q Has Raser considered doing an exploratory
-- beginning with an exploratory drilling now, and
then applying for the permit?

15 A We have considered that. In fact, we have 16 moved forward with exploratory permits from both 17 the OCD and from the State Engineer.

Q Is there a reason that Raser is pursuing the full package of the discharge plan and everything all at once now prior to --

A Yes, commercial reason. We put at risk a considerable amount of money of our own funds if we aren't financed. So if we can -- to the degree that we can finance a project, we can get the permitting completed and have as much engineering

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and other aspects of the project completed and
 receive that financing, then it's an economically
 -- financially it's better for us and for our
 shareholders.

5 Q Okay. So that ties into what you were 6 describing as far as getting the permitting package 7 approved to get the financing to move forward and 8 then develop the project from there?

9 А Yes. There's also a time line associated 10 with this. It has a significant impact on this project. Until recently, we weren't sure that this 11 was going to be included, but the production tax 12 credit available by the Federal government applies 13 14 to renewable -- various renewable resources, and 15 geothermal is one of those.

So these production tax credits can be monetized or packaged and sold to another entity which can actually use those. That brings considerable amount of capital to a project. These are very capital intensive, up-front projects.

So, now, it's been extended for two years. It's been extended through 2010. Though we are pushing a rapid-development approach, there are many things that can potentially come up, such as delays in permitting, for example, and other types

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of issues.

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So we have a limited time line in which 2 3 to try to take advantage of these Federal credits so they are available to us, and use those in 4 5 capitalizing a project. So that's another reason for trying to press for a full permitting package. 6 MS. ALTOMARE: That's all we have for 7 this witness. Pass the witness. 8 9 HEARING EXAMINER: Very good. 10 Mr. Seawright. 11 CROSS EXAMINATION BY MR. SEAWRIGHT 12 Mr. Hayter, for the record, would you 0 restate your title with Raser? 13 14 А Director of Geothermal Development. As Director of Geothermal Development, 15 0 16 based on your title --17 THE REPORTER: I'm sorry. I can't hear vou. Just a little louder. 18 MR. SEAWRIGHT: I'll restate it. 19 20 Based on your title, and also your 0 familiarity with binary-site power generation 21 22 technology you described, are you qualified to speak with regard to -- in general terms, regarding 23 24 the technology you intend to utilize in this project? 25

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1 А Yes. Isn't it a fact, Mr. Hayter, that 2 0 3 alternative technologies exist for cooling the UTC power generation units other than cooling towers? 4 5 I'm not aware of others. Α Are you aware of the Air Cool Technology 6 0 for cooling working fluids associated with power --7 I'm not aware of an Air Cool UTC 8 А 9 application, no. 10 Are you aware of the use of air cooling for Q binary power generation? 11 Yes, I am. 12 А Isn't it a fact that if cooling towers were 13 0 14 not used at the proposed site, that air cooling would be a likely alternative? 15 No, I would disagree. It would not be 16 А likely because the economics make it unlikely. 17 You 18 take a significant derate for air cooling up to 50 percent. In other words, during the hot summer 19 months, you are only producing 50 percent of your 20 21 -- at best, of your power that's committed to a 22 particular customer. Now, we have made commitments to SRP in 23 Phoenix, Arizona, that we will deliver a certain 24 amount of power based on certain technology we are 25

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1 applying. So, no, another technology is not available to us in this situation. 2 3 You're not suggesting that it's okay to 0 potentially contaminate ground water for the sake 4 of profit, are you? 5 6 Α No, I'm not suggesting that. MS. MUNDS-DRY: Objection, Mr. Examiner. 7 8 HEARING EXAMINER: That's argumentative. Yes, I'll sustain the objection. You may continue. 9 10 0 (BY MR. SEAWRIGHT) Well, alternative 11 technologies do exist. Are you familiar that Ormat 12 International was interested in power generation at 13 the same location that you are now interested in? 14 А I'm aware that they looked at the resource 15 at one point. 16 0 Are you aware that they were quite 17 convinced that air cooling was the logical choice 18 for them given ground water conflicts? 19 А I'm aware that they have an air-cooled 20 technology. In their self-serving interest, they 21 would propose an air-cooled technology. 22 Q Were you aware that they regarded that technology to be a profitable utilization of the 23 technology? 24 I don't see how that -- I don't understand 25 А

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1 how it's relevant. Can you explain that to me? HEARING EXAMINER: Well, actually, Mr. 2 Seawright is asking the questions now so --3 THE WITNESS: I don't understand his 4 question. 5 HEARING EXAMINER: Okay. Very good. 6 7 0 (BY MR. SEAWRIGHT) I reference a document 8 acquired by AmeriCulture through the Freedom of Information Act entitled "Preliminary evaluation of 9 10 pumping effects, Lightning project, " by John 11 Shomaker & Associates, a hydrogeological consultant In that document, John lists the likely 12 of vours. impairment of AmeriCulture's water wells as 13 indicated by projected drawdowns in those wells. 14 15 Isn't it true, Mr. Hayter, that the

16 projected drawdowns, if realized, would demonstrate 17 hydraulic connection between your production wells 18 and AmeriCulture's?

A The drawdown is not --

19

20 MS. MUNDS-DRY: Mr. Examiner is --21 HEARING EXAMINER: Ms. Munds-Dry. 22 MS. MUNDS-DRY: Mr. Brooks, I have 23 several objections. Number one, I think we're 24 straying into issues that are not the subject of 25 today's application.

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Number two, if Mr. Seawright is going 1 2 to refer to a document, I would like for my witness 3 to have the advantage of being able to look at that 4 document. 5 MR. SEAWRIGHT: I can provide it. 6 HEARING EXAMINER: Would you restate the 7 question, please, because I don't remember exactly what you're asking? 8 9 MR. SEAWRIGHT: It was a document entitled "Preliminary evaluation of pumping 10 effects, Lightning project" by Raser's 11 hydrogeologic consultant, and I have it in my 12 possession. 13 14 HEARING EXAMINER: What did you ask him? 15 MR. SEAWRIGHT: My question was: In that document, John Shomaker indicates that there will 16 17 be a likely impairment manifested in the form of reduced water level in AmeriCulture's production 18 wells. 19 20 My question is quite simple. Isn't it true that -- doesn't that project a drawdown 21 22 demonstrated that our wells are in hydraulic connection with one another? 23 24 HEARING EXAMINER: Okay. You have a copy of that document present? 25

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1 MR. SEAWRIGHT: I do. 2 HEARING EXAMINER: You may show him the 3 I will overrule the objection as to document. 4 relevance because as Mr. Seawright has refined the 5 question, it does appear to implicate the concerns at issue in this case. 6 7 MR. SEAWRIGHT: May I present it to him? 8 HEARING EXAMINER: You may. Looks like, apparently, an extensive document. Mr. Hayter may 9 10 require to --11 MR. SEAWRIGHT: It's about six pages 12 There's a table in there that shows long. drawdowns that are predicted by their consultant on 13 14 our water wells, AmeriCulture's various water wells. 15 16 THE WITNESS: Can you restate your question? 17 18 (BY MR. SEAWRIGHT) Yes. Isn't it true that 0 19 the projected drawdowns, if realized, would 20 demonstrate hydraulic connection between your production wells and AmeriCulture's production 21 22 wells? I think that there is some speculation that 23 А 24 there could be some effect on your wells, which was 25 the reason for having Mr. Shomaker meet with Mr.

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Witcher to discuss alternative solutions,
 locations for injection wells, for example, and
 other options that would make any kind of
 potential, in fact. I don't think that there is
 any proven fact here.

6 I think that there's a potential 7 discussed, and that is the reason for those 8 meetings to try to elicit from yourself and from 9 Mr. Witcher, ideas as to how we can proceed with a 10 project still mitigating any kind of potential 11 impairment that might occur with your wells. 12 Which, by the way, again, I'm under the 13 understanding is not the relevant point of this particular hearing. 14

Secondly, which you have demonstrated a
lack of, I would say, interest in terms of working
together to try to find a solution.

18 MR. SEAWRIGHT: Mr. Examiner, my line of 19 questioning is directly related to your water 20 quality question, but it does require a progression 21 of three questions.

HEARING EXAMINER: We need to remember to keep our voices up. I believe the answer was not entirely responsive.

25 What I understood the question to be,

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1 on the basis of which I overruled Ms. Munds-Dry's 2 objection was -- the question would be: Does not the evidence of drawdown, which Mr. Seawright 3 represented to me contained in that document, 4 5 indicate that there exists under logical 6 communication between your formation, and the formation from which the wells -- Mr. Seawright's 7 8 wells are drawn? That's my understanding of the question. 9

10 THE WITNESS: Well, I think that there 11 is evidence that there may be communication between 12 the wells. There could be. The wells don't exist, 13 so --

HEARING EXAMINER: Very good. That's aresponsive answer.

You may continue, Mr. Seawright.
 MR. SEAWRIGHT: Thank you, Mr. Examiner.
 Q In your proposed production injection
 program, does it not assume hydraulic connection
 between your production wells and your injection
 wells?

A I, personally, think we're getting into a level of questioning that would be more appropriate to have Mr. Roger Peery answer those questions when he's available for testimony, and for your cross-

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examination. He represents Shomaker, and is well
 aware of the hydrological issues.

I am not a hydrologist. I'm not representing myself as such. I think early on you asked if I was qualified to generally speak about these things, and I think that I am. But I think that we're getting to a level of specifics.

Q Okay. I'll try to be more specific. In a
document entitled --

HEARING EXAMINER: Once again, I will
 admonish both counsel, and the witness, to keep
 your voices up. We are having trouble hearing you.
 THE WITNESS: I'm sorry.
 HEARING EXAMINER: Go ahead.

(BY MR. SEAWRIGHT) For point of 15 0 clarification, in a document entitled, "Discharge 16 plan application brine extractions," this is simply 17 18 part of the application materials submitted with the OCD, page 18, on file with the OCD, Raser 19 20 states: "The geothermal fluid and injection fluid 21 are one in the same. This is a closed loop system." 22

23 So I'm simply asking, based on that 24 explicit language, isn't it true that Raser 25 maintains that the proposed production and

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1 injection wells are in hydraulic connection with 2 one another?

MS. MUNDS-DRY: Mr. Examiner, again, I'm going to object. Mr. Hayter has already clarified he's not a hydrogeologist. We do plan to call a hydrogeologist, and I would suggest to you that those questions could be better answered by our expert in those hydrogeology issues.

9 HEARING EXAMINER: Yes, that would seem
10 to be an accurate observation, under the
11 circumstances. In order to move this hearing along
12 more efficiently, I'm going to sustain the
13 objection.

Q (BY MR. SEAWRIGHT) Mr. Hayter, is there a representative, officer, employee of GeothermEx in attendance of this hearing?

17

A No, there's not.

18 You mentioned in your testimony that you 0 19 have pursued exploratory well permits with the Oil Conservation Division and the State Engineer. 20 21 Which injection locations are mentioned in those prospective injection well applications? 22 23 Exploratory well applications. I'm sorry. I am not sure. I have not seen the actual 24 Α

24 A lam not sure. I have not seen the actual 25 applications for those as it's been handled by our

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permitting consultant.

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2 MR. SEAWRIGHT: One last question. 3 HEARING EXAMINER: Go ahead. (BY MR. SEAWRIGHT) Since alternative 4 0 technologies to cooling towers do exist, is it 5 6 necessary to use cooling towers? 7 In this application it is necessary. We А 8 deem it necessary both technically, and financially 9 that we use water cooling. The economics for using 10 water cooling versus air cooling are very much deeply in favor of using water cooling. 11 We get a higher efficiency, we have 12 committed to our customer to provide a specific 13 14 amount of power. It would not be possible with the 15 air cooling during the summer months. 16 So I would suggest that it is not 17 possible to use air cooling in this particular application. It is a more efficient application to 18 19 use the cold water. We get a better Delta-T, and, 20 therefore, a better efficiency in use of the 21 geothermal energy. 22 MR. SEAWRIGHT: Given the extensive answer, I ask for one more question. 23 24 HEARING EXAMINER: Go ahead. 25 (BY MR. SEAWRIGHT) So based on what you 0

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just answered, the choice of the technology, 1 2 cooling towers as opposed to alternatives such as air cooling, is primarily a financial decision? 3 4 MS. MUNDS-DRY: Objection. We are 5 getting, again, into an argumentative area where 6 we've already covered it. 7 HEARING EXAMINER: Overruled. 8 You may answer the question. 9 THE WITNESS: Will you repeat the question? 10 11 0 (BY MR. SEAWRIGHT) Yes. You've stated that you intend to use the cooling tower technology 12 instead of an alternative such as air cooling 13 14 technology. Based on that testimony, is it true

15 that your decision to use cooling-tower technology 16 over technically valid alternatives, primarily 17 financial?

A No, it is not primarily financial. I think financial is a very important part of that, but it is also a technical decision. We get a better transfer of electricity of heat to recreate the electricity by using a water-cooled solution.

Q Technically speaking, would the use of an air-cooling tower -- air cooling still work? A Well, I think there's a point when you're

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looking at a commercial venture where there is a
 financial consideration, it's not the only
 consideration.

4 Q So, technically, air cooling is an 5 alternative, "yes" or "no"?

А Oh, yes. I've mentioned that there exists 6 air-cooling technology out there. We've selected 7 this particular technology because we feel it works 8 better for our particular business model. 9 It works better for our particular application, and it works 10 better for the customers who are signing up for 11 very long commitments, and very high expectations 12 13 in terms of what they're receiving.

Q Your commitments to the Salt River Project aside, isn't it a fact that air cooling would work in your application --

17

A No, we could not deliver --

18

Q -- from a standpoint --

19 А We could not deliver to -- you can't 20 separate the two. We're not working in a vacuum We could not deliver the solution to SRP 21 here. with an air-cooled solution at this point with the 22 same economics, and with the same expectations. 23 We would have to oversize the plant by almost double 24 in order to deliver on the commitment that we have 25

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1 to SRP. That makes absolutely no sense. 2 HEARING EXAMINER: I would admonish the 3 witness to allow counsel to complete a question 4 before beginning an answer. 5 THE WITNESS: Okay. HEARING EXAMINER: So we don't have 6 7 people talking over one another. 8 Do you have more questions? 9 (BY MR. SEAWRIGHT) Mr. Hayter, your 0 decision to enter into a power purchase agreement 10 with the Salt River Project before establishing the 11 12 permitted ability to using cooling towers, is not at issue here today. 13 What is at issue is the protection of 14 15 New Mexico ground water, animals, plants, and human beings that rely on that for their sustenance. 16 17 HEARING EXAMINER: Do you have a 18 question, or are you just making an argument? 19 (BY MR. SEAWRIGHT) So returning to my 0 It is technically valid, is it not, to 20 question. 21 utilize air cooling irrespective of your commitments with the Salt River Project on a power 22 purchase agreement and the economics therein? 23 In the economics therein it is not 24 А NO. feasible. 25

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1	Q Removing the Salt River Project. In your		
2	commitment to them for consideration, which is not		
3	in consideration in this hearing, is the use of air		
4	cooling technically viable, and I'm not asking if		
5	it's financially viable?		
6	MS. MUNDS-DRY: Asked and answered, Mr.		
7	Hearing Examiner.		
8	HEARING EXAMINER: I'm sorry?		
9	MS. MUNDS-DRY: Objection. This is		
10	asked and answered.		
11	HEARING EXAMINER: I believe it has		
12	been. I'll sustain the objection.		
13	Anything further, Mr. Seawright?		
14	MR. SEAWRIGHT: No.		
15	HEARING EXAMINER: Very good. We will		
16	stand in recess until 1:30.		
17	(Lunch recess.)		
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1	MONDAY, DECEMBER 1, 2008, 1:30 P.M.		
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3	HEARING EXAMINER: The hearing will come		
4	to order.		
5	MS. MUNDS-DRY: Mr. Brooks, I seem to be		
6	missing a witness.		
7	HEARING EXAMINER: Oh, we're missing a		
8	witness. I didn't even notice.		
9	MS. MUNDS-DRY: Oh, he's here. Sorry.		
10	He was sitting right there.		
11	HEARING EXAMINER: Let's see. Has all		
12	counsel questioned this witness?		
13	MS. MUNDS-DRY: I did have a few		
14	redirect questions, Mr. Brooks.		
15	HEARING EXAMINER: Okay. Normally, I		
16	ask my questions before we go to redirect, but I		
17	don't believe I have any for this witness, so I		
18	will let you proceed.		
19	MS. MUNDS-DRY: Thank you, Mr. Brooks.		
20	REDIRECT EXAMINATION BY MS. MUNDS-DRY		
21	Q Mr. Hayter, why has Raser proposed to use		
22	the units in its applications, the cooling tower?		
23	A Why do we propose that?		
24	Q Yes.		
25	A We propose that primarily, again, because		

there is a better efficiency to be gained from
 using cooling water in a binary cycle, organic
 cycle, to condense the working fluid.

One of the advantages as well, in terms of geothermal development both here and in most locations, is that you can generate electricity from lower temperature resources by using water cooling, that you could not do with air cooling.

9 So that enables -- that's one of the 10 reasons that we're able to generate electricity 11 from lower temperature resources, as low as 200 degrees, according to UTC. They do have one 12 13 example of generating electricity as low as 165 14 degrees Fahrenheit in Chena, Alaska, and that's 15 achieved, again, because of the fact that they have very cold cooling waters. They have a larger 16 Delta-T between the hot water and the condensing 17 18 fluids.

19 That is not possible here in this 20 particular situation, but we can generate lower 21 temperature resources. We can also get more of a 22 bottom-cycle efficiency out of that. So we believe 23 that there's enough temperature in the binary cycle 24 to then run it through a second set of UTC machines 25 with, again, cooling water efficiencies to generate

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a net of probably a total of 16 megawatts or so,
 16, 17 megawatts.

3 What does Raser estimate the temperature of 0 4 the water for the producing formation --5 THE REPORTER: "The water" what? MS. MUNDS-DRY: I don't know what I 6 7 asked. Let me start again. What does Raser estimate the temperature 8 0 9 for water will be produced? 10 Α We are estimating a temperature of approximately 280 degrees. There have been 11 12 measured temperatures at a depth as high as 325, but we believe we'll be more in the range of 280, 13 14 maybe 300 degrees. Will a geothermal project using air cooling 15 0 be commercially viable? 16 In this situation, it would not be 17 А commercially viable because of the expense for 18 building this particular project. We have a thin 19 margin of profitability in this project. 20 21 We are a public company. We do have shareholders, and we do need to act in the best 22 interest. We have fiduciary responsibilities. We 23 try to have profitable projects, and water-cooled 24 projects and this situation is the best approach. 25

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1 Q Is it possible to do air cooling with UTC 2 units?

3 А At this point, it is not possible. Mr. Seawright mentioned the proposal by 4 0 5 What happened with that proposal? Ormat. Did Ormat ever follow through with that proposal? 6 7 Α To my knowledge, Ormat did not follow through with that proposal. They did not acquire 8 9 the resource, and did not proceed with development. 10 MS. MUNDS-DRY: Thank you. That's all 11 the questions I have, Mr. Hearing Examiner. 12 HEARING EXAMINER: Thank you. MR. SEAWRIGHT: I have additional 13 14 questions. 15 HEARING EXAMINER: Okay. You may do 16 recross limited to the subject that Ms. Munds-Dry 17 went into on redirect. 18 RECROSS EXAMINATION BY MR. SEAWRIGHT 19 Q You stated just now at this time that it's 20 not possible to --HEARING EXAMINER: Louder, please. 21 22 (BY MR. SEAWRIGHT) You stated that at this Q time it is not possible to use air cooling for UTC 23 units: is that correct? 24 25 Α That's correct.

