

Official Transcript of Proceedings
NUCLEAR REGULATORY COMMISSION

Title: Crow Butte Resources, Inc.
Open Session

Docket Number: 40-8943-OLA

ASLBP Number: 08-867-02-OLA-BD01

Location: Crawford, Nebraska

Date: Monday, August 24, 2015

Work Order No.: NRC-1794

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ATOMIC SAFETY AND LICENSING BOARD PANEL

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HEARING

OPEN SESSION

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In the Matter of: : Docket No.
CROW BUTTE RESOURCES, : 40-8943-OLA
INC. : ASLBP No.
(License Renewal for : 08-867-02-OLA-BD01
the In-Situ Leach :
Facility, Crawford, :
Nebraska) :

-----x

Monday, August 24, 2015

Crawford Community Center
1005 First Street
Crawford, Nebraska

BEFORE:
MICHAEL M. GIBSON, Chair
DR. RICHARD E. WARDWELL, Administrative Judge
BRIAN K. HAJEK, Administrative Judge

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9:00 a.m.

CHAIR GIBSON: I believe it's 9:00. I think we'll go ahead and get started.

Good morning. We are here today on Atomic Safety and Licensing Board Panel, Docket No. 8943, concerning the United States Regulatory Commission's Renewal of a Source Materials License to Crow Butte Resources, Inc. for its in-situ leach mining operation near here.

First, I would like to introduce the Board that will be conducting this evidentiary hearing.

Sitting to my right, your left, is Judge Richard Wardwell who holds a PhD in civil engineering and is a full-time Judge with the Atomic Safety and Licensing Board Panel.

To my left, your right, is Judge Brian Hajek who is a Professor Emeritus of Nuclear Engineering at Ohio State University as well as a part-time Judge with the Atomic Safety and Licensing Board Panel.

Unfortunately, Judge Alan Rosenthal could not be with us. He is serving as Special Assistant to the Board but he will be reviewing the transcript that we develop at this proceeding.

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1 I am Judge Michael Gibson, a lawyer and a
2 full-time Judge with the Atomic Safety and Licensing
3 Board Panel and I also am the Chairman of this Board.

4 Now, I would like to have announcements of
5 counsel, beginning first with Crow Butte.

6 MR. SMITH: I'm Tyson Smith from Winston
7 and Strawn representing the Applicant, Crow Butte
8 Resources.

9 CHAIR GIBSON: Counsel for the Nuclear
10 Regulatory Commission Staff?

11 MS. SIMON: Good morning. I'm Marsha
12 Simon, Counsel for the NRC Staff.

13 MR. CYLKOWSKI: David Cylkowski on behalf
14 of the NRC Staff.

15 MS. MONTEITH: Emily Monteith, Counsel for
16 the NRC Staff.

17 CHAIR GIBSON: I can't see you behind that
18 monitor, unfortunately, so okay.

19 Counsel for the Oglala Sioux Tribe?

20 MR. REID: Hi, it's Andrew Reid from the
21 Ved Nanda Center for International and Comparative Law
22 representing the Oglala Sioux Tribe.

23 Could I have this monitor removed? We
24 don't need it right now so that I can see Judge
25 Wardwell.

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1 CHAIR GIBSON: I really -- I tell you
2 what, we'll see what we can do shortly. Okay?

3 MR. REID: All right, thank you.

4 CHAIR GIBSON: We'll take a very brief
5 recess when we're finished with our introductory
6 remarks and we'll see what we can do, Mr. Reid.

7 MR. REID: Thank you.

8 CHAIR GIBSON: Okay?

9 Counsel for Consolidated Intervenors?

10 MR. BALLANCO: Good morning, Your Honor,
11 Tom Ballanco for Consolidated Intervenors.

12 MR. FRANKEL: Morning, Your Honor, David
13 Frankel for Consolidated Intervenors.

14 CHAIR GIBSON: And, I can't see you very
15 well, Mr. Frankel, either. So, yes, sir.

16 Did I miss anyone? Okay.

17 Next, I would like to introduce the
18 Board's Administrative Staff.

19 First, we have two lawyers over here on
20 our left, Nick Sciretta who's just finishing up a two-
21 year clerkship with our office and with Sachi Desai
22 who is beginning his second year with us.

23 Next is Sara Culler. Ms. Culler, will you
24 hold up your hand or stand up? There you go. She's
25 our Administrative Assistant. She's ably handled our

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1 administrative arrangements here and, if there is
2 anything that you need in that regard, please see her.

3 Our IT coordinator for this trial is Mr.
4 Joe Deucher.

5 We also have two security personnel here
6 as well as Victor Dricks who is with the U.S. Nuclear
7 Regulatory Commission's Office of Public Affairs.
8 Hold up your hand there, Mr. Dricks?

9 And if the press or anyone from the public
10 has any need for anything, any inquiries, Mr. Dricks
11 will handle them for you.

12 Likewise, our Court Reporter over here
13 next to Mr. Deucher is Brandon Paterson.

14 Finally, I would be remiss if I did not
15 acknowledge the hospitality that the City of Crawford
16 has given us by graciously providing us with the use
17 of this community building for this evidentiary
18 hearing.

19 I would also note that all weapons are
20 prohibited from entering this building and, in case
21 your cell phone is not disabled, I would ask that you
22 do that now. And, if you need to use your phone, I
23 would ask that you please do that outside so that you
24 do not interrupt the witnesses during this proceeding.

25 Now, what I would like to do, Mr. Deucher,

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1 at this point, if you could see if you could maybe
2 move these monitors just a little bit so that we have
3 a better sight lines, we'd appreciate it.

4 While Mr. Deucher is doing that, I have a
5 few -- a brief summary of why we're here today. I
6 think that's important considered in the extensive
7 interest that's been expressed about it.

8 About five miles southeast of here, Crow
9 Butte conducts an in-situ leach mining operation.
10 And, for those of you who don't know how an in-situ
11 leach mining works, Crow Butte drills wells into a
12 geologic formation that contains uranium then injects
13 a solution called lixiviant through those wells that
14 leaches into the surrounding geologic formation.

15 The resulting liquid is rich with
16 minerals. It is absorbed through recovery wells and
17 brought up to the surface where Crow Butte removes the
18 uranium by ion exchange at a processing plant.

19 Most of the water used in the in-situ
20 leach mining process is returned to the aquifer after
21 treatment, at least until efforts are made to restore
22 that aquifer.

23 That uranium containing material brought
24 to the surface is then precipitated, dried and
25 packaged into solid yellow cake uranium.

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1 Now, to conduct this mining operation, the
2 Atomic Energy Act requires that Crow Butte have a
3 source materials license from the U.S. Nuclear
4 Regulatory Commission.

5 The original license for this operation
6 was issued in 1989. It was later renewed in 1998.
7 And then, on November 27, 2007, Crow Butte filed an
8 application for a second renewal of this license.

9 Six months later, on May 27, 2008, the NRC
10 Staff issued a Notice in the Federal Register that
11 advised the public of its opportunity to contest the
12 renewal of Crow Butte's license.

13 Two months after that Federal Register
14 Notice was published, three separate Petitions were
15 filed with the Nuclear Regulatory Commission
16 challenging Crow Butte's requested license renewal.

17 Filing these Petitions were the Oglala
18 Sioux Tribe, the Oglala Delegation of the Great Sioux
19 Nation Treaty Council and 11 individuals and
20 organization who share a common counsel whom we will
21 usually refer to as Consolidated Petitioners.