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1 Q Are you familiar with a PureCycle 200 2 System that is commercially sold through the same 3 company, United Technologies, that you purchased 4 your units from which is, in fact, an air-cooling 5 system?

A It is not being used in any commercial geothermal power production anywhere in the world that I'm aware of.

9 Q But you're aware of the existence --10 A No, I'm actually not aware of a 200 11 kilowatt unit. Is that what you said? I'm sorry. 12 PureCycle 200?

13 Q Yes.

No, I'm not familiar with the 200. It's 14 А not something that they have marketed to us. It's 15 not something that we have partnered with on them, 16 17 or with them on, and has not been the direction that the company has taken in terms of where 18 they're going with their geothermal binary-cycle 19 power generation units. 20

Q I find that interesting because just a couple of days ago I pulled off considerable information off the UTC website regarding the PureCycle Technology which involves air cooling just in the last few days.

1 MS. MUNDS-DRY: Mr. Brooks, is there a 2 question? 3 Q (BY MR. SEAWRIGHT) Were you aware of that? 4 HEARING EXAMINER: I'm sorry? 5 0 (BY MR. SEAWRIGHT) Were you aware -- are vou aware of the considerable information on the 6 7 PureCycle air cooler --8 Well, recently I met with --А 9 HEARING EXAMINER: Please let him finish 10 the question. 11 THE WITNESS: I'm sorry. I thought he had finished. 12 13 HEARING EXAMINER: Go ahead. Repeat 14 your question, please. 15 (BY MR. SEAWRIGHT) Are you aware of 0 considerable information available on Value 16 Technologies website referring to the PureCycle 200 17 18 System which involves air cooling in combination with binary-cycle power generation? 19 20 I'm not aware of any of those PureCycle А 21 200's in a commercial geothermal power plant 22 arrangement. I met with John Fox just two weeks ago, and we discussed air cooling as a future 23 opportunity. Mr. Fox is the general manager of the 24 UTC PureCycle unit. 25

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1 MR. SEAWRIGHT: I have to object, Mr. Examiner. Would you please request of the witness 2 3 to answer the question that I asked, and not 4 another question that he might have in his mind. 5 HEARING EXAMINER: Well, I believe the 6 question was: Are you aware of the information 7 that's on the website? 8 THE WITNESS: No. And I've answered 9 already that I'm not aware of that. I'm not aware 10 of a 200 -- a PureCycle 200, nor am I aware of any 11 applications for geothermal -- commercial 12 geothermal power development with the PureCycle 13 200. 14 HEARING EXAMINER: You may continue. 15 MR. SEAWRIGHT: We will make that 16 information available as Exhibit 29 during the presentation of Jim Witcher, which is our direct 17 witness. We'll show a picture of that. 18 19 HEARING EXAMINER: Very good. Do you 20 have additional questions for this witness? 21 MR. SEAWRIGHT: No. 22 HEARING EXAMINER: Very good. The 23 witness may stand down, and you may call your next 24 witness, Ms. Munds-Dry. MS. MUNDS-DRY: We would like to call 25

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1	Roger Peery.		
2	ROGER PEERY,		
3	(Having been first duly		
4	sworn, testified as follows:)		
5	DIRECT EXAMINATION BY MS. MUNDS-DRY		
6	Q Would you please state your name fo	or the	
7	record?		
8	A My name is Roger Lee Peery.		
9	Q Where do you reside, Mr. Peery?		
10	A Albuquerque, New Mexico.		
11	Q By whom are you employed?		
12	A John Shomaker & Associates, Inc.		
13	Q What is your position with Shomaker	. &	
14	Associates?		
15	A I'm at administrative standpoint.	My	
16	position is CEO of the company. From a tec	nnical	
17	standpoint, I'm a senior hydrogeologist.		
18	Q What is your relationship to Raser		
19	Technologies?		
20	A Our company works as a hydrogeologi	.C	
21	consulting firm for Raser.		
22	Q Have you previously testified befor	e the	
23	Division?		
24	A No, I have not.		
25	Q Would you please provide the examin	er with	
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a brief summary of your education and work
 background?

3 А I earned my bachelor in science in geology 4 in 1987 from the University of New Mexico. 5 Subsequently earned a masters in water resources in 1992, also, from the University of New Mexico. 6 I've been working for John Shomaker & 7 Associates for over 20 years, and my work consists 8 9 of water resource evaluations, well siting studies, development of well drilling specifications, 10 oversight during well drilling testing, completion, 11 that sort of thing. 12 13 I've been involved with large capacity water supply wells, injection wells, monitoring 14 wells for various types of contaminates, both with 15 describing how they should be installed, and the 16 sampling of those wells. 17 Have you made a hydrogeologic study of the 18 Q 19 area that is the subject of this application? I reviewed available data as part of my 20 А 21 analysis, the hydrogeology of the area. MS. MUNDS-DRY: Mr. Examiner, we would 22 tender Mr. Peery as an expert in hydrogeology. 23 HEARING EXAMINER: Any objection? 24 25 MS. ALTOMARE: No objection.

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MR. SEAWRIGHT: No objection. 1 2 HEARING EXAMINER: He is so qualified. 3 MS. MUNDS-DRY: Thank you. Mr. Peery, I believe you have a power-point 4 0 up on the screen, and I'd ask you to also look at 5 -- I believe you have a hard copy there of what 6 we've marked as Exhibit No. 5. 7 8 Is that what you have up there on the screen there? 9 10 Α That's correct. 11 0 Would you please identify and review this for the examiner? 12 Α This is a very generalized geologic map of 13 14 the area that we've been talking about today. The source of this, and some of the other maps I'll be 15 showing, are from Cunniff and Bowers 2005, from a 16 report titled "Final technical report, geothermal 17 resource evaluation and definition program. 18 Phases 1, 2 and 3, Animas Valley, New Mexico, geothermal 19 resource prepared for the Department of Energy." 20 If we look at this map, it really 21 oversimplifies what's going on from a geologic 22 23 standpoint. The star represents the geothermal 24 area that we've been talking about today. To the right, or the east side of this map, you see the 25

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Pyramid Mountains down in the Animas Valley on that
 side, and on the west side, you have the Peloncillo
 Mountains.

The geology, it's very complicated out here. We have quaternary-age sentiments, we have tertiary volcanics, lots of folding cretaceous-age rocks and older Paleozoic, Mesozoic-aged rocks. I'll get into that a little bit more as we go through this.

Q Great. Let's then turn to Exhibit No. 6,
and tell the examiner what this shows us?

12 A Exhibit No. 6 is an aerial photo showing 13 some of the features at the Lightning Dock 14 geothermal area. The heavy red boundaries is the 15 extent of the Raser Tech lease.

Towards the right or the east side of this figure you can see the right central would be where the Rosette-Burgett greenhouses are.

Towards the upper right where there's a series of wells, that's where the tilapia farm or AmeriCuluture property is located. It looks like we're a little out of focus here as well. That's about as good as we're going to get.

This area is where the proposed power plant will be, and evaporation ponds in red are

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right here. This also shows the location of some 1 2 of the existing wells in the area. The wells I'll 3 be talking about are wells 55-07, which is located 4 up here. I'm sorry. It's right here. At 52-07 is 5 the deep well that was done as part of the Bowers and Cunniff work that I'll be describing. 6 This 7 well, also, in the red symbols, shows some of the 8 AmeriCulture wells.

9 We also have in green triangles the 10 injection wells that are proposed, currently proposed. One down here in the southern part,  $4^{2-18}$ 11 another one up by the AmeriCulture wells up in the 12 north end of the map, and another injection well 13 towards the more central portion of the map. We 14 15 also have the proposed pumping wells on here which have the rectangular shape around them, and there 16 are five of those. 17

Also, this map shows three monitoring wells, which would be used to monitor the ground water at various intervals, and those are located here.

That would be the proposed monitoring well 3, which is right near the evaporation ponds, monitoring 2, up in the northeast corner of the map.

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Also, this map has a similar problem as 1 2 the one that Mr. Hayter talked about where we're 3 right near the State land, so this is a well that 4 we want in this area somewhere, but the boundary is right there. So it kind of looks like it's pushing 5 6 over towards the State land, and the last one towards the north central portion of the image that 7 8 we're looking at.

9 Q Great. Let's then turn now to what's been 10 marked as Exhibit No. 7 and review this for the 11 examiner.

A Well, what I'd like to do as part of my explanation of this map, is talk about the work that Cunniff and Bowers did. As described earlier today, there's been a significant amount of work performed in this area related to the geothermal resources.

18 Cunniff and Bowers performed a significant amount of site-specific work starting 19 This work, in addition to -- it might 20 in 2001. 21 have been previously listed by other authors, 22 includes gravity survey of the area focused on the geothermal resource. It also included two lines of 23 24 resistivity surveys which were performed, basically, above -- if I can go back to the 25

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previous exhibit, Exhibit 6. The lines were performed, basically, in an east-west direction, north and south of the area of concern, and the greenhouse area there. Those lines were 1.2 to 1.3 miles long.

6 They also performed a very detailed 7 areomagnetic survey, during which time 209 flight 8 lines were flown. As I recall, it was over 2,000 9 kilometers total length. What that study also 10 focused on the geothermal area in section 7, 11 primarily.

12 Four temperature-gradient wells were also completed in 2003 to further identify the 13 geologic structures at this site. Those wells were 14 15 completed to depths ranging from 1,000 to about 1,200 feet deep. Near the facility of one of them, 16 right near the proposed facility to the east, one 17 to the west, another one about half mile north, and 18 19 another one, yet, three quarters of a mile, maybe 20 more to the southwest of the location.

In addition to that, they performed or completed a deep test well. This test well was the one I mentioned that was well 52-05, which is right up here. That well was initially drilled to a depth of 2,220 feet. They put in 470 feet of

1 surface casing, and submitted that in before drilling down to the 2,000-foot mark. They logged 2 3 the cuttings, and they also performed an airlift pumping test on this well. During which time they 4 airlifted water from the well at a rate of about 5 6 325 gallons per minute, and tried to get drawdown 7 and recovery data on that, as well as temperature 8 data of the water.

9 The water produced during that period 10 of time had temperatures ranging from 260, with the 11 peak of about 274 degrees when they were airlifting 12 water. The test went for 23 hours.

During this time, they tried to monitor nearby wells to see if there was any drawdown impacts on there, but the nearest wells that they monitored were something on the 1,300 feet or more away, so they didn't see any impacts on the water levels, but there were other wells pumping at the time.

They were able to determine a specific capacity of a well which gives the production of a well in terms of gallons per minute, per foot. While they were airlifting water from the well, the formation was making 2.7 gallons per minute for every foot of water level decline in the well.

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Because it was such a slim hole, it was nominally a six-inch diameter hole they were airlifting from, they, Cunniff and Bowers, went ahead and calculated the effects of friction loss by airlifting that water out, how that would have affected the specific capacity.

7 Ultimately, they calculated a specific 8 capacity of a little over 22 gallons per minute, 9 per foot, if you were able to negate the effects of 10 friction loss from the hole. So it's a pretty good 11 producing well.

12 They also were able to collect some water quality samples from the open bore hole 13 during this time. The air line was set -- the air 14 15 line lifted the blue air into the hole, and lifted 16 the water up, was set about 700 feet. So the water quality that they have, represents just everything 17 from the production and flow. It was open from 470 18 52-15 to the total depth of the hole. 19 20 The total dissolved solids content of the water was around 1,000 to 1,100 milligrams per 21 liter. Ultimately, this hole was deepened to a 22 depth of a little over 2,500 feet. Surface casing 23 24 was set down to a depth of around 2,200 feet, and they drilled to the total depth of a little over 25

2,500 feet.

1

At that time, they went ahead and also got a water quality sample from the well, and the total dissolved solids content was something over -- just a little bit over 1,500 milligrams per liter. So they were able to get quite a bit of good data in there.

8 Subsequent to that series of studies in 9 2003, in 2004, Cunniff and Bowers also did some additional seismic work out there to further 10 identify structures. Their seismic line went, 11 12 again, along -- sort of along where the production 13 wells are located up here, more or less, in an 14 east-west direction. They also ran another seismic 15 line in a diagonal fashion, more or less, from well 13-07, the proposed pumping well, southeast towards 16 17 the southwestern part of the greenhouse.

In short, there was a significant amount of additional work that's been performed out here in the last several years. As a result of that work, Cunniff and Bowers had developed a new conceptual model of the structures that are present at the site, and in the hydrogeologic setting. Q Is that what is shown here on Exhibit No.

25

7?

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This is part of their interpretation. 1 А Yes. 2 Some previous authors, Mr. Witcher, for example, has identified a structure in his 2008 report 3 that's in the New Mexico Geologic Society Guidebook 4 that actually goes from the northwest to the 5 southeast. This study didn't identify that 6 7 particular structure.

8 What this map does show us is, where the star is sort of in the central portion of the 9 figure, is the geothermal area we've been talking 10 11 about today. The dotted line that goes across from 12 the -- kind of the central portion, west central portion of the map, the northeast direction, is a 13 thrust-fault structure that was identified in this 14 15 area many years ago, but is now better refined as a 16 result of all these studies that were performed out 17 here.

18 The "AVF" is the Animas Valley Fault 19 that Mr. Hayter referred to earlier that runs along the east side of the area. Then the area where the 20 21 dash lines are, we highlighted this. It wasn't 22 highlighted in Cunniff and Bowers. But it was highlighted to show you there's a significant 23 24 structure faulting -- when I say, "structure," I'm 25 referring, primarily, to faults in sheer zones that

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trend from the southwest to the northeast. 1 2 So what this has done is really 3 identify that the geology here is very fractured, 4 it's very faulted, and there's a sheer zone in there. If you think of a sheer zone, a good way to 5 think of it is if you have a deck of cards and you 6 7 kind of slide them and they move a little bit, that's kind of how a sheer acts, of course, on a 8 9 much larger scale. So there's a lot of faulting and so 10 11 forth that happens through this area in a north and south direction. 12 13 0 Could you explain this next line that we've marked as Exhibit No. 8? 14 15 Α Exhibit No. 8, again, is from Cunniff and 16 Bowers. This is what they call their new

17 conceptual model. This figure incorporates some of 18 the sheer structures and faults that I was talking 19 about previously. They are represented by lines 20 with arrows either pointing up or down, which shows 21 which way the rocks move passed each other. It 22 also shows a couple of the wells in the area. 23 You see the TG52-7, which is the second

24 well from the left side of the diagram, is the well 25 that Cunniff and Bowers put in that went to a

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maximum depth of a little over 2,500 feet.

1

2 Another control point is TFD55-7, which 3 was drilled sometime ago. It went to about 7,000 feet nominally, as I recall. So what we have is 4 this new conceptual model that shows there's a lot 5 of fractures that bring water up, hot water up from 6 7 deeper zones into the shallower zones, and that's 8 what those large darker gray arrows are on this 9 figure that show water moving upwards.

10 Then as you get towards the upper part, 11 the light colored yellow with "Qal," the alluvium, 12 it shows that the hot water then disperses out 13 horizontally.

Also, there's a temperature gradient on here that shows the temperatures projected. You can see 150 degrees sea line, 140 degrees, and it gets cooler as you head towards the surface. The greenhouse area is also shown on there for reference.

20 So, in short, the work performed by 21 Cunniff and Bowers significantly increased the 22 understanding and the knowledge of the geologic 23 setting.

24 Q Thank you, Mr. Peery. What do we know 25 about the size of the reservoir in this area?

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A There are two primary estimates of the size of the reservoir area. One is from GeothermEx. Mr. Hayter referred to that report earlier today and to that company. They estimate the size of the reservoir as between 11 and 17 megawatts.

6 Then Cunniff and Bowers, as part of 7 their new conceptual model, also estimates the 8 reservoir size as being between 15 and 24 megawatt 9 reservoir. It's for a 30-year life span. That 10 would be the net energy that would be available, 11 based on the understanding today.

12 Q Why is that important to know the size of 13 the reservoir?

A Well, it's important to know the size of the reservoir because previously it was thought that maybe this was a small structure, and that hot water came up along one or two faults, potentially bringing water to the surface.

Now that the reservoir is understood to
be much larger, it now has some economic resource
to it, and it's viability for a power plant.

Q Mr. Peery, have you reviewed Mr. Witcher's paper published in the New Mexico Geologic Society that was -- the guidebook that was published in 2008?

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A Yes, I have.

2 Q What is your reaction or response to that 3 report?

А Overall, I think the paper provides a good 4 summary of previous work that had been done in the 5 It doesn't have any reference to the Cunniff 6 area. and Bowers report that I just described, so it 7 doesn't have the benefit of all this additional 8 9 data that was available. It does indicate that --10 Witcher does indicate that this is potentially a small reservoir, and water may come up one or more 11 faults. 12

But in his conclusions, he does state that it does -- this area does have a potential to have a significant amount of shattered rocks in the area.

17 So I think that, overall, it's a pretty 18 good paper. It just didn't have all this new data 19 in it to make it more complete.

MS. MUNDS-DRY: Mr. Examiner, we did bring a copy of the -- I say, "a copy," of the Cunniff and Bowers report that Mr. Peery is testifying to. There wasn't a Kinkos open last night. I'm not sure there's a Kinkos in Lordsburg. There may be. I don't know.

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But we can certainly mark this as an 1 exhibit and put it into evidence, and certainly 2 provide all the interested parties with a copy. 3 I'm sorry we just have one with us today. 4 We 5 certainly could, and intended to submit it as an 6 exhibit. I only have one copy. Whatever your pleasure, and whatever other parties wish to do. 7 HEARING EXAMINER: Are there any 8 9 objections to marking this as an exhibit? Does everybody know what it is, or do they want to look 10 at it? 11 MS. MUNDS-DRY: I can certainly pass it 12 around if anybody wants to look at it. 13 14 MS. ALTOMARE: I don't have any objections to it. 15 MR. SEAWRIGHT: AmeriCulture has no 16 objection. 17 MS. MUNDS-DRY: We'll mark that as 18 19 Exhibit No. 9. Again, I will certainly make copies available. I, again, apologize for not having 20 21 copies. HEARING EXAMINER: Very good. We have 22 not admitted Exhibits 6, 7 and 8. Presumably, they 23 would be tendered later, but we'll admit Exhibit 24 No. 9 at this time. 25

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MS. MUNDS-DRY: Thank you, Mr. Examiner. 1 2 Mr. Peery, there has been some discussion Ο about the TDS for the Horquilla formation. What do 3 we know -- not just limited to the Horquilla 4 formation, but what do we know about the TDS for 5 this formation that Raser is looking at? 6 I have not seen a TDS value for the А 7 8 Horquilla formation, but as I stated earlier, based 9 on well TG52-7, that was completed at various times 10 and various steps. The TDS ranged from about 1,100 milligrams per liter --11 12 THE REPORTER: I'm sorry. Can you please speak up louder? I can't hear you. 13 THE WITNESS: So what we do know is that 14 15 the TDS of the water in well TG52-7, range from 1,100 milligrams per liter when water was being 16 developed at a depth of about 2,200 feet, to a TDS 17 of about 1,500 milligrams per liter from a depth of 18 a little over 2,500 feet. 19

20 Q (BY MS. MUNDS-DRY) And that number was 21 determined through sampling?

22 A Yes, samples were collected by Cunniff and 23 Bowers and submitted for laboratory analysis.

Q Mr. Peery, what is our current hydraulic knowledge of the area?

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1 А Our current hydraulic knowledge of the area is fairly limited. The -- we have a couple 2 acquifer systems or sediments that act differently. 3 4 The shallow acquifer, which is alluvial material, quanternary-aged material, kind of has one 5 hydraulic value that has been reported in the 6 7 literature. The transmissivity of that acquifer 8 has been reported to be around 2,500 to 3,500 feet 9 squared per day. The only data we have on the deep 10 wells, or the deeper rocks, is from this TG52-7. 11 The only data that was able to be 12 obtained from that was a specific-capacity data. 13 There were some troubles trying to get recovery data after this well was airlifted. Apparently, 14 the water flashed, became steamed, and when the air 15 16 was turned off, injected air was turned off, the 17 well boiled up at the surface and produced at 100 18 gallons a minute or so.

19So our hydraulic knowledge is pretty20limited at this time.

21 Q Do we have any evidence of reservoir fluid 22 production chemistry at this time?

A What we have is the data that was collected by Cunniff and Bowers from the TG52-7 that I referenced.

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What kind of results did we get? 1 0 I don't remember exactly which parameters 2 А analyzed for, but general chemistry of major ions 3 and TDS pH. I don't remember what metals they 4 might have analyzed for. 5 Mr. Peery, how do we plan to obtain further 6 0 7 evidence on these issues? Well, what we've recommended is completing 8 Ά the three monitoring wells that I talked about 9 earlier. These wells would be completed at three 10 different depths at each monitoring well site, 11 either through a nested piezometer-type structure, 12 or as individual wells. 13 What we're recommending is that there 14 be a deep monitoring well which monitors the 15 16 pumping zone, an intermediate monitoring well which covers some intermediate depth, 6- or 700 feet, 17 18 depending on the depth of the injection or pumping well, and then a shallow monitoring well which 19 20 covers the very shallow water up there. 21 The shallow water table is present 22 around 65-foot depth. So that would give us a lot of good water chemistry data to the area, and, 23 24 additionally, monitor well 3, would be right next

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to the proposed evaporation pond. So the shallow

1 monitoring well there would act as a well that 2 could monitor any potential leaks or something that 3 might occur on it.

Q Thank you. Mr. Peery, would you please identify and review what we've marked as Exhibit No. 10 for the examiner, please?

A Okay. Oh, and, if I may, in additional to water quality samples from the monitoring wells, the production wells and the injection wells would also be sampled for water quality analysis.

11QThank you. Let's go through Exhibit No.1210.

13 A Exhibit No. 10 is a draft of a ground water14 monitoring plant.

Q Mr. Peery, do you know if the OCD -- this
has been submitted to the OCD yet?

A I don't know if it has been or not.Q Okay. I'm sorry. Please go ahead.

17

18

A This is a proposed monitoring plan which describes in more detail what would be done in terms of monitoring at the site, sample collection, water level measurements, that sort of thing, for the monitoring wells, production wells, and other nearby wells where the landowners would allow access to Raser Tech for monitoring.

1 So there would be depth-to-water 2 temperature when it was available from nearby 3 wells, general chemistry that could be included and 4 sampled at regular intervals included in annual 5 reports. This document describes the methodology 6 for performing that work.

Q What level of frequency does Raser suggestpropose to sample or to monitor?

9 A Well, it's like about regular sampling, at 10 least biannual and annual. I suspect early on in 11 the process, when pumping and injection first 12 starts, water levels would be monitored with more 13 frequency than that.

Also, water quality, initially, might be monitored quarterly in order to get a good background set of data. But after that, semiannual and annually is what is being proposed.

18 Q Thank you. Were exhibits 5 through 10 19 either prepared by you or under your direct 20 supervision?

21

22

A I'm sorry?

Q Exhibits 5 through 10?

A Exhibits 5 through 10 were prepared -- 10 was not prepared under my direct supervision. I reviewed that, commented on it, and did have some

involvement with it, but it wasn't under my direct 1 2 supervision. 3 The other diagrams were either prepared 4 under my direct supervision, or were taken from 5 Cunniff and Bowers and properly referenced. 6 MS. MUNDS-DRY: Thank you. Mr. Brooks, we would move the admission 7 8 into evidence of Exhibits 5 through 10. 9 HEARING EXAMINER: Any objection? 10 MS. ALTOMARE: No objection. 11 MR. SEAWRIGHT: No objection. 12 HEARING EXAMINER: 5 through 10 are admitted. 13 14 MS. MUNDS-DRY: Thank you. That concludes my direct-examination of Mr. Peery. 15 HEARING EXAMINER: Ms. Altomare. 16 MS. ALTOMARE: Thank you, Mr. Hearing 17 Examiner. 18 CROSS EXAMINATION BY MS. ALTOMARE 19 20 Q Mr. Peery, what is the ground water gradient in this area? 21 I don't remember the specific gradient in 22 А the area, but ground water flows generally to the 23 northwest in this area. 24 That's both for the shallow and the deep 25 Q

water?

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A It certainly is for the shallow. The deep, I don't know if there's enough data to have a good ground water gradient.

5 Q Is that something that's going to be taken 6 into consideration if further data is obtained as 7 drilling ensues?

A Absolutely. Since we'll have the monitoring wells completed in the shallow, the intermediate, and the deep acquifer, those can be compared to see if they're the same or, indeed, different. But, certainly, the gradient and the flow direction would be part of the monitoring plan.

Q With regard to the ground water, simply the monitoring plan, again, this refers only to three proposed monitoring wells; is that right?

A Yes, but each of the wells is proposed to have three casing strings, so each monitoring well site would have three wells. There would be a total of nine monitoring wells at those three sites.

23 Q Okay. So there's actually a total of nine 24 monitoring wells being proposed in total?

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Yes.

А

Q Is Raser going to be obtaining up-gradient water quality background for this region?

3 А Yes. What's proposed is to get water quality from any of the nearby wells where the land 4 owners will allow access, so we certainly would. 5 6 One of the wells, in fact, would be -- initially be an up-gradient well, and that would be -- monitor 7 8 well 3 would initially be an up-gradient well. But 9 there are other wells in the area that could be 10 used for that too. The proposed injection well, 11 and some of the cold water wells in the area.

Q If after reviewing the draft proposal for the monitoring plan, the OCD recommends additional monitoring wells for variable placement, is Raser willing to work with the OCD to make sure that the monitoring wells and the locations meet with the OCD standards and expectations?

A Well, as their consultant, I would certainly recommend that they do, but I can't say exactly what they'll do.

21 Q Oh, sorry. Would you recommend, as a 22 consultant, that they do that?

A Yes, I would.

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23

Q All right. Did you assist in the preparation -- you may have answered this and I

missed it in the beginning. 1 Did you assist in the preparation of 2 3 the monitoring plan? Most of the monitoring plan was prepared by Α 4 someone else. I provided comments and I reviewed 5 it. 6 But you approved of the draft and the 7 0 recommendations made in the monitoring plan? 8 9 Α Yes. 10 MS. ALTOMARE: I think that's it. I'11 pass the witness. 11 12 HEARING EXAMINER: Mr. Seawright. MR. SEAWRIGHT: Jim Witcher will be 13 14 conducting cross-examination on behalf of AmeriCulture. 15 HEARING EXAMINER: Okay. 16 17 CROSS EXAMINATION BY MR. WITCHER Mr. Peery, in reviewing over the Cunniff 18 Q and Bowers report, were you able to ascertain any 19 20 of the details that they acquired in their geophysical surveys? 21 Did they report any modeling of those 22 surveys, and was any of that raw data presented in 23 that report? 24 The raw data was not presented, but the 25 А

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methodology, the people conducting the work and the interpretation, there were detailed sections on that.

With respect to that, when we take a look 4 0 at this new conceptual model that Cunniff and 5 Bowers proposed, is it your impression that this 6 conceptual model is just a cartoon, or is it, in 7 8 fact, based upon an actual geophysical model and surveys from seismic graphing or resistivity data? 9 10 Do they state this in the report? 11 А It's stated in the report. The work that Cunniff and Bowers performed is quite rigorous and 12 very detailed. I think that their conceptual model 13 is based, indeed, upon all the data that they 14 collected at this site, and existing data that they 15 reviewed also. 16

Q Are you aware of what Cunniff and Bowers'
background is in terms of geoscience?

19 A No. I've read several of their reports,
20 but their specific background, I have not
21 investigated.

Q On the cross section that we see up here, this cross section is -- seems to have a fairly significant vertical scale component exaggeration to it. Also, the cross section is not just a

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straight-line cross section. It seems to me it's
 probably zig-zagging all over a map.

I just wonder if we can come back to your color map and you could show where this cross section goes on your color photo map?

A I think the aerial photo map, which we have as Exhibit 6, would be a much better place to show that.

9 In general, where this cross section 10 lies, is approximately right here. It starts a 11 little bit north of AmeriCulture well A-45-AS3, and 12 continues down in a southeast fashion, kind of 13 between the proposed power plant and the 14 greenhouses, terminating in this area just south of 15 the greenhouses.

16 Q Isn't TG-12-7 out more towards the west on 17 the paved road?

A I believe TG-12-7 is approximately where I showed it to be. I could be off by a little bit, but, generally, it's right about there.

21 Q Speaking in terms of regional geology, are 22 you aware that the thrust-belt concept, the 23 overthrust concept in the southwestern United 24 States has pretty much been debunk?

25 A I'm sorry. I didn't catch what you said.

1 Pretty much what?

2 On their figure, or on their Exhibit No. 7, 0 they show a dotted line across the middle of the 3 map that shows the margin of the overthrust belt, 4 so-called overthrust belt. 5 Are you aware of that concept was 6 pretty much been debunk over the last 20 years? 7 8 А No, I have not heard that. MR. WITCHER: I think that's all I have. 9 HEARING EXAMINER: Okay. I'm not a 10 11 geologist, so if I ask questions that don't make sense, just tell me. 12 EXAMINATION BY HEARING EXAMINER 13 0 Based on what you've testified, it seems 14 like this -- you said this is a highly fractured 15 area; is that correct? 16 Yes, sir. Α 17 And if an area is highly fractured, does that 18 Q tend to mean that water is likely to move over 19 20 fairly long distances, from one depth to another? 21 А A highly-fractured area allows the water to move easier, both vertically and horizontally. 22 Right. And you have not, I take it, really 23 0 done any studies on hydrological communication 24 between various water deposits in this area; is 25

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1 that correct?

2 I have not performed any, nor have I seen А 3 any that provide any values to look at the vertical 4 conductivity between the shallow and the deep 5 acquifer. 6 HEARING EXAMINER: Thank you. That's 7 all I have. 8 Any follow-up? 9 MS. MUNDS-DRY: Mr. Examiner, I have 10 just one question. 11 **REDIRECT EXAMINATION BY MS. MUNDS-DRY** 12 0 Mr. Peery, based on your knowledge of the 13 hydrogeology in this area, do you believe that 14 Raser's application will comply with the water 15 quality standards under water quality regulations? 16 А Yes. 17 MS. MUNDS-DRY: Thank you. That's all I 18 have. 19 HEARING EXAMINER: Any recross? Okay. 20 Very good. You may step down. 21 THE WITNESS: Thank you, sir. 22 HEARING EXAMINER: Ms. Munds-Dry, you 23 may call your next witness. MS. MUNDS-DRY: Thank you. I'd like to 24 call Jennifer Wright. 25

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1	JENNIFER WRIGHT,
2	(Having been first duly
3	sworn, testified as follows:)
4	DIRECT EXAMINATION BY MS. MUNDS-DRY
5	Q Would you please state your full name for
6	the record?
7	A Jennifer Elaine Wright.
8	Q Where do you reside?
9	A In El Paso, Texas.
10	Q By whom are you employed?
11	A I'm employed by Nalco Company.
12	Q What is your position with Nalco Company?
13	A I'm an area manager for the New Mexico,
14	West Texas area.
15	Q And what is Nalco's relationship to Raser?
16	A Nalco has a relationship with Raser, it's
17	basically as a technical consultant on water
18	treatment and controlled technologies that would
19	allow them to treat their water efficiently and as
20	safely as possible.
21	Q Have you previously testified before the
22	Oil Conservation Division?
23	A No, I have not.
24	Q Would you please provide Mr. Brooks with a
25	brief summary of your education and work
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1 background?

2 А Okay. I graduated from Texas Tech 3 University with a chemical engineering degree in 1994. Proceeded to work for Dow Chemical for a 4 couple of years as a process engineer, and came to 5 work for Nalco at the end of 1995, and have been 6 7 employed with them since. I've been with Nalco 13 8 years. 9 My primary background is in power, and 10 I am a power certified consultant for new 11 construction in water treatment. 12 What do your current responsibilities at 0 Nalco involve? 13 14 My responsibilities include developing new Α 15 opportunities for water treatment, and also providing technical expertise for development 16 17 projects such as these, and being a resource for 18 water treatment. 19 MS. MUNDS-DRY: Mr. Brooks, we would 20 tender Ms. Wright an expert witness in chemical 21 engineering in water treatment? 22 HEARING EXAMINER: Any objection? 23 MS. ALTOMARE: No objection. 24 MR. SEAWRIGHT: No objection. 25 HEARING EXAMINER: Very good. So

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qualified.

1

2 MS. MUNDS-DRY: Thank you. 3 Q Ms. Wright, are you familiar with Raser's proposal to construct and operate a geothermal 4 power plant? 5 Yes, I am. 6 А And are you familiar with the proposed 7 0 8 cooling water system? 9 Α Yes. 10 What chemicals has Raser proposed to use in 0 11 the cooling tower? 12 А The chemistries that are proposed to be used in the cooling tower are very traditional 13 14 chemistries that are used pretty widely with most 15 power plants for the corrosion -- for protection of 16 corrosion, scale, and micro-bio. 17 Primarily, all of them to keep the heat 18 transfer surfaces clean, and allow the equipment to operate efficiently as possible. 19 20 0 If you could go through briefly what each 21 of those chemicals are that have been proposed? 22 Α The primary anti-scaling corrosion Okav. inhibitor is a multi-functional blend treatment. 23 Product 3T189, which you'll see in some of the 24 25 exhibits that she'll present here shortly, and that

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serves primarily as a deposit, corrosion, and scale
 inhibitor for the process.

The other chemistries include a commercial bleach, which basically is going to be used as a low-level oxidant to control micro-bio. And an alternative oxidizing biocide to supplement bleach should micro-bio contamination get out of control at some point.

9 The other ones that are also included 10 are acid for pH adjustment to maintain pH levels, 11 basically, at the same level that they come into the process at. A dechlorination agent to 12 13 basically scavenge the chlorine so that when it 14 goes basically back down in the process, it's removed any oxidant potential. That's pretty 15 standard for -- and all of these chemistries are 16 17 very standard for power plants.

Those that discharged to natural water ways, you know, four of them in my direct area of responsibility which includes the San Juan, the Animas, the Rio Grande. Basically, all of these are permanent chemicals for use and control of those things in power plants.

24 Q Why were these particular chemicals picked 25 for this power plant?

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A The chemistries that have been chosen were deemed to be the most environmentally-friendly chemistries. They don't have any source of metals such as zinc or anything like molydates or anything like that that potentially add additional metal species to the water.

7 It includes organic dispersing agents, 8 as well as phosphates, which are naturally 9 occurring as well, which is pretty much the 10 considered -- the least hazardous to the 11 environment, chemical for corrosion inhibition.

12

0

I'm sorry. Go ahead.

13 A And the chemistries and technologies that 14 we're going to discuss here have also been 15 recognized. Actually, we won the 2008 Green 16 Presidential Chemistry Award. So, basically, with 17 the understanding that everybody wants to go green 18 and environmentally friendly, we continue to use 19 our research to develop products that we need.

20 Q What kind of cost does Raser -- not in 21 terms of dollars, but in terms of comparison to 22 other chemicals, what does that mean to Raser?

A Well, they actually have to spend more money. There are more cost-effective mechanisms by which to treat the water, but aren't necessarily as

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environmentally friendly, and probably could be 1 permitted by the EPA and the Water Conservation 2 3 Division that I've seen in other places as well. But they did want to choose the most 4 environmentally-friendly products available, and 5 they happened to be more expensive because of that. 6 7 How would the chemistry be monitored to 0 assure complaints with all applicable water quality 8 standards? 9

10 Α There's multiple facets that we've discussed, and one of them involved an advanced 11 control technology, which is called the 3D TRASAR 12 System, which monitors all aspects of the water 13 continuously real-time. It has multiple ways of 14 communication. It involves real-time pH 15 monitoring, real-time conductivity monitoring, 16 real-time active chemical concentration level, 17 real-time corrosion monitoring. It has direct 18 communication in multiple ways. 19

20 One, by direct link to the control 21 systems, through the DCS control system that goes 22 back to the house, as well as external 23 communication, via wire -- either wireless gateway, 24 or if they choose to put a phone line system there. 25 Also, coupled with, you know, you don't

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remove the man-power element of actually having
 people go by and test on a regular basis to insure
 that all of the equipment is operating as it's
 intended to, and is communicating properly.

5 That's, also, where we come in is 6 actually helping them, train them on-site to be 7 water testers, and how to monitor and respond to 8 any potential upsets.

9 Q Ms. Wright, let's turn to what's been 10 marked as Exhibit No. 11, and if you can explain to 11 the examiner how the 3D TRASAR System works?

A Basically, the way the 3D TRASAR System works, it takes a continuous flowing sample of the recirculating cooling water, and it measures, as you can see, all the different points that it measures. It uses a torroidal conductivity probe, obviously, a pH probe, an ORP probe, which is an oxidation reduction potential probe.

What that does is actually measure the oxidant potential of the water, the direct correlation between chlorine level, which is the micro-bio control agent there. The fluorometer, itself, actually uses our patented flourescent technology to monitor continuous levels of the inhibitor. So it uses on-off control 4-20

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milliampere control to keep the pumps plus or minus
 a 1 ppm of the target dose.

3 So in our case here, based on our 4 modeling and water treatment needs, it looks like 5 the target dosage is going to be about 80 ppm. The 6 control system will actually turn the pump on at 7 79, and turn it off at 81. So it will be about a 1 8 ppm differential, plus or minus our control range.

9 Q Just to back up for a minute to put this in 10 context, when is all the monitoring taking place? 11 At what point in the cycle of the power generation 12 does this all happen?

13 Α The actual control and monitoring Okav. 14 takes place on the evaporating cooling water system that's going directly to the UTC unit themselves. 15 16 So all the monitoring is taking place on the cooling tower itself. The proposal is to obviously 17 use that water in conjunction with the production 18 19 wells, and that volume is on the magnitude of about 20 -- less than one percent.

So if you figure 15,000 gallons a minute of flow, we're looking at 300 gallons a minute contribution. It's about a one percent blend of the total. So we would be contributing 80 parts per million in the bulk water itself. But by

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the time you factor that in as one percent, you're going to be contributing about .8 ppm of product to the recirculating water.

4 Q And, obviously, this all takes place well 5 before injection?

6

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A Yes. Obviously, yes.

Q Let's turn to what's been marked as Exhibit
8 No. 12. Review this packet for the examiner.

9 A Okay. Those are the material safety data 10 sheets that are for the individual products that 11 are recommended. There is a product number in 12 there that we recommended. It's our commercial-13 strength bleach. However, they may choose to buy 14 it from a commodity supplier or, you know, buy it 15 themselves.

I provided that just so that I could testify to the extent of what is going to be used, and how it's going to be controlled, and its contribution to the water chemistry itself.

20 Q And the chemical would be the same 21 regardless --

A It would be absolutely the same. 12 ½ percent bleach, is 12 ½ percent bleach no matter who you buy it from.

Q Okay. And we'll get into specifics in a

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second, but just so the examiner has an idea of
 what we're looking at here, what does each of these
 individual packets that make up Exhibit 12

4 represent?

A Okay. As I mentioned, the 3DT-189 is the MSDS for the multi-functional scale corrosion and that deposit control chemical. That product is based on our modeling and different scale indicies, is expected to operate at about 80 ppm based on the cycles of concentration that they will be operating at.