22 We held oral argument in Chadron, Nebraska
23 on September 30 and October 1, 2008 for the sole
24 purpose of determining whether the Tribe and these
25 other Petitioners had standing to challenge the

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1 renewal of Crow Butte's license and had pled
2 admissible contentions under the Nuclear Regulatory
3 Commission's rules.

4 On November 2008, this Board ruled that
5 the Oglala Sioux Tribe and the Consolidated
6 Intervenors had standing and had pled admissible
7 contentions. And, though we held that the Oglala
8 Delegation of the Great Sioux Nation Treaty Council
9 lacked standing, we ruled that it could, nevertheless,
10 participate in this proceeding as an interested local
11 government body as is provided in the NRC rules.

12 Now, about now, those of you unfamiliar
13 with this case may be scratching your head and asking
14 yourself, if the Board ruled in November 2008 that a
15 hearing was appropriate, why did it take another seven
16 years before that hearing commenced?

17 Well, the answer to that is, that in most
18 instances, Boards such as this may not hold hearings
19 on contested contentions until after the Nuclear
20 Regulatory Commission Staff has completed its final
21 environmental report under the National Environmental
22 Policy Act. And, in this case, there were substantial
23 delays in that study.

24 But, at long last, in October 2014, the
25 NRC Staff issued its environmental report and enabled

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1 the Board to begin this hearing.

2 I should add that the Tribe and
3 Consolidated Intervenors took issues with portions of
4 the Environmental Assessment that the staff issued,
5 proffered some new contention challenging the extent
6 to which that Environmental Assessment was complete or
7 inaccurate.

8 And so, the Board held oral argument
9 earlier this year on those issues and the result is
10 now the nine contentions that we have before us.
11 Some, essentially, date back to our original oral
12 argument in 2008, others concern new matters that were
13 raised by the Environmental Assessment and some are a
14 combination of two or more contentions that the
15 Intervenors have filed.

16 There is one other wrinkle to this dispute
17 that requires a bit of explanation. Shortly after it
18 issued the Environmental Assessment, the NRC Staff
19 renewed Crow Butte's license in November 2014 with an
20 expiration date of November 5, 2024.

21 Renewing a license during the pendency of
22 an environmental hearing may seem odd, but it is
23 certainly provided for in the rules. And, as long as
24 the staff concludes, as it did here, that the public
25 health and safety will be protected.

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1 But, it is also fair to say that when the
2 NRC Staff renewed that license, the staff did not have
3 the benefit of the evidence that will be adduced at
4 this hearing.

5 So, once this hearing concludes, the Board
6 will evaluate the evidence and issue a decision. The
7 Board certainly could conclude that the staff was
8 correct in every respect and the renewal of the
9 license does not pose any significant environmental
10 impact that is not adequately addressed in that
11 Environmental Assessment.

12 On the other hand, the Board could
13 conclude that there are environmental impacts that
14 were not addressed in the Environmental Assessment and
15 those matters will have to be addressed by the
16 insertion of additional conditions in the license
17 perhaps.

18 Another possibility would be that the
19 Board could conclude that the Environmental Assessment
20 contains some minor errors but that can be fixed by
21 the evidence that we develop during the course of this
22 week.

23 It is even possible, if any errors are
24 significant enough, that the Board could conclude that
25 the Environmental Assessment is deficient and that the

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1 NRC needs to go back to the drawing board and clear up
2 those deficiencies.

3 All of these outcomes are possible,
4 depending on the evidence the parties have filed with
5 the Board as well as upon the sworn testimony the
6 Board will hear through the examination of the parties
7 witnesses this week.

8 Before we proceed to asking our questions
9 of the parties witnesses, it might be useful to
10 explain that the differing roles of the Nuclear
11 Regulatory Commission personnel who are here today.

12 The Atomic Energy Act established the
13 Nuclear Regulatory Commission to regulate nuclear
14 facilities in this country. The Nuclear Regulatory
15 Commission is headed by five Commissioners who are
16 appointed by the President and confirmed by the
17 Senate.

18 The Commissioners have a large staff
19 working for them. And, during this proceeding, we
20 will refer to them as the NRC Staff.

21 The NRC Staff is represented here today by
22 lawyers and by technical people who have spent a great
23 deal of time reviewing Crow Butte's application over
24 the last seven years and writing the Environmental
25 Assessment.

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1 That brings us back to the three of us
2 here who make up this Board. All three of us Judges
3 with the Atomic Safety and Licensing Board Panel are
4 with a group that was established under the Atomic
5 Energy Act and that acts for the Commission in
6 contested proceedings such as this one to hear and
7 make initial decisions as to whether a license
8 application should be granted.

9 Those initial decisions can be reviewed by
10 the Commission and can be affirmed, reversed or
11 modified by the Commission.

12 Although the Atomic Safety and Licensing
13 Board Panel is physically housed within the Nuclear
14 Regulatory Commission, and although individual Judges
15 receive their appointments from the Commissioners of
16 the Nuclear Regulatory Commission, we are a fully
17 independent entity and we are wholly and separate
18 apart from the NRC Staff.

19 Rather, the NRC Staff is appearing here
20 today as one of four parties who will be litigating
21 the contentions.

22 We will certainly consider the views of
23 the NRC Staff, but we will give them the same weight
24 that we will the concerns that are raised by Crow
25 Butte, the Applicant, by Consolidated Intervenors and

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1 by the Tribe.

2 And, I assure you, that is what we do, to
3 act independently and to evaluate the evidence.

4 If one of the parties here does not like
5 the ruling that we ultimately make after this hearing,
6 that party can petition to the Commissioners to review
7 our decision.

8 I should emphasize that this hearing is
9 essentially a trial and this Board and the counsel and
10 witnesses for the four parties to this proceeding will
11 be the only people with speaking parts during this
12 week.

13 If you came here to talk about your
14 concerns with Crow Butte's mining operation and you're
15 not a witness, I am sorry, but this is not the forum
16 for that.

17 However, under 10 CFR 2.328, this hearing
18 is open to the public. And so, those of you in the
19 audience are more than welcome and we appreciate your
20 appearance here today to view these proceedings.

21 In addition, 10 CFR 2.315(a) authorizes
22 members of the public who are not represented here
23 today or are not witnesses to provide this Board with
24 written statements which are called limited appearance
25 statements expressing their views on the

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1 appropriateness of renewing Crow Butte's license to
2 operate its in-situ mine.

3 All such limited appearance statements
4 will be transcribed and placed into the official
5 docket of this proceeding.

6 Although limited appearance statements are
7 not evidence, they may assist the Board and the
8 parties as this licensing proceeding goes forward.

9 If you have a written statement today or
10 if you would like to write one up, during a break in
11 our proceedings, you can hand that statement to Mr.
12 Sciretta or to Mr. Desai and they'll make sure it gets
13 placed in the docket so we will have a chance to
14 review it.

15 If you'd prefer to write up a statement on
16 your computer, you can email it to our clerks using
17 the email address that was provided in the July 13,
18 2015 Hearing Notice and we have copies of that Hearing
19 Notice at the back of the room that has those email
20 addresses. And, you can ask Ms. Sarah Culler for a
21 copy of that.

22 We would ask that you send that in by the
23 end of the week because we will be closing the record
24 of this proceeding at that time, with a minor twist
25 we'll talk about at the end of the proceeding.

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1 You should note that today, we will be
2 utilizing some technology in the hearing room that
3 will, I hope, enable the Board and the parties to
4 conduct this hearing more efficiently.

5 But, I need to apologize in advance if
6 there are some bugs that appear as we're trying to
7 work those out in the system.