12 Did you want me to go into more 13 explanation about that?

14 Q Yeah, we'll get into some more specifics.15 What is the next one?

The next product is Nalco's 7341, which I 16 Α mentioned is commercial strength, 12 ½ percent 17 18 bleach. That product will be used to control oxidant levels in the cooling tower at a very, very 19 low range of free oxidant of about .2 to .3 ppm. 20 21 Which to give you an idea is about 10 times less than what you get in your drinking water out of 22 your faucet every day. So it's going to be very, 23 very low levels, but enough to control the mirco-24 bio activity in the cooling system. 25

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1 The third one is Towerbrom 960, which 2 is a supplementary biocide. Most systems typically 3 recommend a non-oxidizing biocide as a back-up for 4 the primary oxidant control. It's kind of like 5 alternating your poisons that you use for your 6 bugs. You know, you don't want them to get used to it, but it does have a tendency to be more 7 8 hazardous to handle, and, obviously, to utilize it.

9 So with the concerns about potential 10 contamination, we've opted to use a supplementary, 11 an oxidizing biocide which will be controlled in 12 the same fashion that the routinely bleach product 13 would be used, and controlled in the same fashion, 14 and will also be dechlorinated when it gets back 15 into the main water stream.

16 The last one is the Nalco 7408, which 17 is a chlorine scavenger, which is used all over the 18 geothermal power processes all over Nevada, 19 California. Basically, any chlorine or any 20 oxidants that are present in the water need to be 21 scavenged before it goes back in for re-injection. 22 There's also concerns about oxygen 23 corrosion and things like that, so it actually helps with those things. 24

25

Q Ms. Wright, have a toxicology and ego-

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1 toxicology test been performed on each of the 2 proposed chemicals?

All of them have, and they're 3 Α Yes. recorded in the MSDS sections, and they're also 4 summarized in the Exhibit No. 13 that we'll get to 5 6 here in a second. They have been conducted, and all of the LC50, which for those of you who aren't 7 familiar with material safety data sheets, is the 8 9 lethal concentration to 50 percent of the 10 population at 96 hours.

11 So if you expose all the different 12 types of species, whether they happen to be shrimp, 13 fish, et cetera, at those concentrations, 50 14 percent would be considered lethal.

15 When you compare where we plan to 16 operate the cooling systems, for example, on the 3DT-189 at 80 parts per million, the LC50 for the 17 fathead minnow, for example, is 3,750. When you 18 make the dilution effect with the 15,000 gallons a 19 minute of brine or geothermal water with the fresh 20 21 water, the contribution is .8 ppm. So we're 3,000 times below any LC50 reading for -- for example, 22 for the fathead minnow. 23

That was used as an example afterdiscussing some of this with our Dr. Viallobos,

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with our toxicologist in our Naperville office, for the fact that if they weren't fresh water fish, that shares a very similar geographical climate to some of the fish that are here in question. So we felt that that was applicable.

Also, the bleach, for example, at the 6 levels that we're looking at controlling in the 7 cooling system, are more than 10 to 20 times the 8 levels of concentration that would be considered on 9 10 the reporting dose, and we will be scavenging those. What I mean by "scavenging" those, is when 11 you put in a product to remove the chlorine, it 12 basically reverts those to elemental chloride 13 14 sulfates.

15So it's no longer an oxidant present in16the water. It becomes an elemental species.

Q Ms. Wright, just to point out to the examiner, it appears that in each of these material safety data sheets, that there's a heading that shows ecological -- actually, before that, toxicological information.

22 Well, in the first packet I'm looking a 23 the 3D TRASAR 3DT189. It starts on page 5 and page 24 6. Is that what you're referring to?

25 A Yes, ma'am. The acute fish results?

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Q Yes.

A Yes.

3 Q And I believe you mentioned that they did 4 studies on the fathead minnow and the rainbow 5 trout?

6

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A Yes, ma'am.

Q No studies were done on tilapia?
A No. No studies were done on tilapia.
However, based on the U.S. EPA standards for
toxicity, basically, it can be deemed non-toxic.

11 Q Thank you. Would you please turn to what's 12 been marked as Exhibit No. 13 and review that for 13 the examiner?

A Yeah, I think we've alluded to this as well. Really, it's actually a summary of the product description, how the product will be fed, and the overall toxicological information summary for each of those products pulled from the material safety data sheet.

It goes into detailed control -- I mean, detail about how the products will be individually controlled and monitored to insure that they're not overfed, and present any risk to any environmental species or humans or the water table as well.

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1 Q What are some of the conclusions that are 2 reached in this letter?

А The conclusion is, basically, that all of 3 4 the chemistries that we are proposing are the most environmentally friendly that can be used to 5 provide the results that are needed. The controls 6 7 that Raser is looking at investing in is basically 8 state of the art, and best available technology 9 that is allotted to be, basically, recognized as a Presidential Green Chemistry Award. 10

All of the levels that are going to be maintained in the water, the cooling water itself, are well below any kind of toxicological contamination or lethal dose to any of the species that are in question. When you factor in the dilution effect, you're going to see that being very --

18 MR. SEAWRIGHT: I have an objection. 19 HEARING EXAMINER: Proceed. MR. SEAWRIGHT: Analogous to the 20 21 alteration of the location of the injection wells, 22 we're getting hit completely out of the blue with a new set of proposed injection chemicals. 23 This is the list that is available on 24 the OCD website. Upon superficial perusal, there 25

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is no match between the chemicals that witness
 Wright is now speaking about, and that which has
 been available to us with preparation for this
 hearing.

5 So for those reasons, the analogous 6 fashion to the issue that we had with the 7 relocation of the injection wells, we move to 8 adjourn this hearing, based upon the continuing 9 practice of altering the testimony as it suits 10 their particular case.

HEARING EXAMINER: I'm going to overrule the objection. The OCD rules actually do not require that exhibits be done in advance, so except for hearings before the commission, which this is not.

16 So you may proceed.

17 THE WITNESS: Okay. One of the things 18 that -- the chemicals that are listed on the OCD 19 website are generic in nature. They don't 20 specifically relate to a Nalco product number. All 21 of the active ingredients that are present in our 22 products are approved on that list.

23 So if you go -- went down to the MSDS 24 and looked at the active ingredients, the hazardous 25 ingredients that are on there, they are present on

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that website. So it's kind of their trade names, basically, by nature, and it's not specific to any company. However, Raser has asked us to support them on this.

5 OCD doesn't necessarily align with any 6 chemical company so, they, basically, generically 7 speaking, have various components of the chemicals 8 available for the different functions in the 9 cooling system.

10 Q (BY MS. MUNDS-DRY) Ms. Wright, do you know 11 if these material safety data sheets have been 12 provided to the OCD?

A Yes, I believe they have. They are available on our website to anybody that wants to have them. They are completely -- it's by law that they need to be available to anybody who may be in contact with them and their right to know.

Q Ms. Wright, in your opinion, will the chemicals being proposed to be used as part of the water treatment system be safe to surface in ground water system?

22

A Yes, I do.

Q In your opinion, will the system proposed by Raser insure that the water being injected or re-injected into the reservoir will maintain the

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original qualities when produced? 1 2 Yes, I do. Α 3 MS. MUNDS-DRY: Mr. Examiner, we move 4 the admission into evidence of Exhibits 11 through 5 13. 6 HEARING EXAMINER: Were there any 7 objections to Exhibits 11 through 13? 8 MS. ALTOMARE: No objection. 9 MR. SEAWRIGHT: The only concern that I have is that I have not confirmed what witness 10 11 Wright claimed that there is a chemical match between these, and that it's simply a matter of 12 labeling under the Nalco label. So I have an issue 13 with that. 14 15 HEARING EXAMINER: Okay. I'm going to admit Exhibits 11 through 13. The concerns you 16 raise, I believe, go to the credibility, rather 17 18 than the admissibility so you may cross-examine the witness about the subject. 19 Does that complete your presentation? 20 MS. MUNDS-DRY: That completes our 21 presentation, Mr. Brooks. 22 HEARING EXAMINER: Ms. Altomare. 23 24 MS. ALTOMARE: Thank you, Mr. Hearing Examiner. 25

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## CROSS EXAMINATION BY MS. ALTOMARE

2 Ms. Wright, you talked a little bit about 0 3 the monitoring that goes on in the cooling tower. 4 Forgive my ignorance. I'm still grappling with 5 this technology a little bit. My impression is that the monitoring 6 7 that you were speaking of has to do more with what 8 kind of monitoring goes on real-time as the fluids 9 are being circulated through the cooling tower; is that right? 10 11 А Yes, ma'am. 12 Is the discharge, the water as it's being 0 13 ready to be discharged, the actual discharge, is 14 that being monitored in real-time as well? 15 I believe the -- from what I understand, А 16 from my discussions with Raser, is that as the 17 wells are explored and they understand the different TDS levels of where the production wells 18 19 will be, that will be the requirement for effluent. 20 So the quality of the cooling tower will have to, basically, meet or be below those 21 levels at the discharge point of the cooling tower. 22 So once it mixes with the effluent water, you're 23 basically putting back exactly what you took out. 24 25 But that's not part of the proprietary 0

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tracing system that you were talking about?

No, and I think there's some discussion 2 Α 3 about putting on line total dissolved solid 4 monitor, or conductivity monitor that will actually 5 be able to measure the effluent quality as well. 6 But I believe the test wells will 7 obviously be monitored for that sake, and there are 8 some discussions about feedback control to monitor 9 the combined mixture of the sample. This 10 technology can be used for that, but the way it's presented will actually be installed on the 11 12 recirculating cooling tower itself.

Q The standards that are applied with regard to the monitoring program, are they generic in nature, or have they been tailored specifically for the Raser project in the Animas?

They have been somewhat tailored. 17 А I mean, 18 really, it's a very good fit. We use this 19 technology at most of our plants that discharge to 20 natural water ways because they have the ability to 21 monitor, you know, things that are controlled by 22 temperature, oxidation potential, the water pH, and concentration of chemicals. 23

24 So it has become a very broad use for 25 that purpose, but there are some specifics that

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they are going to utilize as far as remote
 monitoring.

One of the things that they're 3 investigating, and to actually have it connected, 4 5 we have what we call a Nalco 360 Expert Center 6 where the communications actually go to a 24-hour, 7 365 manned mastered-level chemist who receives any kind of a large system, and responds and 8 9 communicates with a person should there be upsets. 10 So those kinds of things have been --11 sometimes aren't necessarily necessary. Other 12 cases they are investigating that option for their 13 system. But there is the ability to tailor the 14 0 system on a case-by-case basis? 15 16 Yes. Absolutely. А Not just one size fits all? 17 0 18 А No. Absolutely. Do you have a recommendation for a way to 19 0 20 monitor or track the ground-water concentrations of these specific substances in this particular region 21

knowing the concerns that exist here?

22

A Yes. I mean, all of the specific ions that are basically going to be present like, for example, phosphates and things like that, can be

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monitored from any of the monitoring wells.

We have multiple samples of water 2 3 analysis that include chloride, sodium, barium, orthophosphate, total phosphate, total organic 4 carbons. Those are the kinds of things that we 5 would be looking for is for total organic carbon, 6 phosphate levels, and, really, any kind of increase 7 8 in specific gravity or total conductives because 9 that's the measure of the dissolved solid of what's in the acquifer. 10

11 Q So, for instance, knowing what you know 12 about products that you all are producing through 13 this project, you would be able to either directly, 14 or through Raser, assist the OCD in developing a 15 monitoring plan that was tailored specifically 16 tracking the concentrations of these chemicals?

17

1

A Yes. Absolutely. Yes.

Q There is mention in the materials that have been provided of the MSDS for these particular products?

21

A Uh-huh.

Q It's my understanding that sometimes there are proprietary chemicals or some chemicals that are in such small amounts that aren't necessarily listed on these kinds of documents?

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A Yes.

1

2 Q Is that the case with regard to any of the 3 products here?

A Yes, they are. Anything that's on -present on the material safety data sheet is considered anything that has a hazardous degree that might have a reporting quantity, or have any hazardous or affect the environment.

9 The other things that are in there that don't necessarily have any bearing whatsoever are 10 11 not necessarily listed. That is confidential 12 information. However, if the OCD itself feels like that information is necessary, we can have that in 13 a private discussion about those things, and 14 specific interest, if there's certain elements that 15 you're looking for of concern, we can talk about 16 17 those and find out how to mitigate those.

18 Q Finally, the last question that I have is, whether or not the synergistic effect, how these 19 20 particular products that have been selected for use 21 in this particular project interact, has been 22 studied? Is there a known effect of how these 23 particular products might interact when they are actually --24

25

All together?

Α

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Q Yeah.

1

2	A They're defined to all work in conjunction
3	together. So, basically, all four of these are
4	actually used constantly at the same time, the same
5	concentrations in a dynamic system.
6	So, I mean, we won't be feeding any of
7	them neat in a mixed situation. Each one of them
8	will be fed at individual points where they're
9	diluted; they won't be mixed.
10	The only concern about mixing in
11	adverse effects would be, you know, pH's are not
12	compatible, and the products become unstable and
13	precipitate out a solution or, you know, scaleable
14	line because the pH goes too high and some of the
15	calciums and things fall out of the water.
16	But not from the standpoint if you're
17	asking about reactivity or explosivity or
18	flammability or anything like that, no.
19	Q Did your company do any kind of studies
20	regarding the specific interactions of these
21	products in the course of developing them?
22	A Yes. Yes.
23	Q Would those things be publically available
24	or available to our agency for review?
25	A Yes.

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Do these things involve toxicology as they 1 0 would affect wildlife and ground water? 2 3 You mean as far as --А The synergistic effect. 4 Q Oh, the synergistic effect? 5 Α 6 0 Yeah, the interaction of the products. Were there studies or testing that was 7 done specifically with regard to toxicology and the 8 9 interaction of --10 Α You know, I can't answer that. I'm not a toxicologist. We do have Dr. Villalobos, who is 11 our chief toxicologist, who is available. 12 In fact, 13 we've had a lot of dialogue and discussion with him over developing a lot of this information for this 14 hearing. 15

He's very willing to even have a oneon-one dialogue to answer your questions. You don't have to ask me, and I don't have to ask him. You know, we could set up an opportunity for you guys to have that discussion with him directly.

Q You had mentioned that you would be willing to discuss in private conference with the Department proprietary chemical content. Your company would not be willing to make that information public, though?

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A No. Well, we can actually talk about it, each of the individual -- I mean, I can go through and tell you what all the individual components of the different products are, the active ingredient part. I just can't tell you concentrations and things of that nature.

Q Okay. Would you be willing to do aquatic toxicity tests testing specifically with regard to the synergistic effects of these particular products that have been selected for this product -- project?

12 A I would believe they would. That's just 13 something we'd have to ask our toxicologist. I 14 have a feeling it's all been done because all these 15 products are used consistently together in dynamic 16 cooling systems all over the world.

17 So I would expect that that data is 18 probably already available, but I just can't answer 19 that.

20 Q Okay. Is it possible that something was 21 withheld from an MSDS that was possibly hazardous, 22 but also under the category of proprietary -

A No, ma'am.

23

24 Q -- withheld on that basis?

25 A No, ma'am. Anything that's hazardous is

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listed.

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2 MS. ALTOMARE: I'll pass the witness. 3 THE WITNESS: Well, excuse me. Ι 4 understand what you -- anything that is hazardous 5 that is present in -- or anything but negligible 6 concentration is listed on the MSDS, from what I 7 understand. 8 HEARING EXAMINER: Pass the witness? 9 MS. ALTOMARE: Pass the witness. 10 HEARING EXAMINER: Mr. Seawright. 11 CROSS EXAMINATION BY MR. SEAWRIGHT 12 Ms. Wright, you mentioned the 3D TRASAR 0 13 System --THE REPORTER: Mr. Seawright, you need 14 15 to speak up. 16 HEARING EXAMINER: Louder, please. 17 0 (BY MR. SEAWRIGHT) You mentioned the 3D 18 TRASAR System. As I understand it, that is a 19 system primarily developed to optimize the use of 20 chemicals in a cooling tower situation; is that not 21 right? 22 А No. 23 MEMBER OF PUBLIC: You're going to have 24 to speak up. 25 HEARING EXAMINER: Yes, keep your voice

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1 up. You tend to fade out.

2 THE WITNESS: Not necessarily. It's 3 used to monitor performance of active corrosion 4 levels of mild steel and copper. It's also used to 5 control oxidant levels, and also used to monitor for dechlorination effect. 6 So it's not necessarily -- it is for 7 8 the use of optimization of chemicals from the standpoint of basically minimizing under and over 9 10 feed situations, yes. 11 0 (BY MR. SEAWRIGHT) So cooling tower operations? 12 А 13 Yes. 14 Does it serve to eliminate the introduction 0 of chemicals into blow-down water depth as being 15 proposed to be injected in the ground? 16 17 А I'm sorry. Would your repeat that? Does it serve to eliminate chemicals used 18 0 in the cooling tower from being introduced -- from 19 20 being put into the blow down that's injected into the ground? 21 2.2 Α It's primarily there to control the No. use of chemicals that are added to the cooling 23 24 tower. You mentioned that the objective is to 25 Q

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1 maintain the original quality of the water. On one 2 occasion you mentioned that the criterion was total 3 resolved solids. Then, yet, in response to a query 4 by the Oil Conservation Division counsel, you 5 answered the question in regard to chemistry. I 6 would like you to be a little more clear.

So my question is: Is the 3D TRASAR
System, does it monitor only the TDS -

9

A No.

10 Q -- as far as the blow down, as far as 11 monitoring part of that system that is directly 12 related to the blow down, namely, the discharge 13 from the cooling tower into the environment?

Is it TDS only, or are you monitoring in real-time the chemical constituents of that well?

It monitors real-time level. Basically the 17 A dosage of the 3DT-189 will actually give you a 18 direct dosage read out. It uses fluorescent 19 technology that's blended in our products. Where 20 it actually puts it through a fluorometer, it 21 22 fluoresces out or at a wavelength that the product has blended in, and it ignites a reading, which it 23 can be correlated into a dosage. But it actually 24 also reads active polymer as well. So it reads 25

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both dosage and active level continuously real time. Yes, it does.

Q I have a Ph.D. in fishery science from the University of Washington, so your toxicity comments are of great interest to me.

Are you aware that there are 28,000 species of fish on the planet earth that are known --

9

A No, I do not.

10 Q Do you know that the physiology --11 physiological requirements and sensitivity to at 12 least those domesticated fish, those species, 13 drastically differs from one to another?

14

A I would assume they do.

Q In your reference to flathead minnow and rainbow trout acute toxicity levels, isn't it true that their applicability to the species that we grow, namely, oreochromis niloticus, is of limited applicability?

A Based on the recommendation of our toxicologist, was that the species are very similar in nature due to their geographic location, the climate that they withstand, and that they happen to be somewhat more hearty in the standpoint of the things that would be -- they would be affected by

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such as temperature and oxygen level. They are
 more hearty from the standpoint of those aspects.
 So that was a comparable analogy to the

4 data that was provided.

5 Q Are you aware that the native ecological 6 zones for tilapia, flathead minnows, rainbow trout 7 exists -- at least with compared to tilapia, exists 8 on different continents?

9

A I'm not familiar with that.

10 Q And that their physiological11 characteristics are drastically different?

12 A The only purpose of the reference to the 13 flathead minnow is that it is a similar fish to 14 what's in question here, and we were provided that 15 information by our toxicologist.

Q I have a follow-up question that OCD counsel asked you. Would you be willing to conduct toxicity studies in order to determine the specific toxicity levels relevant to our species,

20 oreochromis niloticus?