8 We have digitized the documentary record
9 of this proceeding to make it accessible and usable in
10 a courtroom proceeding. The exhibits have been
11 transcribed electronically to the electronic hearing
12 docket. And that has kept the process entirely
13 electronic from start to finish and so it allows you,
14 the public, to have easy access to these documents on
15 the NRC website.

16 Additionally, as Mr. Paterson's presence
17 indicates, we will be transcribing this proceeding
18 and, at the conclusion of the hearing, we will
19 establish a mechanism for the parties to correct the
20 transcript of any errors and that was the one little
21 thing that doesn't end at the end of the week.

22 Further, we anticipate using display
23 technology as part of our evidentiary proceedings.
24 And, you can see the displays -- you've got the
25 display screens there that you can see. Hopefully,

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1 this will make the information more accessible and
2 understandable.

3 Now, we have a few housekeeping matters we
4 need to attend to.

5 First, we're planning to be able to
6 conclude this proceeding before the end of the day on
7 Friday.

8 Second, this proceeding will be a little
9 different from most trials that you may have seen on
10 TV or that you may have been a juror in or even a
11 party.

12 Perhaps the most unusual aspect of this is
13 that we are using Subpart L procedures. And, by
14 virtue of that fact, the attorneys for the parties
15 will not be questioning witnesses. Instead, the
16 witnesses direct testimony has already been submitted
17 to the Board in written form.

18 And the Board, itself, the three Judges
19 here, will perform the oral examination of the
20 witnesses.

21 However, many of the Board's questions
22 will be based on suggested questions that the parties
23 have already provided to the Board through in camera
24 submission.

25 The Board has grouped the contentions in

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1 this case in to three batches, the hydrogeology
2 contentions, the scientific contentions other than
3 hydrogeology and the historic preservation and
4 consultation contention. And we will be questioning
5 witnesses on each topic.

6 That is why you see so many seats here in
7 front of us. We'll have every witness on a group of
8 contentions seated there so we can ask questions back
9 and forth of the parties' witnesses.

10 We don't know exactly how long that's
11 going to take, but we can give you a rough estimate of
12 the timing.

13 We expect the hydrogeology questions to
14 start today and last until sometime on Wednesday; that
15 the other scientific contentions will start on
16 Wednesday and sometime on Thursday; and that the
17 historic preservation and consultation contention
18 questions will start on Thursday and run through
19 Friday.

20 There is one exception to this order which
21 I will explain in a moment.

22 Once we've completed our examination of
23 the parties' witnesses on a batch of contentions, we
24 will take a short break to allow each party to suggest
25 any additional questions it thinks we should have

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1 asked but did not. Those questions will be submitted
2 privately to the Board.

3 The Board may or may not ask those
4 additional questions, but the parties will certainly
5 be afforded an opportunity to make those suggestions
6 and, if the Board doesn't ask them, it's simply
7 because the record is already clear.

8 I mentioned there would be one exception
9 and that is Dr. Redmond, a joint witness for the
10 Intervenors and the Tribe with respect to Contention
11 1, has a scheduling conflict and cannot appear at the
12 time we had set aside for Contention 1 on Thursday and
13 Friday. So, we will be interrogating Dr. Redmond
14 first in just a couple of minutes.

15 In all other respects, we expect to
16 proceed just as we described.

17 One thing to keep in mind as the hearing
18 proceeds, it would be folly to ascribe any particular
19 significance to the number and types of questions that
20 the Board directs to any particular witness as
21 compared to any other witness.

22 Trying to draw any conclusions about how
23 the Board perceives the testimony of a witness or
24 witnesses on a particular matter based on the number
25 and types of questions the Board asks is not accurate,

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1 as some issues may be more complex than others or
2 simply require more questions to develop the
3 foundation.

4 In questioning any particular witness or
5 group of witnesses, the purpose of the Board's
6 examination is to create a record to support a fair
7 and reasonable determination of the issues that are
8 before us for decision.

9 We make our decisions based upon the
10 record of the exhibits and testimony submitted by the
11 parties and developed in this hearing.

12 Another housekeeping matter that has
13 arisen, there was a question arising about whether you
14 can leave your stuff here overnight. The answer to
15 that is yes, it will be locked.

16 But, you should know that there is a
17 custodian who will be coming in to clean this place up
18 and so, there will be somebody else in here after we
19 lock the doors, will be in here before we come back in
20 in the morning.

21 So, with that, you can make your own
22 decision about what you think is appropriate.

23 Secondly, I've never had to talk about
24 this in a hearing I've been involved in, but the
25 facilities here are a little unusual. We are going to

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1 have to have a restroom protocol.

2 What we would like, what we'd ask you is
3 we will be recessing. I suspect we'll recess once or
4 twice in the morning, for lunch and once or twice in
5 the afternoon.

6 If you would please -- if you would all
7 mind just staying where you are, let the Judges run to
8 the restroom. We're all kind of geriatric guys anyway
9 and, you know, we do have to go frequently. And if
10 you will -- I promise you when we're finished with the
11 restrooms, we'll go back to our little chambers back
12 there and y'all -- we'll give y'all another ten
13 minutes to go to the restroom.

14 But, it would just make things a little
15 easier if you'd try to accommodate us. We'd
16 appreciate it.

17 Another thing I need to tell you is, your
18 microphones are hot. And, by that I mean they are on
19 all the time. So, if you want to say something ugly
20 about, you know, one of us, you ought to be sure and
21 push the mute button there to make sure that whatever
22 you're saying doesn't get heard by us.

23 Finally, when we ask a witness questions,
24 we may ask that witness or witnesses to essentially
25 draw something or to annotate an exhibit. Normally,

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1 in a courtroom, back in the day when I was trying
2 cases as a lawyer, we'd walk up and have an easel
3 there and we'd draw something or have the witness draw
4 it. We can't do that, we're not doing that here.
5 Everything is electronic.

6 But, we have figured out a way to annotate
7 these exhibits and I'm going to let Mr. Deucher
8 explain to you how it is you should proceed. I would
9 ask counsel for any witnesses who are not here to
10 please explain that to them so that they'll know if
11 they come on another day.

12 MR. DEUCHER: Good morning. Just to let
13 everybody know, what we've done is we've established
14 and set up an extra mouse attached to my computer.
15 And my computer is actually what's going to be
16 displaying the evidence in the proceeding.

17 What we will then do is provide the mouse
18 to the particular witness who is interested in doing
19 the annotation and we will be using commenting tools
20 built into Adobe Acrobat which is the software that we
21 will be using to display the evidence.

22 And, with my help, in terms of making sure
23 that I get the right tool on for you, you'll be able
24 to draw using the mouse over that particular area.

25 Your screens are tied to my screen, so

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1 you'll be able to see it as if you were working on a
2 computer at your desk.

3 CHAIR GIBSON: Okay, thank you, Mr.
4 Deucher.

5 Okay, Judge Wardwell, is there anything
6 else that I overlooked?

7 JUDGE WARDWELL: I'll just make one
8 comment in regards to the monitor problem. Bear with
9 us on that. I mean the witnesses are going to have to
10 use those monitors to see evidence and that type of
11 thing. And so, we will have blockages of views.

12 Our other alternative would have been to
13 put us up on this stage and we felt it was just a
14 little too high up and domineering over everyone that
15 we didn't feel was a very comfortable type of an
16 arrangement.

17 So, we brought it back down to this -- we
18 brought our benches back down to this level. But, in
19 the process, have created this somewhat difficult
20 thing with the monitors.

21 But, just bear with us so that the
22 witnesses can see what they need to see once we get a
23 full table of those.

24 CHAIR GIBSON: Yes. And, Mr. Deucher, at
25 some point, it would be nice if you could move this

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1 monitor over just a little bit so I can -- because I
2 can't see this part of the --

3 Judge Hajek, do you have anything else you
4 need to raise to the parties?

5 JUDGE HAJEK: I have nothing else. You've
6 done a thorough job.

7 CHAIR GIBSON: I assume no one has
8 anything else they need to raise for the Board at this
9 point.

10 For those of you -- oh, Mr. Reid has
11 something. Yes, sir?

12 MR. REID: Yes, we would renew the
13 objections we made before as to the jurisdiction and
14 the authority of the Panel. They were in our opening
15 statements, so I won't go into that.

16 But, we'd also renew our objection to the
17 Board's procedure that does not allow the Elders from
18 the Tribe to present oral testimony to the Board.

19 CHAIR GIBSON: Thank you, Mr. Reid. Your
20 objection is duly noted.

21 I should add for the parties that those
22 folks who are not -- weren't involved in our pretrial
23 last week, we had a pretrial on the phone last week.
24 We resolved a number of these evidentiary questions
25 such as the one Mr. Reid just raised. And, we

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1 admitted the evidence of the parties in almost all
2 respects.

3 What we have before us now is the evidence
4 that was admitted at that pretrial.

5 If there is nothing further, I believe we
6 can turn to our first witness. Mr. Redmond? Is it
7 Mister or Doctor Redmond?

8 DR. REDMOND: Doctor.

9 CHAIR GIBSON: Dr. Redmond, very well,
10 sir.

11 Would you please stand up, sir?

12 DR. REDMOND: I'm getting there.

13 CHAIR GIBSON: That's okay, take your
14 time, sir.

15 Could you state your full name for us,
16 sir?

17 DR. REDMOND: Dr. Louis Arthur Redmond.

18 CHAIR GIBSON: Very well, sir.

19 Could you raise your right hand?

20 You do affirm that all the testimony you
21 are about to give in the case now before this Board
22 will be the truth, the whole truth and nothing but the
23 truth, this you do affirm under the pains and
24 penalties of perjury?

25 DR. REDMOND: So help me, God.

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1 CHAIR GIBSON: Thank you, sir.

2 You might, yes, sir, pull that mic so we
3 can -- everybody can hear you clearly. Thank you,
4 sir.

5 Dr. Redmond, you did not submit direct
6 testimony in this case, but you did submit two opinion
7 letters which have been marked as INT022 and 054 and
8 that have been marked and admitted at the pretrial
9 last week.

10 I just want to ask you, first of all, sir,
11 do you have any corrections to your testimony that is
12 set forth in either INT022 or INT 054?

13 DR. REDMOND: I don't believe so, but I
14 have not --

15 CHAIR GIBSON: Well, it would be unusual
16 if you had. It's just I want to be sure we get that
17 clear before we get started into the specific things
18 you said, sir.

19 Okay, and you've not submitted any
20 rebuttal testimony, it was just those two exhibits,
21 correct? Okay, very well.

22 All right. Dr. Redmond, you have read the
23 Environmental Assessment in this case, I take it?

24 DR. REDMOND: Most of it, yes.

25 CHAIR GIBSON: Okay. Have you read the

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1 Bozell and Pepperl 1982 and 1987 Class II Survey
2 Reports for the license renewal area?

3 DR. REDMOND: I've read the site reports
4 for them. I've not gotten the narrative of it and
5 I've asked for that several times. I've got the site
6 reports and I have a lot of problems with the site
7 reports as they sit.

8 CHAIR GIBSON: Okay. But, I'm talking
9 about there was a 1982 survey that was done by two
10 archeologists, anthropologists, Bozell and Pepperl, P-
11 E-P-P-E-R-L, maybe I'm saying that wrong.

12 DR. REDMOND: Pepperl.

13 CHAIR GIBSON: There was one in '87 and
14 one in '82. Are you familiar with those, sir?

15 DR. REDMOND: Yes.

16 CHAIR GIBSON: Okay, okay, very well. All
17 right.

18 It appeared from reviewing the INT054
19 exhibit that your testimony concerned the Crow Butte's
20 Environmental Report for the Marsland Expansion Area.
21 Is that correct?

22 DR. REDMOND: Yes, part of it because,
23 number one, I wasn't able to see that report and I
24 wasn't able to find the qualifications for the person
25 who allegedly did the report.

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1 CHAIR GIBSON: Okay. You're talking about
2 -- this was an Environmental Report that the staff did
3 or it was one that the Applicant did.

4 DR. REDMOND: Oh, I'm sorry, I thought you
5 were talking about the archeological report that was
6 done for that area.

7 CHAIR GIBSON: By the Applicant's expert,
8 and you said you haven't seen that report, sir?

9 DR. REDMOND: The archeological report,
10 yes.

11 CHAIR GIBSON: Okay, okay.

12 DR. REDMOND: Allegedly, there was an
13 archeological survey that was done in that area and
14 I've never seen the archeological report that was
15 done.

16 Let's get clear on this, we may be talking
17 past each other.

18 CHAIR GIBSON: Well, do you know -- okay,
19 let's start over and --

20 DR. REDMOND: Okay.

21 CHAIR GIBSON: -- maybe we can get there.

22 There is a -- there are several of these
23 uranium mine operations in this part of the world,
24 okay?

25 DR. REDMOND: Yes.

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1 CHAIR GIBSON: There is one for Strata,
2 there's one for PowerTech, there's one for Crow Butte
3 at the Marsland facility.

4 DR. REDMOND: Right.

5 CHAIR GIBSON: There's one for Crow Butte
6 that wants to amend the current area. I think it's
7 called the North Trend Expansion Area.

8 And, then there's one here that is the
9 subject of this hearing which is not any of those.
10 And, this is just for the Crow Butte license renewal
11 area where they're operating right now and where they
12 want to continue to operate under this license
13 renewal.

14 DR. REDMOND: Right.

15 CHAIR GIBSON: Okay? And, I guess, what
16 I was having difficulty understanding after reading
17 your reports was that it appeared to me that what you
18 were criticizing about work that the Applicant or the
19 staff had done was work that had been done with
20 respect to these other facilities. And I couldn't
21 find much that you said there about this Crow Butte
22 license renewal area.

23 And, I'm just curious, sir, did I miss
24 something? Is there something there that, you know,
25 escaped me? Or, are these -- are you saying that

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1 they're essentially all the same? They're all similar
2 areas and so the archeological evidence in them would
3 be very similar?

4 DR. REDMOND: No, I had gotten several
5 things all at once and I responded to them in the same
6 letter. And, I responded essentially in the same way
7 because I wasn't getting --

8 Number one, I wasn't getting the upgraded
9 -- the alleged upgraded reports. And I wasn't able to
10 find out what the qualifications were of the people
11 who were doing these surveys.

12 Apparently, they were people who were
13 going out here and in Marsland, apparently or
14 allegedly, that were looking at the areas both here
15 and in Marsland and they were making statements about
16 the areas being cleared and I couldn't find out what
17 their qualifications were to make those statements.

18 Because, both the NHPA and the Bulletin
19 38, to make statements about whether the Traditional
20 Cultural Properties were because they were essentially
21 also saying that there were no Traditional Cultural
22 Properties.

23 CHAIR GIBSON: Yes.

24 DR. REDMOND: And, there are
25 qualifications for both.

1 CHAIR GIBSON: Well --

2 DR. REDMOND: And, I couldn't find out
3 what their qualifications were.

4 CHAIR GIBSON: Dr. Redmond, I understand
5 that you have concern about the qualifications of the
6 archeologists, historians, who were looking at this
7 information. I'm not --

8 DR. REDMOND: I couldn't even --

9 CHAIR GIBSON: I'm not disputing that
10 that's what you're disputing.

11 What I'm trying to find out, sir, though,
12 is something a little different and I must not be
13 asking my question right.