A I can't, basically, speak directly for our research and development portion of our company. But I would imagine if that's something that Raser feels that is in their best interest, and is something that is required by the OCD, I would

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imagine that we would be able to make that happen. 1 2 Ο Thank you. Do you have any idea whether or 3 not injected water would eventually migrate to a production well of AmeriCulture? 4 А 5 I can't testify to that. 6 0 So isn't it true that if we don't know the acute toxicity levels that the proposed injected 7 chemicals on tilapia, and we don't know whether or 8 not the cooling water might migrate to 9 10 AmeriCulture's production well?

Isn't it true that your expertise on whether or not the injected chemicals will have any impact on our fish is limited?

A I can base it on the USA/EPA standards that it is -- they are deemed non-toxic at the levels that we're planning to use them to any of the species that have been studied.

Q I guess I'll repeat my question. You stated in testimony that you do not know the acute toxicity levels of these chemicals for the species of the fish that we grow?

22

A That's correct.

Q You also testified that you do not know whether or not these chemicals will migrate to our location. Since you know neither of those --

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1 A As far as the migration pattern, that has 2 to do strictly with --

HEARING EXAMINER: Please allow counsel
to finish his question before you answer.

(BY MR. SEAWRIGHT) I understand. 5 0 Tt's a bottom-line question. Since you know neither the 6 7 acute toxicity concentrations, nor whether or not these chemicals will migrate to our production 8 wells, then, isn't it true that you are unable to 9 10 render a scientifically credible argument regarding the safety of injection-proposed cooling tower 11 chemicals to injection wells? 12

MS. MUNDS-DRY: Mr. Examiner, I am not quite sure where to begin with that question. Part of my issue with that question -- and I'll try to get this into an objection. I'm just articulating this out loudly.

18 Part of his question relating to 19 connection between injection and production wells 20 is not within her expertise. She said she did not 21 She was not rendering an opinion on that. know. So my concern with her answering that question is 22 that she's getting outside of her expertise, which 23 is water chemistry and water treatment. She's not 24 a hydrogeologist, and she did not testify to 25

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1 anything related to that.

2 MR. SEAWRIGHT: Mr. Hearing Examiner, I 3 did not expect her to know the answer to that 4 question. 5 MS. MUNDS-DRY: I'm not sure that's fair 6 to ask her, then. 7 MR. SEAWRIGHT: I was simply raising the 8 point that there is an overall tone in her 9 presentation that somehow these chemicals are 10 somehow safe to our fish that we rely upon for 11 business. And, yet, as demonstrated through testimony, she knows neither whether or not that 12 whether the chemicals will migrate to our wells, or 13 14 whether they're even toxic to our fish. So she's unable to make a 15 scientifically, credible opinion of whether or not 16 17 the injection cooling towers used by Raser into their injection wells will have any impact on our 18 19 fish. MS. MUNDS-DRY: And, Mr. Examiner, I'm 20 I'll just add that her testimony and her 21 sorrv. 22 opinions are as to the chemicals' effect on the quality of water, rather than to any specific 23 24 species. She is testifying to the fact that the cooling water system will meet all of the 25

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applicable water quality standards.

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2 MR. SEAWRIGHT: I object. She's --3 HEARING EXAMINER: Okay. Now, that 4 we've heard Ms. Munds-Dry's and Mr. Seawright's 5 opinions about what the witness is saying, perhaps 6 the witness would like to answer the question with 7 such qualifications as she feels are appropriate. 8 I'll overrule the objection.

9 THE WITNESS: Okay. You know, I, 10 basically, would like to say that we utilize these 11 same exact chemistries in water that meet water 12 quality standards that discharge to natural water 13 ways, which include different types of fish. I'm 14 not sure of all the different types of fish they 15 include.

The assimilation for the chemicals that we have studies on are somewhat similar in nature to the warm fresh-water species that are in question. And that's the extent of my ability to answer that question.

HEARING EXAMINER: Okay. That's fine.
Go ahead.

Q (BY MR. SEAWRIGHT) Is it true to say your expertise on whether or not the injected chemicals will have a negative impact upon our fish is

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limited?

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2 А On your particular species of fish, yes, 3 that would be a fair statement. 4 MR. SEAWRIGHT: That's all the questions 5 I have. 6 HEARING EXAMINER: Very good. There's a 7 member of the audience who is raising his hand. 8 MAN FROM AUDIENCE: Is it possible I can 9 ask one question regarding her testimony? 10 HEARING EXAMINER: Okay. I'm going to 11 allow you to do that. 12 MAN FROM AUDIENCE: Are the chemicals 13 that are being used in this water treatment 14 regarding the cooling tower for water treatment, is 15 that the same set of chemicals that are used in 16 cooling towers for commercial office buildings, 17 hospitals, that sort of thing? 18 THE WITNESS: Yes, sir. 19 MAN FROM AUDIENCE: Doesn't that water 20 get discharged into the city sewer system? 21 THE WITNESS: Yes, they are all in --MAN FROM AUDIENCE: In Albuquerque, it 22 23 would end of in the Rio Grande River? 24 THE WITNESS: Yes. 25 HEARING EXAMINER: Could you identify

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1 yourself? 2 MR. SILVERMAN: My name is Paul 3 Silverman. 4 HEARING EXAMINER: Okay. Thank you. Τ have no questions for this witness. 5 6 Ms. Munds-Dry, do you have redirect? MS. MUNDS-DRY: I do have one question. 7 8 HEARING EXAMINER: Go ahead. 9 REDIRECT EXAMINATION BY MS. MUNDS-DRY 10 Do the use of these chemicals meet their 0 11 eventual -- whatever concentration they end up in, 12 in re-injection to back into the wells, meet all 13 applicable water quality standards? Yes, ma'am. А 14 MS. MUNDS-DRY: That's all I have. 15 HEARING EXAMINER: Very good. 16 Ιf there's nothing further, then the witness --17 18 MR. SEAWRIGHT: I have recross. 19 RECROSS EXAMINATION BY MR. SEAWRIGHT What is the justification for that 20 0 21 statement that the injected water meets all WQCC standards? How can you say that so generally? 22 Ιt contains chemicals that are, as part of the 23 testimony in this very hearing that we're going to 24 have to re-investigate since they are not included 25

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## in the New Mexico Statutes?

How can you be so confident of a statement like that? What is the basis for that statement? Please elaborate.

5 А The products in all of the active constituents in the products are non-toxic. 6 For 7 example, organic dispersants, phosphates, sodium, things of that nature. They don't necessarily have 8 9 any affect on the ground water, and they're 10 permitted in a number of issues at higher 11 concentrations than what we are speaking of today.

Q Where are they approved in higher
concentration? Give me a context for that? State
a location.

A The levels of -- I guess the levels of when you talk about concentrations in the cooling systems, whether it be 50 parts per million, 80 parts per million, 100 parts per million, those waters are discharged to nature water ways and exemplified to natural sewers which go into the rivers, eventually.

The levels that we're talking about are 100 times less than that. So there's not going to be anything in the product in the water that has any reportable limit whatsoever.

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All of them are going to revert to natural species such as chloride sulphate and -chloride sulphates and phosphates or phosphonates, something of that nature, that are organic phosphates that are present in natural current water.

HEARING EXAMINER: Thank you. Thewitness may stand down.

9 MR. SEAWRIGHT: Can I -- I still have 10 follow-questions. It's a very important issue.

HEARING EXAMINER: Yes, but your recross 11 is limited to the scope of redirect. One question 12 was asked which, as I understand it, related to the 13 WOCC standards. We can take administrative notice 14 of the WQCC standards. We know what they are, and 15 16 the witness's testimony was that the -- it's my understanding that it was that all WOCC standards 17 would be met. 18

You are free to disagree with that and put on efforts to the contrary, but we don't want to keep hammering on it at this time of the afternoon. The witness may stand down and we can proceed to the next portion of the testimony.

24 MS. MUNDS-DRY: That concludes Raser's 25 presentation, Mr. Hearing Examiner.

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HEARING EXAMINER: Okay. With that, we 1 will take a 10-minute recess. 2 3 (Recess.) 4 HEARING EXAMINER: We will call the hearing back in order. 5 6 Before we begin the protestor's case, however, because it's getting late in the day, is 7 8 there anyone here who wishes to make a comment as a 9 member of the public at this time? Yes, sir. Would you come forward and 10 sit or stand over here close to the court reporter 11 12 and state your name and then proceed with your 13 comments? 14 MR. CURR: My name is Ed Curr. I'm just a local citizen. I taught in the county schools 15 for 22 years. I've always been interested in new 16 17 industry coming to this area. I'm very familiar with the geothermal site. My family has land in 18 that area, and have been part of -- I've even -- I 19 know the Seawrights, and I've dealt with them. 20 21 But I'm very supportive of this 22 project, and I hope it comes to fruition. I just want to give my public support for the geothermal 23 24 power plant. HEARING EXAMINER: Thank you, sir. 25

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1 Is there anyone else that wishes to 2 make comments as a member of the public at this 3 time? Very good. 4 Hearing none, Mr. Seawright, you may 5 proceed with your case. 6 MR. SEAWRIGHT: I call our direct case witness, James Witcher. 7 8 HEARING EXAMINER: Would you take the 9 witness stand, please. 10 THE WITNESS: May I stand? 11 HEARING EXAMINER: If you prefer. 12 THE WITNESS: I prefer. These chairs are pretty chilly. 13 14 HEARING EXAMINER: In English Courts, the witness is to stand when they deliver their 15 16 testimony. It's only in America that we have chairs. 17 18 You may proceed. 19 JAMES WITCHER, 20 (Having been first duly 21 sworn, testified as follows:) 22 DIRECT EXAMINATION BY MR. SEAWRIGHT For the record, Mr. Witcher, would you 23 Q 24 state your name and the name of your business, and the role, and association, and nature of that 25

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1 association with AmeriCulture?

A Yes. My name is James Charles Witcher, and I live in Las Cruces, New Mexico. I'm the principal of Witcher & Associates. My work is principally deals with geothermal investigation and sub-ground water. I've worked with water quality.

7 My experience with Damon Seawright and 8 AmeriCulture goes back almost to the time when they 9 were planning to do their project years ago when I 10 worked at NMSU. Damon and his dad came in, and 11 they were interested in taking a look at different 12 sites across New Mexico that would be suitable for 13 aquiculture, so that's the beginning.

14 Since that time, we worked on several 15 exploration drilling efforts, in particular, the 16 AmeriCulture number 2 well, which I will talk about 17 later.

Q Thank you. Would you please describe your education, professional qualifications, and also elaborate on your qualifications to testify in geothermal and hydrology relating to the geothermal resource?

23 A Yes. My education, I have a bachelor's 24 degree in 1977 from New Mexico State University. I 25 also have a master's degree at New Mexico State

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University in 1992 in geology. I've worked in 1 2 geothermal and ground water almost all my career. 3 After my graduation as an 4 undergraduate, I went to work in Tucson at the 5 Arizona Geological Survey which was, at the time, at the University of Arizona. Then an opportunity 6 came back to come back to New Mexico and work at 7 8 NMSU with a non-profit research institute, Applied 9 Research Institute, over at the engineering 10 college. I was one of the principals in the geothermal program on campus. I worked there for 11 about 20 years, and then since that time I've gone 12 13 out on my own. Thank you. We are -- you have a power-14 0 15 point presentation, do you not? Yes, I do. 16 А 17 Did you prepare your slides in conjunction 0 with your testimony? 18 Yes, I did. 19 А Did you prepare them by yourself? 20 0 21 А Yes, I did. Did this facilitate the discussion of the 22 0 subject matter to testify? 23 24 А Pardon? Did this facilitate the discussion of your 25 0

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subject matter?

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2

A Yes. Yes.

3 Q Will you please review those slides for us4 and associated testimony?

5 HEARING EXAMINER: Okay. Mr. Seawright, 6 you asked that I advise you regarding the way the 7 presentation is customarily done here in the 8 customary order.

At this point, having reviewed the witness's credentials, you would then tender him as an expert in the field in which you wish him to testify, and give counsel a chance to respond if they wish to do so, and examine their chance to rule on the witness's qualifications.

MR. SEAWRIGHT: Thank you. We ask that James Witcher be tendered as an expert in geology and hydrology as the Lightning Dock Resource.

MS. MUNDS-DRY: Mr. Examiner, I don't know that I have an objection, but I would like to understand the parameters of his expertise, and I'd like the chance to voir dire the expert.

HEARING EXAMINER: You may proceed withvoir dire.

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VOIR DIRE EXAMINATION BY MS. MUNDS-DRY

Mr. Witcher, as a fellow Aggie, I'd like to

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1 say, "hello."

2

A Hi.

Q I'd like to -- you mentioned that you had
some experience in water quality. Can you expand
on what your experience is in water quality?

6 Α Yes, ma'am. I worked the Interstate Stream Commission with a group of people there in Las 7 Cruces, including John Hawley and Phil King, and a 8 9 couple of graduate students. We did a fairly detailed -- in fact, the first really comprehensive 10 11 study in the Mesilla Basin, the Las Cruces area, 12 from El Paso to Radium Springs, looking at the sources for salinity that are in the ground water 13 in that region. 14

We applied standard chemistry, but we also used a whole suite of isotopes which had never really been done up and down the Rio Grande River. It's really expertise that I have learned playing around in geothermal waters that I learned how the isotopic systematics worked with ground water, so we applied it.

Q Thank you, Mr. Witcher. Have you done a water quality study for this area that's the subject of the application?

25

A Yes. Yes, I have, and I will be speaking

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1 about that in my presentation. 2 0 Do you have any experience with water 3 chemistrv? 4 А Yes. 5 Ο What sort of projects have you worked on 6 relating to water chemistry? 7 Well, really almost all geothermal А 8 exploration efforts require geochemical or water chemistry evaluation and sampling. So I have a lot 9 10 of experience in that regard. And how about for water treatment? 11 0 12 А That's beyond anything I know. 13 MS. MUNDS-DRY: Thank you, Mr. Brooks. 14 I have no objection. HEARING EXAMINER: Ms. Altomare? 15 16 MS. ALTOMARE: No objection. 17 HEARING EXAMINER: The witness is 18 qualified to as requested. You may proceed. 19 DIRECT EXAMINATION BY MR. SEAWRIGHT 20 0 Mr. Witcher, will you please go through the exhibits, 1 through 29, as listed here and 21 22 distribute to respective counsel and hearing 23 examiner, along with your testimony that coincides with that? 24 Thank you. I will begin. The first slide 25 Α

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1 you see here, the first thing I'd like to do is just go through a basic geothermal 101. And then 2 I'd like to talk about heat loss at Lightning Dock 3 4 in terms of the fact that it's a small system, and 5 how that might relate to water quality overall. Then I'll summarize what we know about the sub-6 surface geology from geophysics that have been done 7 8 in the area and from well drilling.

9 Then I'll talk about the water 10 chemistry, and then I'm going to finish up on the 11 water chemistry with an overview of the isotopic 12 systems that we see in the thermal waters at the 13 Lightning Dock. It's very illuminating on what our 14 reservoir looks like in the sub-surface.

15 Then I'll just finish up with what I 16 think is happening there, and some of our 17 recommendations.

18 To start off, this is just a geothermal map of New Mexico. It's a little different map 19 20 than you normally see. A lot of times you just see 21 these "measles" maps with the little red dots for thermal wells and springs. This is broken out into 22 different categories of geothermal. The ones that 23 we're really interested in are the -- high 24 technology sometimes doesn't work like you want it 25

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to.

1

2	Anyway, the ones we're interested in
3	here are the red blotches on there. They are the
4	convective systems, and they're the ones that
5	transfer deep-seeded heat through upflow of water
6	to the shallow sub-surface. The other areas that
7	you see on there are blue, just really deep-seeded
8	geothermal resources that break down to rely upon
9	the background temperature gradient.

A typical convective geothermal system has to have a heat source, and you also have specific structures that it's associated with that give you a flow framework. So you have a recharge area, you have a flow reservoir, and you have a discharge area.

There's two different types of flow that you commonly see with this. When you look at free convection, you're really looking at densitytype differences that could be caused by differences in density from -- thank you. It's just not working.

Free convection is density differences, and you can get that from high-temperature gradients, or you can get it from salinity differences.

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1 In general, the geothermal systems here 2 in New Mexico, to the most part, represent forced-3 convective-type systems. If you take a typical basin, you have the recharge of the upper-end 4 5 basin, and the hydraulic head difference between the lower end and the upper end, tends to drive 6 7 that water deep. So that's a forced-convective-8 type system.

9 Some of that water that flows to the 10 deep, has to flow back out of that system at the 11 other end. We call these "constrictions." It's a 12 very common effect, especially along the Rio Grande 13 rift. At the end of all these basins you have 14 little thermal areas, you have higher salinity in 15 the water.

In fact, the river even increases in salinity to each one of these sites. This is one of the reasons why the northeast trend has been pointed out here in the Animas Valley as having some sort of geothermal importance to the Lightning Dock System.

22 What is actually happening there is you 23 get a little different chemistry change, and you 24 also get a little higher temperature gradients that 25 result in that because water in the upper Animas

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Basin that's been at greater depth, is now flowing out of that basin across the bedrock high into the lower Animas Basin where the Lightning Dock System is.

5 It has nothing to do with the Lightning 6 Dock System. It's just upflow of water over a 7 bedrock high. You can think of it as water going 8 over a dam on a spillway. It's just coming out of 9 a dam that's backing up a sand and gravel reservoir 10 filled with water. So that's one way to look at 11 that.

12 Now, what you're looking at at 13 Lightning Dock is a more intense flow. To do that, 14 you have deep circulated water at some place down 15 here in the reservoir, and it's capped by an 16 aquitard which keeps it from flowing to the 17 surface. But in certain areas, these aquitards 18 have been stripped away structurally or erosion.

19 So what happens is that water then 20 flows to the surface in an upflow zone. This -- I 21 used the term "hydrogeologic window." A Lightning 22 Dock can be one of these, or it could be one of 23 these. I'm going to show you -- I probably prefer 24 this model. There may be a minor sort of leakage 25 on the west side through fault zones where an

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1 aquitard may be displaced.

This particular system is fairly common in the Rio Grande. The Socorro Peak System is one of these. Radium Springs, north of Las Cruces, figures in to a system like this. McGregor System in Southern New Mexico, and, also, there at Las Cruces on the NMSU campus, A-Mountain, this is a type system you see for that.

9 Now, then, outflow dynamics. What are 10 we looking at here? We've got a deep reservoir, 11 we've got an aquitard, we have a hydrogeologic 12 window that allows that deeper water to flow up 13 towards the surface. When it gets near the 14 surface, then it flows out laterally in the shallow 15 ground water and that's the outflow.

The current production in Lightning Dock is in this outflow plume in shallow depths. What we don't know is what's down here. That hasn't been tested, and I'll go through some of this.

What we do know and can say is -- we can say something about the total heat loss on this system provided that we've got enough temperature gradient data, and we assumed all the heat on the system was lost by deduction above the water table

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or above the geothermal outflow. And when we do this, we come up with a total heat loss of about 6 to 9 megawatts thermal. That's not electrical, but it's megawatts thermal. Convert that to electricity, you have to -- it would be a lower number.

Now, the numbers that were thrown out 7 earlier, 20 megawatts and that sort thing, that's a 8 different sort of number. Let me explain that to 9 This number is a renewable geothermal 10 you. discharge heat loss. The 20 megawatt electrical 11 that you saw was a number that is basically heat 12 mining. In other words, it's not sustainable for 13 100 years, it's not sustainable for 300 years, it 14 may only be sustainable for 20 or 30 years, and 15 then it's done. Then you have to wait a long time 16 for that system to heat back up. 17

With this system, as long as you're 18 producing at a lower rate that's natural heat loss, 19 then it's basically and really a sustainable and 20 even a renewable rate. That's not the only factor 21 that enters in here. When you start producing 22 this, you're also dropping the water table and 23 creating a cone of depression, which affects all 24 the other users in the area. So with this 25

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1 background, let's move on to something else.