14 DR. REDMOND: No, I understand --

15 CHAIR GIBSON: My question is this, you
16 said in INT022 the materials utilized for the Crow
17 Butte Expansion Cultural Resource Licenses appear to
18 be faulted in several places.

19 And, what is before us today is not the
20 Crow Butte Expansion Area, but the Crow Butte license
21 renewal area.

22 So, was that just a typo or did you mean
23 to say and the renewal area or were you only focusing
24 on the expansion area? Because we're not talking
25 about the expansion area here now --

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1 DR. REDMOND: Yes.

2 CHAIR GIBSON: -- just the license renewal
3 area.

4 DR. REDMOND: And, I understand. I don't
5 think it was so much a typo as it was a
6 misunderstanding on my part at the time.

7 CHAIR GIBSON: Oh, okay.

8 DR. REDMOND: And, in retrospect, I
9 probably should have worded it differently. Okay?
10 Because, it's my understanding that the people that
11 were assigned to do the Cultural and the TCP Surveys
12 were doing both the areas and I couldn't even find out
13 if they were archeologists or historians.

14 CHAIR GIBSON: Okay.

15 DR. REDMOND: Or simply people who were
16 sent to do it.

17 CHAIR GIBSON: Okay. Well, you know, it's
18 a little hard for us to evaluate -- I hope you can
19 appreciate this, sir -- it's a little hard for us to
20 evaluate your testimony, your opinion, when we're not
21 really clear what it is you're focused on.

22 Because the only thing that we can really
23 entertain at this point is not any of these other
24 facilities, it's just the license renewal facility.

25 DR. REDMOND: Yes, and I understand that.

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1 CHAIR GIBSON: Okay. Let's look at, on
2 page one and two of INT022.

3 You say there is no identification or
4 accreditation of those who conducted the Class III
5 Survey or the TCP Surveys. And I think that's what
6 you're saying that you don't know what their
7 credentials were?

8 DR. REDMOND: Correct.

9 CHAIR GIBSON: What specific surveys were
10 you -- are you speaking to there?

11 MR. REID: Can I request that the exhibit
12 be pull up on the monitor so that this witness can
13 look at it?

14 CHAIR GIBSON: I'm sorry, Mr. Reid?

15 MR. REID: Can I request, if you're
16 reading from the exhibit that it be pulled up on the
17 monitor so that the --

18 CHAIR GIBSON: Yes, we can do that, sure.

19 MR. REID: Okay.

20 CHAIR GIBSON: No problem, Mr. Reid.

21 DR. REDMOND: Don't go hunting.

22 CHAIR GIBSON: And, you're basically
23 saying these people, there's no indication these
24 people have the credentials? This is what they need
25 to have and there's no indication they have it, right?

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1 Well, my question is, I just need to know
2 what it is you're saying about this particular
3 facility? Is it this license renewal facility you're
4 saying what the Applicant submitted or what the staff
5 did that you can't tell who it was responsible for
6 that? That they had credentials?

7 DR. REDMOND: Mr. Frankel had sent me some
8 information on, I can't remember what you sent me at
9 that time, do you remember?

10 CHAIR GIBSON: Well, unfortunately, Mr.
11 Frankel can't really help you out now.

12 DR. REDMOND: Okay.

13 CHAIR GIBSON: Okay? We just -- all we
14 need to know is what it was you're really focusing on?
15 It sounds to me like you're just not sure.

16 DR. REDMOND: Like I was --

17 CHAIR GIBSON: I don't want to put words
18 in your mouth, but it sounds like you're just not sure
19 whether it was this license renewal facility or not.

20 DR. REDMOND: I didn't hear the last part
21 of what you said.

22 CHAIR GIBSON: Yes, sir. It sounds to me
23 like you're not sure whether it was this license
24 renewal facility or not.

25 DR. REDMOND: No, it was -- we were

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1 discussing both the expansion area and Crow Butte's.

2 CHAIR GIBSON: Okay, okay.

3 DR. REDMOND: Okay?

4 CHAIR GIBSON: And, you know that Crow
5 Butte is doing both the expansion and the license
6 renewal? That's the same company, they're just doing
7 a different thing?

8 DR. REDMOND: Yes, I do.

9 CHAIR GIBSON: But, when you say and Crow
10 Butte, you mean this facility?

11 DR. REDMOND: Yes.

12 CHAIR GIBSON: Okay, okay, very well. All
13 right.

14 Well, let's look at the -- go back to
15 these 1982 and 1987 Bozell and -- do you know how to
16 say that last name?

17 DR. REDMOND: Pepperl.

18 CHAIR GIBSON: Pepperl. How this surveys.

19 Mr. Deucher, could we pull up CBR030 to
20 help Dr. Redmond? I'm sorry, CBR030. There we go.

21 This is the Nebraska State Historical
22 Society, okay?

23 Now, this exhibit was issued in 1987 and
24 it accepts the Bozell and Pepperl, or Pepperl, study
25 as meeting that agency's requirements as well as its

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1 professional standards. Do you see that, sir?

2 DR. REDMOND: Mm-hm.

3 CHAIR GIBSON: Okay. Now, you're not
4 asserting, I take it, that the archeologists and the
5 State Historic Preservation Officer who signed this
6 letter did not do their due diligence in reviewing the
7 credentials of these two archeologists, Bozell and
8 Pepperl, are you?

9 DR. REDMOND: No.

10 CHAIR GIBSON: Okay. And, you're not
11 disputing the authenticity of this letter, correct?

12 DR. REDMOND: No.

13 CHAIR GIBSON: Okay. So, are you
14 maintaining that Bozell and Pepperl were unqualified
15 to perform a Class III archeological study?

16 DR. REDMOND: I'm not disputing -- I don't
17 hear well, I'm sorry. I didn't hear your last
18 statement.

19 CHAIR GIBSON: I'm very sorry, sir, I'll
20 try to speak louder.

21 DR. REDMOND: No, it's just the way you
22 said it, I don't hear at times.

23 CHAIR GIBSON: I'll try to go more slowly.
24 Okay?

25 Are you maintaining that the Bozell and

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1 Pepperl, these two archeologists, are you disputing
2 that they were unqualified to perform this study?

3 DR. REDMOND: No.

4 CHAIR GIBSON: Okay, okay. All right,
5 very well.

6 DR. REDMOND: There are problems, though.

7 CHAIR GIBSON: Okay, and we'll get to
8 that.

9 DR. REDMOND: Okay.

10 CHAIR GIBSON: Yes, we'll get to that, I
11 hope. All right? And, if we don't, I promise your
12 lawyers will provide us some additional questions to
13 ask you after you finish. Okay? So, just at a break.

14 Okay. You say that not considering
15 traditional, ceremonial or cultural properties or
16 viewshed or landscape impacts is a direct violation of
17 the current cultural heritage laws. Is that correct?

18 DR. REDMOND: Mm-hm.

19 CHAIR GIBSON: You'll have to say yes or
20 no. The Court Reporter --

21 DR. REDMOND: Yes, yes.

22 CHAIR GIBSON: -- can't pick up -- okay,
23 very well, sir.

24 I would like to you tell me specifically
25 the cultural heritage laws that you claim are being

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1 violated.

2 DR. REDMOND: Bulletin 38 and NAGPRA.

3 CHAIR GIBSON: Bulletin 38 of who's
4 bulletin is that, sir?

5 DR. REDMOND: Who's?

6 CHAIR GIBSON: Yes, you said Bulletin 38.
7 I'm just curious?

8 DR. REDMOND: The National Register
9 Bulletin 38, Guidelines for Evaluating and Documenting
10 Traditional Properties.

11 CHAIR GIBSON: Okay.

12 DR. REDMOND: And the Native American
13 Graves Preservation and Repatriation Act, 1990.

14 CHAIR GIBSON: Very well.

15 Okay. In your INT002 opinion, you mention
16 the Secretary of Interior's Standards and Guidelines
17 as specifically defining PCPs, correct?

18 DR. REDMOND: Correct.

19 CHAIR GIBSON: Okay. And, that is
20 Bulletin 38?

21 DR. REDMOND: That's where the Guidelines
22 come from, yes.

23 CHAIR GIBSON: Okay. Now, is Bulletin 38
24 an exhibit? Let me just ask your counsel. Is
25 Bulletin 38 an exhibit?

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1 MR. REID: No.

2 MR. CYLKOWSKI: Your Honor, this is David
3 Cylkowski for the Staff.

4 Bulletin 38 is an exhibit. It's NRC083.

5 CHAIR GIBSON: 083, thank you. Could we
6 call that up, Mr. Deucher? Okay, there we go.

7 This is Bulletin 38, sir?

8 DR. REDMOND: Correct.

9 CHAIR GIBSON: Very well, thank you.
10 We've actually got it in a digital form. That helps.

11 DR. REDMOND: Correct.

12 CHAIR GIBSON: Okay.

13 MR. FRANKEL: Excuse me, Your Honor?

14 CHAIR GIBSON: Yes?

15 MR. FRANKEL: When something's on the
16 monitor, could it be not reduced so small? I'm having
17 a hard time reading the text.

18 CHAIR GIBSON: I think we're constrained
19 by --

20 MR. FRANKEL: Well, it's fine when it
21 starts and then he reduces it a couple of times. And,
22 if he could refrain from that, that would be helpful.

23 CHAIR GIBSON: When we get to a specific
24 page, we'll try to let you -- well, you let me know if
25 you can't see the display, please, Mr. Frankel.

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1 MR. FRANKEL: I sure will.

2 CHAIR GIBSON: We don't want you to be
3 hampered in any way, sir.

4 Okay. So, this is Bulletin 38 is NRC083.
5 Okay? And this is what you say was the -- contains
6 the Standards and Guidelines that for cultural
7 heritage laws that were being violated, correct?

8 DR. REDMOND: Yes. It's what the
9 Guidelines are based on, yes.

10 CHAIR GIBSON: Okay, okay, very well.

11 All right. All right, let's -- now, you
12 also made a reference to -- on page one to the
13 Department of Interior rules. And, I believe we found
14 that. I don't think anybody submitted it as an
15 exhibit. We probably ought to make this a Board
16 exhibit. That would be the 48 Federal Register 44716.
17 This is what you were referring to, Dr. Redmond?

18 DR. REDMOND: From what I can see, I
19 believe this is it, yes.

20 CHAIR GIBSON: Okay, very well.

21 MR. REID: Your Honor, just so we're clear
22 on the record, when you say referring to, could you
23 identify the exhibit he has two letter?

24 CHAIR GIBSON: Yes, we're going to provide
25 copies to you.

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1 MR. REID: I'm not talking about the
2 Federal Register exhibit but the letter, he had two
3 letter opinions. You said on the first page and you
4 didn't identify --

5 CHAIR GIBSON: Oh, I'm sorry, yes. That
6 was in the first -- that was on 022. I'm sorry.

7 MR. REID: Thank you.

8 DR. REDMOND: Yes.

9 CHAIR GIBSON: Thank you for that
10 clarification, Mr. Reid.

11 Now, this exhibit, we'll just call this
12 Board Exhibit 1 for simplicity sake, right, so we'll
13 know what we're talking about. This is 48 Federal
14 Register 44716, correct?

15 It is a publication of the Department of
16 Interior, correct?

17 (Whereupon, the above-referred
18 to document was marked as Board
19 Exhibit 1 for identification.)

20 DR. REDMOND: Yes.

21 CHAIR GIBSON: It is entitled Archeology
22 and Historic Preservation, Secretary of Interior's
23 Standards and Guidelines, correct?

24 DR. REDMOND: Correct.

25 CHAIR GIBSON: Okay. Now, we could scroll

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1 to page two of this highlighted portion there about
2 archeology. Do you see that on the board, sir, it may
3 be highlighted on your copy as well.

4 DR. REDMOND: Correct.

5 CHAIR GIBSON: Okay. These are, as you
6 say, the minimum professional qualifications of a
7 principle investigator, correct?

8 DR. REDMOND: Of a principle?

9 CHAIR GIBSON: Investigator?

10 DR. REDMOND: Correct.

11 CHAIR GIBSON: Now, are there any of these
12 minimum professional qualifications that you're
13 asserting that Bozell and Pepperl failed to meet?

14 DR. REDMOND: No. This is not what I was
15 applying to Rob or Pepperl.

16 CHAIR GIBSON: Okay, okay.

17 DR. REDMOND: This is what I was applying
18 to the people who had made the subsequent
19 investigations for the TCPs and the subsequent
20 investigations here at Crow Butte and the expansion
21 area. Okay?

22 CHAIR GIBSON: Very well.

23 DR. REDMOND: This --

24 CHAIR GIBSON: Thank you for that
25 clarification. And, when you said Rob, were you

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1 referring to Bozell?

2 DR. REDMOND: Oh, I'm sorry, yes.

3 CHAIR GIBSON: You know this person by
4 first name, I guess?

5 DR. REDMOND: Yes, I'm sorry. He was a --

6 CHAIR GIBSON: No, it's okay. I just
7 wanted the record to be clear, Dr. Redmond, that's
8 all.

9 DR. REDMOND: Right, good. Yes, Dr.
10 Bozell and Bozell and Pepperl.

11 CHAIR GIBSON: Okay, well, let me ask you,
12 sticking with Bozell and Pepperl --

13 DR. REDMOND: Please, yes.

14 CHAIR GIBSON: -- are there any other
15 criticisms you have based on this Board Exhibit 1 that
16 you have in front of you of those two archeologists?

17 DR. REDMOND: They are highly qualified.
18 They're -- I have no problems with anything that
19 either did in the field. They are both -- I worked
20 with Bozell in the field out here and I have no
21 problems with what he did in the field.

22 At one time, I was the forest archeologist
23 out here in Chadron for the Nebraska National Forest
24 and Bozell and I and Terry Steinacher, the State
25 Archeologist actually worked on a project out here.

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1 CHAIR GIBSON: Okay. Okay, very well.

2 DR. REDMOND: Just to qualify that, I have
3 no problems with his qualifications.

4 CHAIR GIBSON: Okay. You also make a
5 reference to the project being in direct opposition to
6 the Nebraska State Historic Preservation Plan. And,
7 there is a rebuttal exhibit that the Staff submitted
8 which is NRC085. Could we call that up, Mr. Deucher?

9 Now, this is -- are you familiar with this
10 Nebraska State Historical Society publication?

11 DR. REDMOND: Yes, I believe this is what
12 I was basing my opinion on.

13 CHAIR GIBSON: Okay.

14 All right, at the bottom of -- in your
15 testimony, at the bottom of page two, I guess we're
16 back in 022, you say that the Crow Butte project is in
17 direct opposition to the specific goals, solutions and
18 problems for cultural resources, archeology and
19 interaction with Tribal groups and local populations
20 that is taking place at Crow Butte.