This is just a temperature profile. This would be an outflow plume right here. You usually get a rollover, and then the temperature may kick back out. That high temperature or high heat flow that's used to sum up the amount of heat loss over the system, is this straight area in this part of the temperature curve.

9 Lightning Dock. Here we are at Southwest New Mexico. Here's a map showing how 10 that total heat loss is calculated. These are 11 temperature gradients. I don't have all 12 temperature-gradient data that's available on this 13 There's certainly enough to understand what 14 map. the total heat loss is. 15

Now, then, this is a system that's contained in volcanic rocks. I'm going to show you another system here that has a reservoir in carbonate rocks like the Horquilla limestone has been mentioned as a reservoir. I'm going to show you some important differences.

One difference that you need to know right off the bat, this is your upflow. Underneath this is where your upflow zone is. This is where your highest heat flow is, then that flows out.

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It's almost a point source. The actual upflow zone
 may not be any bigger than two or three of Dale
 Burgett's greenhouses out there.

Now, we're going to take a look at a 4 5 system that's been well drilled, and I know a lot 6 about it. This is out on McGregor Range out on Fort Bliss land, northeast of El Paso, just in New 7 It's a geothermal system contained in 8 Mexico. paleozoic rocks, carbonate rocks. This is a much 9 10 bigger system, and it's got a much larger area. 11 We know the permeability is several. 12 The reservoir is maybe 2- to 3,000 feet thick. The heat loss on this system is significantly higher. 13 You'll also notice there's several discreet upflow 14

15 zones within this system. So it's a much larger 16 system.

Another big difference is the 17 salinities in these carbonate reservoirs are high. 18 19 The lowest salinity I've seen in a carbonate reservoir in New Mexico is 3,000 to 2,500 parts per 20 21 million. Usually it could be up 7- to 10,000 or This particular system we're looking 22 even higher. at is 7- to 8,000. It's sodium chloride water. 23 Lightning Dock. This is just a summary 24

25 of the structural settings. We've already seen

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some of this today. One of the things I'm going to talk about right quick is that a laramide basementcored compression uplift. This is really that northwest structure that was talked about. It's been confused as an overthrust belt?

6 The overthrust belt is a concept that 7 was thrown out by the U.S. Geological Survey, and 8 Lee Woodward at the University of New Mexico, back 9 in the 70's. It was applied in Arizona and in New 10 Mexico. Philips Petroleum went out and spent about 11 \$40 million to go in eight or nine homes and prove 12 that the overthrust belt does not exist.

What we know now from mapping in 13 14 mountain ranges by faculty and students at the University of Arizona and New Mexico State 15 University, that these zones are really basement-16 17 cored. They're not horizontal transport. They're more basic, they're more vertical transport. You 18 do have minor thrust belt properties, but it 19 doesn't make ground preparation. 20

This is an example of the basementcored uplift in the Las Cruces area. You can think of these things like the Wind River Range in Wyoming. All the geothermal systems pop up along these and their structures, on their virgin

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structures. That's where your fracture
 permeability is.

This -- these areas are where the regional aquitards have been stripped away. This is the regional hydrogeologic window with smaller more discreet windows superimposed on that. It's something that you can predict across the entire region.

9 Now, then, Lightning Dock. We've got a west/northwest trending lineament, and you see 10 11 big structures and mountain ranges in Southeastern 12 Arizona and Southwest New Mexico. That's the basement-cored uplifts that have been mapped. 13 Thev 14 have a west-northwest aeromagnetic signature, and 15 they are the largest scale structures in Southwest 16 New Mexico and Southeastern Arizona. We're looking at sometimes 10-, 20,000 feet of vertical 17 18 displacement on these things. This trend, you've probably -- some of you may have heard the term, 19 20 "Texas lineament." That's what these structures 21 represent.

Lightning dock. To get more specific, it's sitting right over this aeromagnetic lineament. There's two wells that are 7,000 feet on each side of it that we can get some idea of

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1 what's going on there.

2 And, also, in the Pyramid Mountains 3 just to the east, there's some neogene hydrothermal deposits there that are probably very good analogs 4 5 to today's geothermal system at Lightning Dock. There's an area northwest trending 6 7 calcite veins, that when you sit up there with a 8 front compass and you take a strike on these things, it goes right in to Dale Burgett's 9 10 greenhouses down there. You have a fluoride mine nearby. 11 There's been fluid inclusion work done on that. 12 The temperatures and the salinities in these 13 14 deposits right here are the same as - based not too 15 different to the Lightning Dock, in many cases the 16 same. Now, let's take a look at what the 17 18 geology looks like in the subsurface. This is the 19 well to the north, the Cockrell Pyramid well. This is the Federal Steam Reserve well to the south. 20 There's something very striking here when you look 21 22 at it. One is, you have a tertiary unconformity on the Mississippian Escrabosa right here. 23 Your unconformity over here on the 24 tertiary is on the Mesozoic Bisbee Group. 25 Yet, at

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the same time, you've got Precambrian Basin in the same elevation on each side. So how do you do that? Well, you take this side over here and you uplift it as a mountain range, and you erode everything down to the Mississippi.

6 The stuff that you're eroding off that 7 mountain block, you're depositing it right here, is 8 the Bisbee Group. In fact, you see the basin 9 conglomerate. It's an early cretaceous 10 conglomerate. It's called the Glance Conglomerate, 11 or they call it the Hell-to-Finish here in New 12 Mexico, also.

13 Then, this was during a time when you 14 had a west/northwest trending rift zone that 15 crossed Southeastern Arizona and Southwest New 16 Mexico, just like the Rio Grande rift. Then, 17 during a compressional time frame, later during the 18 laramide, these basins were inverted into mountain 19 ranges.

20 So this structure right here went down, 21 and now it's inverted there, and the laramide is a 22 basement-cored uplift. And that returned the 23 Precambrian, basically, to the same elevation. 24 And, then, of course, you have later basin range 25 faulting that dropped this block down.

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Now, how do I know all of this? From the logs in the two deep wells, but we also know from the log of the AmeriCulture 2 well. We know exactly what's in that hole. There's no guessing. We cored it, so we've got little round cylinders of rock that we pulled out of this hole.

7 So we know where the stratigraphy is in 8 the subsurface, and there's no guessing. And we 9 found out one important thing. One of the units 10 that's been previously called rhyolite, is not, in 11 fact, rhyolite. It's just silicified Gila 12 Conglomerate.

Another thing that we found out is that there's a rhyolite flow in there that's probably the ring fracture zone flow of the caldera that Wolf Elston from UNM identified in the Pyramid Mountains to the east. Another structural control on this geothermal system.

19 Now, then, let's back up here a second. 20 This is a complete Bouguer gravity map of this 21 whole area. This data is public domain. It's 22 available on a website at the University of Texas 23 at El Paso. They operate a national clearing house 24 for gravity and areomagnetic data.

25

So, basically, I have the same benefit

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of looking at gravity data as Cunniff and Bowers 1 2 do. I will add one other thing. Mr. Cunniff is 3 not a geologist. He has no background in the geosciences. There are also other studies that we 4 also had. I had the benefit of geophysical 5 information looking at all these studies. I just 6 got it from a little different sources, but I also 7 present my data. I don't hide it someplace. 8

9 This is -- these points right here are actual gravity stations. This is your Bouguer 10 11 gravity map. The Lightning Dock Geothermal System sits on a horst block. It's a block that's been 12 uplifted within the basin, and then it's been 13 buried by alluvial fans coming off the mountains. 14 15 These gray areas you see here are really fault 16 zones. They're fault zones interpreted to gravity data. That's why they show up as fairly wide 17 18 zones.

19 This is the Animas Valley Fault. 20 That's a hot late Pleistocene Fault. It actually 21 displaces caliche on the alluvial fans. You'll 22 notice that it's not a basin-boundary fault as some 23 people have wanted to make it, including the 24 Cunniff and Bowers' report. This fault actually 25 intersects and goes right down through the top of

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that uplift. I'll show you a cross section of how
 that works.

This is the first cross section, and that's the second cross section, and I'll go back to these cross sections. I just wanted to show you where they are.

AMC-2 is the AmeriCulture 2 well that 7 we used as control. The AmeriCulture 2 well lets 8 us know something about the deep 55-7. This is the 9 7,000-foot hole. This is a temperature gradient 10 hole that Cunniff and Bowers reported. The 52-7, 11 that's that deeper test hole that they drilled, 12 Cunniff and Bowers. And then 12.7 is their 13 temperature gradient hole. 14

So cross section 1 is your blue line up 15 here, and this is cross section 2. Now, to give 16 17 you an overview of what we're looking at, the gravity data says there's an eastbounding horst 18 block fault over in about this region here. 19 This is your Animas Valley Fault, the Pleistocene Fault 20 This is an inferred westbounding fault, 21 here. trending northeast that we see from drill hole 22 23 data.

Then this is another fault which may actually be a northeast tending fault. I drew it

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in here as a north/south fault without having any
better control, but I know there's a fault there
because of the differences in the lithology in
these holes.

Unfortunately, we don't know exactly 5 6 where we're at on these holes because the geologic 7 logs that Cunniff and Bowers threw out, didn't have 8 any detail in it. They just said it was volcanics. 9 If you looked at the log that I showed on the AmeriCulture 2 well, it's not just 10 11 volcanics, there are several different types of volcanic layers that are in there, and this is 12 important. Each one of those has different 13 hydrogeologic characteristics. They'll have 14 15 different hydroconductivity, they've got differences in permeability and drillability. It's 16 17 an important feature.

This is the first cross section. This is more or less the one that goes east/west. This is the AmeriCulture 2 well. This is the Horquilla formation. There's only two wells in the Lightning Dock System that hit the Horquilla formation; AmeriCulture 2, and 55-7.

Neither hole has sampled the Horquilla
chemistry. Neither hole has tested either one of

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those formations for hydraulic conductivity or production capability, at least to my knowledge. The only testing that's been done on 55-7, was done back up in the volcanic interval, which I'll show you in a moment.

6 This is hole 52-7. It bottomed in 7 volcanics, so there's a huge structure between here 8 and there. 12-7 out here bottomed in basin fill. 9 There's no vertical exaggeration here. Horizontal 10 is the same as vertical.

This is the ring fracture zone rhyolite flow, and I've tossed this back and forth with Wolf Elston at UNM. He's the expert on these volcanics in that mountain range, and he agrees with my assessment on those. We're going to nail that down here in the very near future. I'm getting this stuff age-dated so we'll know exactly what it is.

18 The other thing is, is there may be a 19 ring fracture zone rhyolite intrusion over here. 20 This is the aeromag-high that Cunniff and Bowers -this may be what's causing their aeromag-high. 21 I 22 didn't see their aeromag-data in detail, but you 23 can pull the regional aeromag-data out and there's 24 that signature. All they did was repeat what was 25 already out there.

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This could be an upflow zone or close to it. This is your fault that -- the Animas Valley Fault; it's pleistocene. I show it intersecting the surface.

This is the silicified Gila 5 Conglomerate. The volcanics in this block and in 6 7 this block are pretty much the same elevation, which tells me that this is really an older fault, 8 for the most part. It may have had minor movement 9 where you had some displacement above this, but 10 this is probably impediment or an erosional 11 surface. 12

Section 2. This is the section that's more or less southwest. This connects the AmeriCulture well 55-7 hole, and then the 36-7 heat-flow hole out here. There's a huge structure here.

Now, then, the elevations of these 18 formations between the AmeriCulture well and the 19 55-7 well are basically the same. There are no big 20 faults in here. It's not like you see in these 21 22 cross sections where everything is just busted all up like the dominos or cards. It's not that way at 23 all. There's probably some small-scale structuring 24 here, but if it's in there, it's not large 25

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displacement.

1

2 The other feature is that this came up 3 earlier today. I had a meeting with John Shomaker in Albuquerque, and we were talking about where the 4 production wells were sited, and where the 5 injection wells were sited. I told John that I 6 thought it was strange that they were producing out 7 of this block. That's where their plan was to put 8 9 their production wells here, Raser, and they were going to put their injection wells in this block 10 11 Well, let me back up and you can see it a here. 12 little clearer.

Production wells here, injection wells here. They still have one of their injection wells on this block. The other important part of that is, is that Raser has no idea what's down here. It's never been drilled. Raser has no idea what's down here. It's never been drilled.

Just to summarize, this is your hot wells horst block. This is your west/northwest tectonic inversion. The yellow dots are the deep wells, and this is your ring fracture zone of the caldera. The cauldron is just the eroded caldera. A caldera is a volcanic crater, for those of you that don't know what that is. It's a very large

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feature, and this is your Pleistocene Fault.
So the intersection of all those
elements help to localize an upflow zone or a
hydrogeologic window. The hydrogeologic window is
probably a ring fracture zone where it intersects
that young fault.

7 This is a Piper diagram of thermal 8 water chemistry. This is not chemistry that you 9 expect out of a carbonate reservoir. It's a sodium 10 sulfate water. It's got low TDS, 1,100, 1,200 11 parts per million. It's also a fairly tight 12 grouping here.

This is the AmeriCulture Federal well, 13 and these are the three Burgett wells. If you were 14 15 to take water chemistry and a carbonate block of these temperatures, you'd come out with a lot 16 different temperature, or a lot different 17 chemistry, and a lot different TDS. 18 Oxygen isotopes, hydrogen isotopes. 19 Now, this is meteoroic water. It pretty much 20 follows meteoroic water line. These are just 21 isotopes with water and hydrogen. It's basically a 22

ratio of oxygen 18 to oxygen 16, compared to a
standard. It's in per mil. It's not percent, it's
per mil. Like these are very small ratios.

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Deuterium is the heavier hydrogen, and that's
 hydrogen 2 versus hydrogen 1. This is just water.
 This is water that's coming out.

This trend that you see coming out in 4 this direction, it's not interaction with rock, 5 necessarily. This is probably a boiling in an 6 evaporation line. Certainly, the colder waters, 7 8 these may be -- there may be a little bit of subsurface boiling in the shallow subsurface. 9 Now, then, here's the interesting part. 10 We sampled these for also carbon isotopes, carbon 11

13, carbon 12 ratio, and, also, the sulfur 34 or

13 sulfur 32 ratio, and, also, the strontium 87,14 strontium 186 ratio.

12

15 So what we found out, is that this geothermal waters that are flowing up in the 16 outflow plume, they have never interacted with a 17 carbonate reservoir ever. They have been in 18 volcanic lives their entire history. Because if 19 they had been in volcanic rocks -- I mean in 20 21 carbonate rocks, you would have a strontium isotope ratio of less than .71, because that's what 22 Paleozoic Ocean, strontium isotope ratio was. 23

In fact, the sulfur and the carbonisotopes and the strontium isotopes are used in the

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petroleum industry to take a look at stratigraphy 1 in the subsurface, and they don't have micro-2 3 fossils to identify exactly where they're at. 4 Has the train missed us yet? HEARING EXAMINER: Well, after several 5 interruptions of ignoring it, it's best if we just 6 7 instruct people to talk loud and try to talk over the trains. If you will do that, we can proceed 8 ahead. 9 THE WITNESS: I will do that. 10 The carbon isotopes, they're far 11 different than paleozoic carbonate. The sulfur 12 isotopes are a little closer. You look at the 13 sulfur isotopes, they are a real tight little group 14 there. One metal that's a source of that, and 15 16 that's probably pyrite in a rhyolite or granitic intrusion here that's associated with that caldera 17 18 or even Precambrian. The strontium isotopes, to get the 19 ratios that you have there, you have to flow 20 21 through -- you have to flow that stuff through a rhyolite or granite. There's just no other way you 22 can do that. 23

24Okay. We've pretty much covered some25of this. I don't think it will sustain more than 2

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or 3 megawatts. I just base that upon drawdowns that would probably take place if you produce 3,000 gallons across that outflow plume. So the nature of this geothermal system is not well known at all contrary to what you've been told today.

6 Deep reservoir. We don't know anything 7 about it. It's never been tested. It's never been 8 drilled except by one hole, and that was the 9 AmeriCulture -- or two holes; the AmeriCulture 2 10 hole, and, also, the 55-7 hole. They're the only 11 holes that gotten into the paleozoic area. 12 Everything else is conjecture.

13 So when I hear "1,300 parts per million" thrown out as a number for what they're 14 going to produce, I see the isotopes showing that 15 that water has never flowed through a carbonate 16 I know that that is not correct. 17 reservoir. The real chemistry, if there is a 18 reservoir of carbonate rocks, it's going to be much 19 20 higher TDS. It's probably going to be at least 21 3,000 TDS. It's probably going to be a sodium chloride water, and it might have arsenic and other 22 stuff in it. We don't know. It's never been 23 24 tested.

25

So the Lightning Dock Geothermal System

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is really in a wild-cat exploration stage. The
only thing that we know about that is what's going
on in the outflow plume. Everything else is -we've got a lot of work to do.

5 So I think the gist of my recommendation would be is that these not be 6 7 approved for injection purposes until we know what's going to be injected in that hole for the 8 production side. So they ought to just be 9 10 permitted as a test well or exploration well 11 because that's, in fact, what those holes will be. That concludes -- well, no. I've got one other 12 13 thing.

This goes to the thermal output. This would be your natural output, like Lightning Dock would be right about here. A lot of people will say, "Oh, you can do that five, ten times higher." Well, yeah, some people do that. We don't know how sustainable this is going to be over the long term either.

On the other side of it, there's just as many points to fall back on the other side. So that's another point that I wanted to make. I'll just end with a picture of an air-cooled tower, the PureCycle 200. This is one of the items that came

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up earlier in today's discussion.

1

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2 So with that, I think I've covered all 3 I wanted to cover.

4 Q (BY MR. SEAWRIGHT) Thank you. Have you 5 reviewed Raser's injection well application and 6 related materials posted on the OCD website?

A No, I haven't.

8 Q As an expert in hydrology, based on what 9 you know regarding Raser's application, does it 10 raise any concerns in particular?

11 A It raises many concerns. One of the main 12 concerns is, is that to do an analysis long term on 13 the effects on a reservoir, you need some actual 14 data to project this out. You also need some 15 chemistry information to understand what you're 16 going to be injecting, and where you're going to 17 put that.

So without hydraulic testing, well 18 testing, there's a real lack of information there 19 The other side of it is, is that the 20 on that side. 21 information that I've seen developed by Raser 22 that's been put out, and also the stuff that Cunniff and Bowers produced and some of the other 23 reports that they're relying upon, there's very 24 little actual information in those reports. 25

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In fact, a lot of the stuff that's in 1 2 there is just flat not right. They haven't even 3 looked at their own data and analyzed that correctly. Simple things like looking at a 4 geologic log from a well you just drilled and draw 5 a cross section. These cross sections, I haven't 6 7 seen them. The ones you've seen are probably the only cross sections that exist for the Lightning 8 Dock right now. 9

10 So as a hydrologist, I have real doubt 11 as to whether there's adequate information to make 12 any projections on drawdown reservoir life, where 13 that chemistry is going to go.

14 0 Perhaps my previous question was misunderstood. You were directly involved in the 15 development of the letter that we submitted 16 17 requesting a hearing, and that was technical, it was technical in basis and it mentioned a 18 substantial -- in terms of details, related to the 19 20 application materials that Raser has submitted of OCD, and, as you recall, we had some communication. 21 I just want to, just for the record, 22 ask you, again, that you did have the opportunity 23 and have reviewed some of the application 24 materials? 25

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1 A Yes, I have reviewed the application 2 materials.