21 And you say that -- which specific goals,
22 problems and solutions are in conflict with the
23 project?

24 DR. REDMOND: Can this be moved up?

25 CHAIR GIBSON: Yes, sir, I'm sorry.

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1 DR. REDMOND: It just went -- that's
2 moved, but the Nebraska --

3 CHAIR GIBSON: Dr. Redmond, do you need
4 some help? We can get you what you need, you just
5 have to tell us what you need.

6 DR. REDMOND: The --

7 CHAIR GIBSON: You have to be a little
8 more articulate than this or that.

9 DR. REDMOND: -- Nebraska goals.

10 CHAIR GIBSON: We can't get there.

11 DR. REDMOND: The Nebraska goals just
12 disappeared.

13 CHAIR GIBSON: You wanted to stick with
14 Nebraska goals? We can do that.

15 DR. REDMOND: If it can be moved down a
16 bit.

17 CHAIR GIBSON: Okay.

18 DR. REDMOND: Nebraska goals.
19 Preservation.

20 All right, in the Nebraska goals --

21 CHAIR GIBSON: Yes, sir?

22 DR. REDMOND: -- it talks about the
23 preservation of the lands for the -- this one --
24 preservation of the lands for the people, preservation
25 of the lands for the --

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1 MR. REID: If I may, Your Honor, I believe
2 the goals start on page 60 --

3 DR. REDMOND: Something about --

4 MR. REID: -- on the exhibit. I believe
5 the goals start at page 60 of the exhibit, 60 and 61.

6 CHAIR GIBSON: All right. We're on 60
7 right there.

8 MR. REID: Sixty-one is the goals, the
9 next page.

10 DR. REDMOND: It defines the utilization
11 of the lands for the --

12 CHAIR GIBSON: You have to speak into the
13 mic, the Court Report can't pick up.

14 DR. REDMOND: It defines the utilizations
15 of the lands for the traditional use of the people,
16 all the people. And, that's not being done in the
17 Crow Butte area in that the lands are not being
18 utilized at least for the Oglala people.

19 There are traditional properties that are
20 out there that are not accessible for the Indian
21 peoples.

22 CHAIR GIBSON: Okay.

23 DR. REDMOND: And, that's essentially in
24 violation of the spirit and the letter of what's being
25 stated in the goals of the State of Nebraska.

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1 CHAIR GIBSON: Okay.

2 DR. REDMOND: At least in my humble
3 opinion.

4 CHAIR GIBSON: Okay. And, when you're --
5 when you say these traditional properties are not
6 being protected or receive the treatment they should
7 be receiving, you're referring back to your earlier
8 statement about the traditional, ceremonial or
9 cultural properties or viewshed or landscape impacts,
10 is that --

11 DR. REDMOND: Correct.

12 CHAIR GIBSON: That's what you're speaking
13 to, is that correct, sir?

14 DR. REDMOND: Correct.

15 CHAIR GIBSON: Very well, okay, thank you.

16 Dr. Redmond, I take it that you consider
17 yourself familiar with the history of the Lakota
18 peoples?

19 DR. REDMOND: I do to some extent.

20 CHAIR GIBSON: Okay, okay.

21 DR. REDMOND: Not as well as I would like.
22 I can give you a quick thumbnail sketch, if you'd
23 like.

24 CHAIR GIBSON: I won't need that. I was
25 actually just wanted to make sure you had sufficient

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1 familiarity that I could ask you some other questions.
2 I don't need an exposition on that. I just have some
3 specific questions I want to ask. Okay?

4 DR. REDMOND: Okay.

5 CHAIR GIBSON: And, if you don't have
6 them, it's just find, I just need to know.

7 Mr. Yellow Thunder has previously
8 submitted testimony indicating that there's seven sub-
9 bands of the Lakota people, do you agree with that?

10 DR. REDMOND: Yes.

11 CHAIR GIBSON: Okay. And the Oglala are
12 one of those seven peoples, is that correct?

13 DR. REDMOND: Correct.

14 CHAIR GIBSON: Okay. Now, in your opinion
15 INT054, you state on the first page near the bottom
16 that the primary Tribal use of this area was by the
17 Sioux and Cheyenne, is that correct? That's what you
18 said?

19 DR. REDMOND: Lakota, yes.

20 CHAIR GIBSON: Okay.

21 DR. REDMOND: And Cheyenne.

22 CHAIR GIBSON: So, can you say that they
23 historically used this area where the Crow Butte mine
24 is located more than other Tribes?

25 DR. REDMOND: Yes, especially in the

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1 historic period. The --

2 CHAIR GIBSON: Just to be sure, so the
3 record is clear, when you say the historic period, is
4 that opposed to the pre-history period or is that
5 something else?

6 DR. REDMOND: Both.

7 CHAIR GIBSON: I'm sorry, I don't --

8 DR. REDMOND: I would say both.

9 DR. REDMOND: Okay. So, both during the
10 pre-history period and the historic period, that would
11 be the time when people would have recorded in, you
12 know, more traditional history books, that's what --

13 DR. REDMOND: I emphasize the historic
14 period because it's actually documented.

15 CHAIR GIBSON: Okay, very well.

16 DR. REDMOND: And, the Red Cloud and the
17 Spotted Tail Agency were right there.

18 CHAIR GIBSON: Okay, all right.

19 Do you know, if you don't, it's fine, I'm
20 just curious, do you know if the Oglala Sioux Tribe
21 used this territory for historical and cultural
22 purposes more than the Santee Sioux Tribe?

23 DR. REDMOND: Absolutely.

24 CHAIR GIBSON: Okay. Did they use this
25 more than the Crow Nation?

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1 DR. REDMOND: Yes.

2 CHAIR GIBSON: Okay.

3 Now, it was the Santee Sioux Tribe and the
4 Crow Nation who were the two Tribes that participated
5 in the a TCP Survey of certain Crow Butte sites,
6 correct? If you don't know, that's okay.

7 DR. REDMOND: From what I've been told.

8 CHAIR GIBSON: Okay.

9 But, you don't -- now, you haven't looked
10 at that yourself, is that correct, sir?

11 DR. REDMOND: I haven't been given that
12 documentation although I've asked for it.

13 CHAIR GIBSON: That's great. That's
14 great. Okay.

15 Okay, okay, very well.

16 I believe that concludes what I have.
17 Judge Wardwell?

18 JUDGE WARDWELL: I have no questions.

19 CHAIR GIBSON: Judge Hajek?

20 JUDGE HAJEK: None.

21 CHAIR GIBSON: Okay. This is what I would
22 like to do. Since I've completed --or we've
23 completed our initial examination of Dr. Redmond, I
24 would ask if counsel has any additional questions that
25 he or she feels need to be asked of Dr. Redmond, if

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1 you would please put those on some paper.

2 We will take a ten minute recess and, per
3 our restroom protocol, the Judges will run to the
4 restroom here and then we'll go sit in our chambers
5 for ten minutes and let y'all use the restrooms and
6 then we'll come back on the record.

7 Until then, we will stand in recess.

8 Thank you.

9 (Whereupon, the above-entitled matter went
10 into closed session at 10:28 a.m.)

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(Whereupon, the above-entitled matter went into open session at 10:36 a.m.)

CHAIR GIBSON: Okay. We are back on the record. Dr. Redmond, was there, in your opinion, was there adequate subsurface testing done in connection with the Crow Butte surveys?

DR. REDMOND: No.

CHAIR GIBSON: Okay. Very well. And what, in your opinion, should have been done in that regard?

DR. REDMOND: In several of the --

CHAIR GIBSON: And I'm talking about the license renewal area now, not any of the other ones.