3 Q You have concerns, but what are your4 general chief concerns?

A Well, they're two-fold, really. One, which we're not really addressing here today, but I believe that if you were to inject 15,000 gallons a minute across that cross section area where I showed the volcanics, that western block, you can do a simple calculation.

If you calculate a 2 kilometer cross section and say that's a half a kilometer thick, and you shove 15,000 gallons a minute across that, you're looking at about a meter and a half per second velocity. If you figure 3 percent permeable porosity or Darcian-type porosity.

So you do anything like that, you've 17 got thermal breakthrough. The reality is, you're 18 not going to have 3 percent porosity with little 19 tubes going from one end to the other. They are 20 going to do all this sort of thing, but you're 21 22 going to have fractures in there also. So you still are going to have real potential for thermal 23 breakthrough. That goes to the water quality 24 25 issue.

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If you have chemicals in there that are hazardous, say, from the cooling tower, or potentially that, one might argue that the temperatures in that reservoir might break these chemicals down. But if you're scooting that stuff along over there at a real high velocity, you're going to be producing it, say, at AmeriCulture.

8 And then the other issue is, we have no 9 information on the reservoirs that Raser wants to produce from. There's not been any testing in the 10 11 carbonate reservoir they have as a target. In the lower, deeper paleozoic or the deeper volcanic 12 rocks that they're going to produce from, they've 13 14 already presented data today where the quantities are increasing. So there may be some leakage in 15 16 some of these zones from greater depth.

17 The other thing is, you create a large cone of depression out there on that basin side of 18 that horst block out to the west, and you create a 19 20 large cone of depression if it's connected with shallower stuff. Then you start drawing in basin 21 water elsewhere in the basin. There are basin 22 waters out there that are probably fairly saline. 23 You've got to fly it down there to the south. 24

25

In the subsurface stratigraphy in that

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area, there's probably some other finer grain applied-type materials, which is fairly prominent in these basins all over the southwest that would contribute to higher salinity.

5 You can get leakage of that in there, 6 and then things just start going downhill from 7 there, and then that starts going into the 8 injection cycle, and then it has a potential to be 9 produced over in the outflow plume.

10 Q So it's conceivable that chemicals that are 11 injected into injection wells can make their way 12 quite quickly to production wells of AmeriCulture? 13 A Yes.

Q The technical velocity that we discussed. At this time, is enough known to create an acceptable level of assurance that deep injected water won't make its way back into the shallow ground water?

19

A It's certainly possible.

20 Q These concerns that you just raised, what 21 might they mean to businesses and even human beings 22 whose sustenance relies upon this resource?

23 A I think without further information, it24 puts things in doubt.

25

Q You had mentioned the possibility of

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thermal breakthrough. If this were to happen,
 would this be a -- needless to say -- a very brief
 phenomenon, or is it potentially longer duration?

It's potentially very long in duration. 4 А Ιf vou overproduce a reservoir -- well, I read a study 5 6 recently -- in fact, it was published by the Geothermal Resources Council, and the author is 7 also the president and CEO of GeothermEx. 8 He was 9 talking about if you actually produced a reservoir in a maximum rate, and just used all heat in a 30-10 year period of time, his calculations from his 11 model was, give or take, anywhere from 100 to 300 12 years for that reservoir to recover. 13

HEARING EXAMINER: Okay. If I may
interject. No counsel is objecting, but I believe
the issue of waste of geothermal resources is not
before this -- not a matter for consideration in
this hearing.

19 So in the interest of conserving our 20 time, I would suggest we move to water quality 21 issues.

Q (BY MR. SEAWRIGHT) Are there risks associated with the use of binary working fluids with regard to ground water contamination?

25

A Oh, absolutely. In binary power plants,

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1 that working fluid that's traveling through that 2 power plant and heat exchangers, if the seals go out, you've just started leaking that organic fluid 3 4 that they're using as a working fluid into your 5 geothermal effluent that you're sending out to your injection well. There is a record of this out 6 I can't cite anything right off the top of there. 7 8 my head, but it has happened.

9 So the mere fact that you have a binary 10 plant, and for some reason the seals start leaking 11 and you're not paying attention to it, you can end 12 up injecting your working fluid back into your 13 reservoir.

And, also, whoever else may be down stream from all of that, could pump that stuff down to the ground water.

17QDo you think that the injecting can18potentially contaminate the working fluid, and19would it satisfy WQCC water quality standards?

20

A I don't believe it would.

Q I'd like to ask you to elaborate on a comment made by witness Hayter earlier that you were somehow involved in the proposed relocation of two of the three geothermal wells which is the -that came as a bit of a surprise, given that you

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and I had never heard of that until today.

2 Would you please elaborate on that 3 conversation?

A Yeah, I will elaborate on that. I thought I covered that a moment ago. In the meeting that I had with John Shomaker in Albuquerque, in his office I brought up the information that I had that I used to make these cross sections that you just saw.

I made the comment to John that I 10 11 didn't think it was a good idea to be injecting in one structural block, while producing out of 12 There was potential that that -- for the 13 another. purpose of what Raser had stated it was, there 14 15 wouldn't have been any recharge to that producing 16 reservoir. It would have been in a totally 17 different structure block.

18 So, apparently, that was changed 19 because of that comment. I didn't recommend any 20 specific changes in sites or locations or anything. 21 I was just making a general comment that I thought 22 that it was not a good idea to inject in this 23 structural block when you're producing out of that 24 structural block.

25

1

Q I just want to confirm, you stated in your

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testimony that the state of understanding of the geology and hydrology is very mature. And you made -- is it not true that you made the recommendation that the wells, if permitted, should be done so as exploratory wells, both for the production and injection wells?

A Yes.

7

10

15

22

Q In your opinion, is Raser's developments9 sustainable?

A As it's currently configured, no.

11 MR. SEAWRIGHT: I'd like to move the 12 admission be made into the record of Exhibits 1 13 through 29 that Mr. Witcher used in his testimony. 14 HEARING EXAMINER: Objections?

MS. MUNDS-DRY: No objection.

16 MS. ALTOMARE: No objection.

17 HEARING EXAMINER: 1 through 29

18 propounded by Seawright will be admitted.

19 MR. SEAWRIGHT: Pass the witness.

20 HEARING EXAMINER: Okay. Ms. Munds-Dry.

21 MS. MUNDS-DRY: Thank you, Mr. Brooks.

CROSS EXAMINATION BY MS. MUNDS-DRY

Q Mr. Witcher, I'd like to understand your familiarity with the Cunniff and Bowers report, the 25 2005 report. Had you previously reviewed that

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1 report before today?

A Yes, ma'am. In fact, I've seen that report off and on, looking at it for probably the past year or more. It's a report that's public domain. It's available off of the Department of Energy website.

Actually, they have two reports. They have one for one study, and another for another study. They kind of go together. You have to see both reports to see all that temperature in there. So, yes, I'm familiar with it.

Q Okay. Did you consider that report, take that report into -- or those two reports into account when you wrote your report for the New Mexico Geological Society in 2008 report?

16

A Yes, ma'am, I sure did.

Q If we could go through some of your exhibits. On Exhibit 14, Mr. Witcher, I notice that you have, of course, sited to your sources, and this appears, if I understand correctly, to be a regional view of the Lightning Dock area; is that correct?

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23 A Yes.
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Q And I notice that you do not site to Cunniff and Bowers in your report; is that correct?

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А No, I didn't site the Cunniff and Bowers 1 report on here. 2 3 I have to ask, since their report was more 0 4 site-specific, did you take that into account in 5 these mappings? Yes, ma'am. 6 А 7 0 If we could go to Exhibit 16? 8 Α Okay. Is that it? 9 Thank you. I notice in your Q Yes. 10 illustrations here you have -- looks to be the AmeriCulture number 2 well, the 55-7, and the 11 Cockrell 1. 12 Where are your control points here for 13 your illustration on this cone here? Is this your 14 interpretation? 15 This is an interpretation, but there's 16 Α something like that in the subsurface. This is a 17 18 diagramatic drawing. It's not a true cross 19 section. The structure there would be much more 20 complex. What we do know, there is a big fault 21 zone here that has inverted movement on it. Our control, what we do know is what's in these wells. 22 We know that to be true. 23 24 This particular area right here, that's a gravity low so I know there's a fault there. 25 Ι

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also know there's a fault in that proximate 1 2 location because the tertiary basin fill is much 3 thicker in the Pyramid Cockrell well, than it is in 4 the AmeriCulture State 2. 5 Could you do it with multiple faults? Q Certainly. In fact, there's probably a 6 А step-down of these faults in this zone right here. 7 8 Probably. Thank you, Mr. Witcher. If we can go to 9 0 Exhibit 18? 10 11 Α Okav. HEARING EXAMINER: What exhibit? 12 13 MS. MUNDS-DRY: Exhibit 18. Sorry. 14 I'll speak up because of the train. 15 THE WITNESS: This one? 16 0 (BY MS. MUNDS-DRY) Yes. Thank you. You mentioned that you did this log of AmeriCulture 2, 17 and you were mentioning, I think, during your 18 testimony that there hadn't been any testing of the 19 chemistry or TDS in any of these wells in this 20 21 area. Why hasn't AmeriCulture done any 22 testing in their wells? 23 We had some problems with the final 24 А configuration of this well, and we weren't able to 25

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1 get a water sample out of the water. Believe me, I 2 would have loved to have had one, but we just 3 weren't able to do that. We did encounter, you 4 know, some rocks that we've been interested in 5 testing.

6 Q Thank you. If we can please then go to 7 Exhibit 23. That's it.

A This one?

8

9 Q Yes. Is this a site-specific diagram or is 10 this a generic diagram?

This is a Piper diagram, and it looks at 11 Α the mil-equivalent ratios of your major cations and 12 It is site specific. It is -- all these anions. 13 wells are out that area of the outflow plume. 14 These are thermal wells of Dale Burgett's 15 greenhouses, and then this is the AmeriCulture 16 17 Federal well, which is just to the east of the -probably about 600 feet, 800 feet, maybe, east of 18 the fish farm. 19

20 Q Thank you. If you could go to Exhibit 25. 21 Yes. Thank you. You were discussing the -- what 22 evidence we have for a reservoir. I guess my 23 question is: If you don't find this to be a 24 reservoir with hot water, then what is it, in your 25 opinion?

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A I don't understand the question, I guess. Q From what I understood from your testimony, you didn't think that this was simply a reservoir of what I call "hot water"? You probably have a more technical word.

A Well, the geothermal waters that we sampled here, I term those as geothermal waters while they are less than 250 degrees Fahrenheit. They are still geothermal waters. They're thermal -there's thermal water.

But my point is, with this diagram or table and my discussion of these isotopes, is that if there's hot water that flowed through carbonate rock or limestone, you can have completely different carbonate ratios, different sulfur isotope ratios, and different strontium isotope ratios. The data is so much different.

I know that this water, the thermal 18 water in Lightning Dock, all the stuff that we know 19 in that outflow plume, that water has never flowed 20 through carbonate reservoir or through carbonate 21 The only way it can get to the surface from 22 rock. upteen thousand feet down there, is it has to flow 23 up through an intrusion, a rhyolite intrusion, and 24 then flow out -- there's an outflow plume in the 25

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Gila Conglomerate and in the volcanics.

1

Or if it's coming from Precambrian basement, it may have flowed across carbonate rocks in the sense that the carbonate rocks were sealed off from this upflow by silicification of the limestone.

So this geothermal water has never
flowed through limestone; it's never had a
limestone-deep reservoir. It's always had a
tertiary, rhyolite, volcanic reservoir or a
Precambrian reservoir.

Q And if it's flowing up, as you suggest,
wouldn't the TDS in the formation be higher?

Α If it's water that has flowed through 14 No. a rhyolite and a granite, it's not going to reach 15 as high TDS as it would if it's flowing through a 16 granite -- or, I mean, a carbonate rock. 17 1,100 parts per million is pretty good water. 18 There are several hot springs in New Mexico that flow out of 19 rhyolite and have rather low total resolve solids. 20

21 Q Thank you. If you could go to Exhibit 26, 22 and this is your summary of findings?

A Okay.

23

Q Mr. Witcher, your first finding is that you find this is a small geothermal system. I take it

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you disagree with Mr. Cunniff and Mr. Bowers? 1 2 Α Absolutely. 3 And, also, with GeothermEx's report? 0 Absolutely. 4 А On Exhibit 27, your list of 5 0 recommendations. Do you have any recommendations 6 7 as it relates to the discharge plan? Well, I think the discharge plan, you can't 8 А approve a discharge plan into the injection wells, 9 10 if you don't know what the chemistry of the production was. We don't have that. 11 12 But you do understand that the APDs are 0 13 approved separately, and not in this proceeding? I guess I know now. 14 Α Okay. On Exhibit 29, you last -- the 15 Ο picture of the PureCycle 200. Are you familiar 16 with this system? 17 18 А No. Is this something that you are recommending 19 0 be used? 20 Just used as an example of an air-21 А No. cooled cooling tower. 22 What was your purpose for introducing this? 23 0 It was -- the purpose was to point out that 24 Α that technology exists out there, and it exists 25

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1 with the people that are -- the background with UTC, which is Carrier. This is their equipment. 2 3 Are you aware that this system is used 0 4 actually as a waste heat system, and not geothermal 5 systems? А I'm not aware of that. 6 7 0 Are you aware that this is not designed, actually, for geothermal systems in any way? 8 9 Α I'm not aware of that. 10 0 Are you aware that there's actually no 11 geothermal power plant that uses this system? Α I'm not aware of that. 12 I think I just have one more question. 13 0 14 You mentioned a meeting between you and Mr. Shoemaker? 15 16 А Uh-huh. 17 0 I believe you mentioned that the -- your 18 argument, in any event, is that it didn't make 19 sense to have injection wells in two different 20 structural blocks as you see it. Did Raser move their injection wells 21 into the same structural block? 22 23 А Not all of them. But did they move two of them all into the 24 Q 25 same block?

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1 A Well, actually, they only moved one of 2 them.

3 Q Okay.

A And the eastern-most injection well is actually in a complete different structural block out to the west. So now there are three different structure blocks.

8 MS. MUNDS-DRY: Thank you. I have 9 nothing further.

10 HEARING EXAMINER: Ms. Altomare.

MS. ALTOMARE: Thank you, Mr. HearingExaminer.

13

## CROSS EXAMINATION BY MS. ALTOMARE

14 Q Regarding the AmeriCulture wells, how many15 total wells does AmeriCulture have?

16 A In terms of geothermal wells that I've 17 worked with, they have three thermal wells. They 18 have AmeriCulture 1, AmeriCulture 2, and the 19 Federal AmeriCulture well.

20 Q Okay. AmeriCulture 1 and AmeriCulture 2 21 are thermal wells. Are they State or Federal? 22 A Those are State.

Q How deep are the -- just general, ballpark,
the depth ranges for those wells?

A Well, AmeriCulture 2 is 2,100 feet, and

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AmeriCulture 1, gee, I want to say 400 feet. I 1 2 don't have an exact number on that. I haven't 3 looked at that. The 2,100 foot, though, is the deepest that 4 0 5 they have? 6 Yes, and that's the AmeriCulture 2 well. А 7 Ο What is the temperature range, generally, 8 of these wells? 9 А They run anywhere from 180 to 112; 107 to 10 112 degrees centigrade. 11 0 112 you said? Yeah, 100 degrees centigrade. 12 Α 13 Centigrade. Where are the temperatures 0 14 Is that the water as it comes up to the measured? 15 surface? 16 Yeah, there's two ways you can measure the Α 17 temperature in these wells. One is you take a 18 measurement at the discharge, and the other is with 19 a temperature log. You actually go in with a probe 20 and measure temperatures at discrete intervals all 21 the way to the bottom. 22 In your experience, which methodology is 0 used by AmeriCulture for these temperatures that 23 you are referencing? 24 Well, the temperatures that I'm talking 25 А

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about, it's a combination of those. That's --1 2 THE REPORTER: I can't hear you. 3 THE WITNESS: It's a combination of temperatures from two different methods. Either a 4 temperature log, or a sample at the surface from a 5 discharge, either while pumping or while drilling. 6 (BY MS. ALTOMARE) About how often is 7 0 testing of temperature and chemistry done at well 8 sites for the AmeriCulture wells? 9 10 Α It's sporadic. There's not a regular schedule for that. 11 Is there a schedule for a particular 12 0 chemistry and TDS testing? 13 Α There hasn't been, no. 14 Do you know what particular kind of -- when 15 0 there is testing done, what exactly is tested for? 16 17 Almost always it's tested for inorganic А chemistry, complete anion, cation, plus silica, 18 maybe arsenic. 19 So whatever things that AmeriCulture has 20 0 determined might affect the fish that it relies on? 21 Yeah, and there may be other sampling that 22 А I'm just referencing to the sampling that 23 qoes on. I've been familiar with in terms of looking at the 24 reservoir from a geological standpoint. 25

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1 Q Okay. So you're not familiar with the 2 regular sampling that AmeriCulture does in the 3 course of its business?

A

No.

4

9

5 Q Are you familiar with the recordkeeping 6 that AmeriCulture keeps, as far as sampling and 7 monitoring its wells, and the quality of the water 8 on its particular sites?

A No.

10 Q What is your understanding regarding why 11 the particular well sites were changed in this case 12 to the locations that are now designated on the 13 exhibit that was provided by Raser?

14 A I don't know. I don't know why those15 particular sites were located.

Q Did you have any further discussions with Mr. Shomaker or anybody else from his firm or from Raser regarding relocation of those well sites?

19ANo. In fact, I had -- I was not aware that20they had been even changed.

21 Q Were any specific site locations discussed 22 as alternatives during the meeting that you had 23 with Mr. Shomaker?

A No. What I brought up to Albuquerque with me was some information that I had that I thought

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might be useful for him, that I knew wasn't available out of these other reports. It's like the cross section and a few things like that. That's what I brought up me and shared, and we talked for maybe an hour about some of the data, and that's it.

Q Did you make any recommendations at any point for relocation of any of the wells being preinjection wells?

10 A No.

11 Q Was it just you and Mr. Shomaker that was12 in attendance at that meeting?

A It was just Mr. Shomaker and I. Or Dr.
Shomaker, actually.

Q Are there any particular chemicals that come to mind that you would recommend specifically testing for, in relation to this project, from what you know of AmeriCulture's concerns and the ground water standards?

20

A Inorganic or organic?

21 Q Any parameters that you're concerned about 22 with regard to water quality standards and the 23 concerns that have been expressed in this hearing?

24 A My sampling on something like that, I would 25 recommend a complete suite of cation and anion, and

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I would also recommend also sampling for trace
 metals.

Q Trace metals?

3

9

12

A Basically, run a periodic table. You can do that these days with equipment that we have. Then if something pops out of there that you don't like to see, you can get another sample and make sure you got a correct analysis.

Q What about organic sampling?

10 A Organics? I'm not an organic geochemist.
11 I have no idea what I'm talking about there.

Q Thank you for being honest about that.

Are you currently aware of any specific problem chemicals or metals within the scope of your expertise in this particular region?

16 А I'm not. In fact, having seen samples and 17 having seen arsenic tested, it's surprising that it doesn't show up as a constituent that alerted it. 18 19 Because almost all geothermal systems have that This one was one of those that doesn't. 20 component. 21 MS. ALTOMARE: That's all the guestions 22 I have. Pass the witness.

HEARING EXAMINER: Okay. I gather you
 have redirect. However, normally, I would now go
 ahead and ask my questions, and you can include any

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response to my inquiry to evidence developed in my
 questions in redirect.

EXAMINATION BY HEARING EXAMINER

Mr. Witcher, good afternoon. 4 0 5 Ά Hi. As a preliminary, I would have to say that, 6 0 7 unfortunately, I did not understand your testimony very well. I'm going to ask you some fairly 8 general guestions, and I will ask you to, perhaps 9 in some instances, to confirm or deny some things 10 in knowing and understanding what you were saying. 11 First of all, I would like to get the 12 geography straight here. This map, which was 13 brought into evidence as Exhibit -- as Applicant's 14 Exhibit 1 referred to, and then if you could put 15 your Exhibit 16 up on the screen. You passed it 16 by. 16. There we go. 17

18

3

A This one?

19 0 Okay. Now, those two deep wells that you have shown there, the Steam Reserve 55-7 and the 20 Cockrell Pyramid Federal, where are those? 21 Are those within this circle which is shown on 22 Applicant's Exhibit 1, or are they further away? 23 24 Α I need to look at this. Okay. The 55-7 well is located right here. 25

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I'm going to ask you to take a pen 1 0 Okav. 2 and show us on that where that is located, on Applicant's Exhibit 1. 3 4 А I'll draw a circle. 5 Yes. Put your initials on there. Q (Witness complies.) 6 Ά And what about the Federal, the Pyramid 7 0 Federal? 8 9 Well, that well is going to be off the map А right about there. 10 11 Q That would be north, maybe a couple of 12 miles? Is that a correct summary from the area shown on that, on Exhibit 1? 13 It's about two, two-and-a-half miles. 14 Α Yes. 15 In fact, the scale at the bottom is 5,000 feet, so that would be about --16 17 You can show the mark you made on that map 0 18 to Ms. Munds-Dry and Ms. Altomare so they can see 19 where you spotted it. 20 А (Witness complies.) Now, I did not follow your depositional 21 0 22 testimony very well, but is that pyramid structure that you have drawn in there, you said that was 23 conjectural, right? 24 Largely. It might not be a pyramid, but 25 Α VICKIE ISAACS. CCR/RPR 275 1

there's certainly a structure high in there.

2 Q Now, do you interpret that as being an 3 upthrust, a lower stratum that came up from below 4 into that area?

Think about it this way. Remove this 5 Α No. fault from your vision, and just think about this 6 And think about this fault having its first 7 fault. 8 movement with the north side going up, and the south side going down. All of these rocks that you 9 10 see right here being eroded off this side, and 11 everything eroded down into here. In other words, 12 we form a mountain range on this side.

Q So you're suggesting, then, that the left side, the fault slippage on the left side occurred first --

16

A Yes.

17 Q -- and there was some of the time when the 18 area up there farther to the right was at the same 19 level as the area in the middle?

A Yes. Yeah. They were originally this way, and then you had a rift or extension, and we call these "normal faults" where this block goes up, and your block to the south goes down. We, basically, formed a rift or a drawdown basin, just like these mountain ranges and basins today.

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1 Then, later on, that same structure, 2 this happened when the ground was pulling apart. Later on, when the ground is being pushed together 3 several tens of millions of years later, it did --4 it moved the opposite, and this block moved up and 5 formed the mountain range, and this became a basin. 6 We know that from these unconformities here. 7 8 Now, where these faults are, where is that 0 9 in relation to the geography that's shown on Exhibit 1? Do you have it spotted? 10 These faults would be in the Yeah. 11 Α subsurface. I don't have it on this map, but I can 12 13 kind of rough it out for you. Well, just general, in general terms, is it 14 0 somewhere in the vicinity of the Burgett Farms? 15 Yeah, that big structure would probably be 16 Α running through here, something like that. 17 It would cross, in other words, from 18 Q northeast to southwest, somewhere in the vicinity 19 20 of the Burgett Farm? 21 А Uh-huh. 22 From northeast to southwest? 0 Yes. Southeast. 23 А I don't know that I need to 24 0 Okav. understand the geography that much further. What I 25

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believe you said about -- if I correctly understood what you said about the water quality testing, was that there just isn't really enough information to know if that's accurate or not; is that correct?

A That's correct.

5

Q And I believe the testimony was that that was taken from -- well, I won't attempt to recite the testimony because I might get it wrong.

9 But your belief is that that's just not 10 reliable data, the 1,300 or whatever TDS 11 temperature?

A 1,300, 1,200, 1,100 TDS, those kinds of numbers, those are fine for the upflow plume. But if you're going to say that that is a chemistry that represents the carbonate reservoir, that's not true.

Q Well, what was being said was that it would be -- it was being represented as the quality of the water that would be injected into these injection wells. You're saying that's not an accurate statement?

22 A That's not an accurate statement. If 23 you're producing out of a carbonate reservoir, 24 you're going to be producing much higher salinity 25 fluids. Those will be what you're going to be

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injecting.

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2

4

8

17

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Q Why do you say that?

3 A What?

Q In layman's terms, as best you can say.

5 A Okay. I can put it this way. If you take 6 a salt shaker, dump a bunch of salt in water, that 7 dissolves pretty quickly and it gets pretty salty.

Q Right.

A And you can take a similar-like substance,
like white sand like you see over near Alamogordo,
dump that in a glass of water, and that will
dissolve very quickly.

So it's that kind of a difference.
Rhyolite is not going to dissolve in high
temperature like -- and have chemical reactions
like a limestone would have.

Q Carbonate is limestone?

18 A Yes. Yeah, limestone. And so those are 19 much more soluble, and so you end up getting a lot 20 higher total dissolved solids.

The other thing with the limestone is that you have fluid inclusions in the limestone that are basically little pockets of ocean water that are caught in there when they form.

So when you start dissolving

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limestone, you start adding that stuff in there too. So there becomes a point where that water can become quite salty, and it usually does. Oilfilled brines are a perfect example of that sort of thing.

6 Q Now, what you're testifying here is 7 theoretical in the sense that it's based on 8 analysis of the general geology, you don't have 9 samples of production from particular horizons? 10 A That's correct.

11 Q If I understand correct, they didn't have 12 either?

A They didn't have either. But I have one thing they didn't have. I know that that outflow plume water has never -- the existing geothermal water that's out there, it never flowed through a limestone.

Q And you're saying what they would produce from their proposed project would flow through carbonate, is that what you said?

21 A Well, they said that's what their target 22 is.

23 Q Okay. Very good. Now, you did not give 24 any testimony that I heard anything specific with 25 regard to the hydrologic connection between waters

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in various places, did you? If you did, I
 overlooked it.

No. And it's really -- to really quantify 3 А something like that, you'd need some pump-test 4 To my knowledge, there's only been two pump 5 data. 6 tests ever done at Lightning Dock. AmeriCulture did one of them, and then there was a report that 7 8 was done many years ago by the Ag College at NMSU, 9 and they did a pump test on a well over there near Burgett's greenhouse. So that's the only 10 information that's available. 11 12 So there's never really been any long-

13 term testing or pump testing to get some reliable 14 numbers where you can really calculate something 15 over a broad area, and understand the overall big 16 picture.

HEARING EXAMINER: Okay. Very good. Ithink that's all of my questions.

19 Redirect, Mr. Seawright.

## 20

## REDIRECT EXAMINATION BY MR. SEAWRIGHT

21 Q Mr. Witcher, for an organic Rankine cycle, 22 waste recovery system utilizing air cooling, would 23 the purpose of the air cooling system be to dispel 24 heat or thermal energy from an intermediate working 25 fluid?

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1 MS. MUNDS-DRY: Objection, Mr. Brooks. He's already testified he wasn't familiar at all 2 3 with the PureCycle 200 System. 4 HEARING EXAMINER: I believe that is a fair assessment. I believe his testimony doesn't 5 really establish much of anything with regard to it 6 7 in any way because of his disclaimer, so I will sustain the objection. 8 9 MR. SEAWRIGHT: I would ask for reconsideration on that because I'm not asking for 10 11 any -- I'm not asking any question in regard to PureCycle 200, rather a general question regarding 12 the use of air-cooling systems for dispelling heat. 13 14 HEARING EXAMINER: Very well. I will ask the witness. 15 16 Do you have any experience or expertise with regard to the use of air-cooling systems in 17 geothermal operations? 18 19 THE WITNESS: I don't. 20 HEARING EXAMINER: Very good. I'11 sustain the objection. 21 (BY MR. SEAWRIGHT) Are there any potential 22 0 surprises with regard to arsenic in a carbonate --23 24 prospective carbonate reservoir that Raser is pursuing using? 25

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A Actually, there is a potential for arsenic in a carbonate reservoir in the area because the Permian rocks that exist in Southeastern Arizona and Southwest New Mexico, includes some units that are -- we call them "red beds" in Northern New Mexico. They go by the name of "Abo and Yeso."

In this part of the world we call them 8 Earp formations and things like that. These are 9 red beds, and they can frequently have higher 10 arsenic contents. So if you put something hot, you 11 know, if you put hot, salty water through that 12 stuff, it's certainly possible you can liberate 13 that. But we wouldn't really know until somebody 14 drills into it and samples it. That's the bottom line on that. 15

16 MR. SEAWRIGHT: That's all the questions17 I have.

HEARING EXAMINER: Very good. Any
recross limited to the scope of redirect? Of
course, the attorneys should have a fair
opportunity to respond to my questions as well.
Include my questions in redirect.

MS. MUNDS-DRY: I have one question.
HEARING EXAMINER: Okay. Go ahead.

25

## RECROSS EXAMINATION BY MS. MUNDS-DRY

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1 0 Mr. Witcher, you were referring to the 2 potential surprises with arsenic. You referred to 3 the rocks in the northwest, the "red bed" is what you called it? 4 Uh-huh. 5 А Isn't it true that generally they're low 6 0 levels of arsenic? 7 8 А I don't believe that's true at all. If you 9 look at the --10 THE REPORTER: A little louder, please. 11 THE WITNESS: I don't believe that's true at all. If you look at a lot of these red 12 beds, the sequences' like the Abo and Yeso, they 13 14 have higher arsenic. 15 In fact, some of the gas production in 16 Southeastern New Mexico runs into problems with arsenic being produced out of their gas wells from 17 the Abo formation. 18 19 (BY MS. MUNDS-DRY) What about the carbonate 0 rocks underneath? 20 The carbonate rocks, that's untested. 21 А Ιt 22 probably wouldn't have a arsenic component, would 23 be my first thought, but you don't know until you test. 24 25 MS. MUNDS-DRY: Thank you.

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HEARING EXAMINER: Ms. Altomare. 1 2 MS. ALTOMARE: No further questions. 3 HEARING EXAMINER: Very good. The witness may step down. 4 5 Does that conclude your presentation, 6 Mr. Seawright? 7 MR. SEAWRIGHT: Yes. 8 HEARING EXAMINER: Do you have rebuttal 9 testimony to offer, Ms. Munds-Dry? 10 MS. MUNDS-DRY: No, Mr. Brooks. HEARING EXAMINER: Very good. I would 11 12 like to, at this time, recall Chief Price to the stand briefly. 13 14 WAYNE PRICE, 15 (Having been previously sworn, testifies as follows:) 16 EXAMINATION BY HEARING EXAMINER 17 18 Just a couple of questions. 0 Your Honor, if I'm in trouble, I need to 19 А 20 get an attorney. 21 Well, you have Ms. Altomare, all right. 0 22 Maybe she's the one that got me in this А 23 trouble. 24 Q You're not suggesting, are you, that your testimony may have involved a conflict of interest 25

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between yourself and the Oil Conservation 1 2 Committee? 3 No. Seriously, Chief Price, just a few questions, for the record, about the OCD's 4 procedures in a case of this kind. 5 6 You indicated, and I believe Mr. Chavez also indicated, in your testimony this morning that 7 the OCD would likely be requesting additional 8 9 information from the applicant in the course of its 10 further consideration of this permit application; is that correct? 11 That is correct. Ά 12 13 And when I say the "OCD," I want to be Q specific here because I'm talking about the 14 Environmental Bureau. Is it correct --15 16 А Relating to water quality, it will be the Environmental Bureau. 17 18 0 And the Environmental Bureau will, at some point, make a recommendation to the OCD director, 19 correct? 20 А That is correct. 21 22 0 Okay. Now, when you receive that additional information, will it be posted on the 23 Oil Conservation Division website? 24 It will be available on the OCD website. 25 А

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Now, when we say, "Posted," generally, it won't be 1 2 a special posting that you see in "What's new," but 3 it would be in the permit application that we normally put it under. It would also be in the 4 5 image file system. 6 0 All right. As you probably know, I know even less about computers than I do about geology. 7 8 Anyway, do you have a facility-specific mailing 9 list for this application? Yes, we do. 10А 11 Is Mr. Seawright on that list? 0 12 Α Yes, he is. Will he be advised when additional 13 0 14 information is received? Absolutely. 15 А 16 0 Very good. I believe I've already asked you if the Bureau's hydrologist will be involved in 17 review of this application? 18 19 Α Yes. 20 HEARING EXAMINER: I don't want to 21 repeat myself. That's all I have for the chief. 22 Any further questions that need to be asked from counsel? Very good. 23 24 You may step back down. 25 THE WITNESS: Thank you.

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1 HEARING EXAMINER: Let's see. Did you indicate that you did not have rebuttal testimony? 2 3 MS. MUNDS-DRY: I do not, Mr. Brooks. 4 HEARING EXAMINER: Okay. Very good. 5 We're getting late in the afternoon. I would, 6 normally, in a hearing if we were concluding I would invite closing statements for counsel or, 7 8 alternatively, counsel to submit written closing 9 statements. However, I have concluded, at this 10 point, that we cannot terminate this hearing for 11 two reasons. Legally, we are running on something 12 of a new slate in terms of the procedure in this 13 case because what has always been true here before, 14 15 has been that applications for discharge permits 16 are reviewed, are handled administratively by the agency, the constituent agency. Then if a party 17 18 feels a necessity for a hearing, then they would --19 the agency can either hold a hearing, or not hold a 20 hearing as the agency saw fit. And then the person 21 that was agreed to have an opportunity to appeal to 22 the Water Quality Control Commission, which would hold a de novo hearing. 23

In 2006, the legislature changed all of that, and now requires the constituent agency, upon

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appropriate request, to hold a hearing. But it's 1 2 not entirely clear to me how that hearing fits in 3 the sequence of the processing application. I do believe, however, that we cannot 4 make a determination, and I cannot recommend or 5 prepare or recommend an order for the director on 6 7 this matter until the Environmental Bureau has completed its basic technical review. Therefore, I 8 think that this hearing should be recessed or 9 10 adjourned until further continuation. If, however, we didn't have -- even if 11

12 that were not a factor, however, we have the fact 13 that we have a defective notice in that the 14 locations of the injection wells have changed from 15 what's indicated in the original notice.

Because of that kind of ties to the preliminary nature of the administrative proceeding, because it's not impossible that they may change again when we have the final hearing in this case, if we do have the final hearing, we need to have a definitive notice.

22 So what I'm going to do is, this 23 hearing will be adjourned indefinitely. When I 24 say, "indefinitely," that means we'll not fix a 25 definite date. That doesn't mean -- I'm not using

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1 "indefinitely" as if it were forever, as it's
2 sometimes used in common speech. We will not fix a
3 date because we don't know what -- how quickly the
4 Environmental Bureau's review will proceed.

At such time as the Environmental Bureau has reached what it regards as an effective working recommendation, then they can advise the director to that effect, and we will set a hearing, and the applicant will be directed to publish a new notice of hearing at that time.

I said if this hearing is concluded at 11 another time, because another determination that I 12 13 think I can make fairly based on what I heard today 14 is, that there is not any evidence that there is significant general public interest in this 15 16 application. It was published notice, and a small number of people showed up here to respond, but 17 they supported the project. 18

There does not appear to be general public opposition for the project. So, therefore, we believe that the hearing would be continued from this point to indicate private rights of the protesting party, rather than to hear further input from the general public.

That does not mean the general public

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1 will be excluded from anything; they never are. At any hearing they would be given an opportunity to 2 3 comment, but it would not appear to be necessary to 4 have a further hearing in the event that the protestants were to withdraw their protest, then I 5 believe the matter can be processed 6 7 administratively in the normal course without necessity of a further hearing. 8 With that said, I declare this hearing 9 10 to be adjourned subject to further notice. Any further comments? 11 MS. MUNDS-DRY: Mr. Brooks, I just have 12 13 a question, really. 14 HEARING EXAMINER: Sure. 15 MS. MUNDS-DRY: I quess I'd like to 16 request on behalf of Raser that before a hearing date is set, that we'd be allowed to have a pre-17 hearing conference to determine whether another 18 19 hearing, with need for additional testimony, is 20 really necessary. HEARING EXAMINER: Okay. One thing I 21 forgot to say, and I need to say this for the 22 record, is that all the evidence received and that 23 I admitted today, is admitted and will be part of 24 the consideration, that is, when a further hearing 25

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1 in this occurs.

2 It will not be necessary to bring the 3 same witnesses back, either to repeat their 4 testimony or for further cross-examination unless they are subpoenaed. 5 I think a pre-hearing conference might 6 7 well be a good idea. 8 MS. MUNDS-DRY: Thank you, Mr. Brooks. 9 MS. ALTOMARE: If the proceedings do go forward as a hearing to determine private rights of 10 11 the parties, as opposed to a public hearing --HEARING EXAMINER: Well, I didn't say it 12 wasn't a public hearing. I said I don't think -- I 13 14 think we can conclude it on the basis of what we have today; that we have received public input. 15 16 The public input does not oppose the --17 does not oppose the application. Therefore, 18 there's no particular reason to have another public 19 hearing in the event the protestant were to 20 withdraw their protest. 21 MS. ALTOMARE: In which case, would such proceedings go forward? 22 23 HEARING EXAMINER: In that case, the Environmental Bureau will proceed with their review 24 of the application as they do with all the 25

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1	applications, and make an administrative
2	recommendation.
3	MS. ALTOMARE: Thank you.
4	HEARING EXAMINER: Okay. Very good. We
5	will stand adjourned.
6	(End of hearing.)
7	
8	
9	
10	
11	
12	
12 13	<b>d do</b> hereby certify that the foregoing is second by record of the proceedings in
12 13 14	de hereby certify that the foregoing is second for record of the proceedings in The Execution to acting of Case No, Cheard by we do
12 13 14 15	<ul> <li>I do hereby certify that the foregoing is</li> <li>(a) complete record of the proceedings in</li> <li>(b) the Execution 1 and by of Case No.</li> <li>(c) the on</li> <li>(c) the proceeding of Case No.</li> <li< td=""></li<></ul>
12 13 14 15 16	d do hereby certify that the foregoing is se complete record of the proceedings in The Executor 1 satisfy of Case No Theard by me on, Examiner Oil Conservation Division
12 13 14 15 16 17	d do hereby certify that the foregoing is a complete record of the proceedings in the Execution Leading of Case No, theard by me on, Examiner Oil Conservation Division
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12 13 14 15 16 17 18 19 20 21 22 23 24 25	4 de hereby certify that the foregoing is se conclosa cecard of the proceedings in the Exeminant searing of Case No. beard by the on Cil Conservation Division

1 STATE OF NEW MEXICO ) 2 ) ss 3 COUNTY OF DONA ANA )

5 I, VICKIE ISAACS, Court Reporter for the 6 State of New Mexico, hereby certify that I 7 transcribed, to the best of my ability, the 8 proceedings taken on December 1, 2008; that the pages numbered 1 through 294 inclusive, are a true 9 10 and correct transcript of my stenographic notes, 11 and were reduced to typewritten transcription 12 through Computer-aided transcription; that on the 13 date I transcribed these proceedings, I was a New 14 Mexico Certified Court Reporter.

15Dated at Las Cruces, New Mexico, this 2ND day16of FEBRUARY 2009.

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Vickie Isaacs New Mexico CCR No. 191 Certified Court Reporter

VICKIE ISAACS, CCR/RPR