DR. REDMOND: The license renewal, there should have been a resurvey or a retesting on at least

1 six of the sites. Specifically on --

2 CHAIR GIBSON: When you say six of the
3 sites --

4 DR. REDMOND: Yes.

5 CHAIR GIBSON: -- are you saying six of the
6 sites on the license renewal area?

7 DR. REDMOND: Yes.

8 CHAIR GIBSON: Okay. Very well.

9 DR. REDMOND: Specifically --

10 CHAIR GIBSON: Be sure you don't talk about
11 anything that might be under there. Just what it was
12 they should have been in terms of subsurface testing.

13 DR. REDMOND: I didn't catch the first
14 part.

15 CHAIR GIBSON: Okay.

16 DR. REDMOND: I was thinking.

17 CHAIR GIBSON: You know we just were off
18 the record a minute ago.

19 DR. REDMOND: Yes.

20 CHAIR GIBSON: I want to be sure you don't
21 say anything --

22 DR. REDMOND: Yes.

23 CHAIR GIBSON: -- about anything that they
24 might find there. I'm just saying what should they
25 have done to test right?

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1 DR. REDMOND: They should've tested --
2 either put in more test pits on several of the sites
3 or on at least two of the sites, they should have
4 tested them, period. Because two of the sites, they
5 didn't even test them. They simply either surface
6 collected them or visually checked them and that was
7 it. There were two isolated finds near several of the
8 sites that are probably part of -- at least one of the
9 sites and two of the sites actually may be one very
10 large site. And if they were tested sufficiently, it
11 may be that you could just combine those two sites
12 together. And then on one of the sites, I think it's
13 Site 25DW194, Bozell mentioned that the northern part
14 of the site was outside the area. In 1987, it was,
15 but today it's actually almost dead center in the
16 project area. And, therefore, that part of the site
17 should have been tested.

18 CHAIR GIBSON: Of the -- dead center of the
19 Crow Butte renewal site?

20 DR. REDMOND: Where the project area is
21 today.

22 CHAIR GIBSON: Okay. All right. Okay.

23 DR. REDMOND: So it -- I mean, what was
24 done in 1987 is not sufficient for what's being done
25 today.

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1 CHAIR GIBSON: Because it's your testimony,
2 sir, your opinion that the area of concern is a
3 broader one than what was looked at in 1987 by Bozell
4 and Pepperl, is that correct?

5 DR. REDMOND: Absolutely.

6 CHAIR GIBSON: Okay. Very well. Okay.
7 Now, I have one other question for you. Judge
8 Wardwell and Judge Hajek may have one, but I have one
9 other question for you. There has been a lot of
10 discussion in testimony about the
11 government-to-government relationship, the
12 nation-to-nation relationship between the United
13 States and the Tribes, such as the Oglala Sioux
14 Nation, and whether or not that has been respected and
15 integrated in the design and procedures for the TCP
16 survey. My specific question for you has to do with
17 the issue of Tribal elders and your opinion as to the
18 significance of a dialogue with Tribal elders and why
19 that would be important for a TCP survey.

20 DR. REDMOND: To date, many companies like
21 Cameco have attempted to act as a government in
22 dealing with Tribes. They attempt to set up a
23 government-to-government dialogue between themselves
24 and Tribes when, in fact, they're not a government and
25 they're not a government agency. They attempt to bull

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1 their way over any type of respectful dialogue with
2 the Tribe. And in several of the telephone
3 communications that they've made, several of the
4 Tribal elders and several of the Tribal chairmen have
5 tried to make that clear. To wit, John Yellowbird
6 Steele tried to make that clear in one conversation
7 that this was not a government-to-government telephone
8 call, nor a government-to-government communication.
9 And I forget who was making the call, but she said,
10 oh, that's been duly noted. And then the call went on
11 for another hour.

12 CHAIR GIBSON: Sure.

13 DR. REDMOND: And that is the general way
14 that, that's been done.

15 CHAIR GIBSON: Okay. Well -- very well.
16 I guess my question really just has to do -- I
17 appreciate the fact that there had been criticism
18 about that. My question was a little different, Dr.
19 Redmond, and maybe I didn't ask it precisely enough,
20 sir. But I want to know what in your estimation is
21 the benefit of having a dialogue with the Tribal
22 elders in terms of a TCP survey? Not whether it was
23 done, not whether it should have been Cameco versus
24 the government. I just want to focus on this
25 question. What is the benefit that would be derived

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1 from the involvement of those Tribal elders in the TCP
2 survey?

3 DR. REDMOND: The benefit is that they
4 bring the knowledge of the tradition, first of all.
5 When they come, they bring their families and the
6 cooperation of their families. And when they bring
7 the cooperation of their families, they bring the
8 cooperation of the entire Tribe with them. The elders
9 lead their separate tiyospayes, their separate
10 extended families and that brings these separate
11 groups in. And when that happens, it brings -- it's
12 kind of like a tidal wave. And if you get several
13 families coming in, it shows the other families that
14 you have a good heart --

15 CHAIR GIBSON: Yes, sir.

16 DR. REDMOND: -- and as it shows that you
17 have a good heart, more people will begin to come in.
18 And they'll begin to share and they'll begin to show
19 you where things are. And as more and more people
20 come in, you'll begin to understand what you're
21 dealing with on the ground.

22 CHAIR GIBSON: Very well. Okay. Thank
23 you, sir.

24 DR. REDMOND: Does that make sense? Did it
25 make sense to you?

1 CHAIR GIBSON: I understand what you're
2 saying, sir. Yes, I do understand what you're saying.
3 Okay? I mean, you made your point and we needed to
4 hear that point, so we wanted to know your opinion.
5 You also testified earlier a little bit about
6 pre-history and history. And I just want to make
7 sure, when you say the historic period, are you really
8 referring to the period of time that would have been
9 memorialized in a history book or something, writing
10 about it as opposed to something that happened before
11 there was writing and recording of these things that
12 happened? Or are you talking about something else?
13 I just want to make sure so that we're clear. When we
14 review this transcript and you say, during the
15 historic period, that we know that about which you are
16 speaking.

17 DR. REDMOND: No. I'm talking about the
18 conventional idea of the historic period when it
19 begins to be written down.

20 CHAIR GIBSON: Very well. Okay. Thank
21 you. The Oglala Sioux Tribe is the largest of the
22 Lakota Tribes, is that correct? Or do you not know?
23 That's fine. It's correct? Okay.

24 DR. REDMOND: I can ask my cousin.

25 CHAIR GIBSON: No, it's okay. We

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1 appreciate it. I think your expert -- that may have
2 gone beyond your expertise. Which is fine. On which
3 you could rely on hearsay. Judge Wardwell, you have
4 anything else?

5 JUDGE WARDWELL: I have no questions.

6 CHAIR GIBSON: Judge Hajek?

7 JUDGE HAJEK: I have no questions.

8 CHAIR GIBSON: Okay. Dr. Redmond, you are
9 excused and I wish you well on your other events that
10 you've got to take care of this weekend.

11 DR. REDMOND: Thank you.

12 CHAIR GIBSON: Yes, sir. All right. At
13 this point, we will have the witnesses for Contentions
14 A, C, D, F, and 14, please come and sit at the witness
15 tables. As you are setting up, if I could ask that
16 the person that you each feel will be answering most
17 of the questions to sit kind of in the middle in front
18 of a microphone, that would be appreciated. I know
19 many of the -- much of the testimony was supported by
20 all of the witnesses here and I'm going to ask that
21 each party designate kind of a lead person to direct
22 things, recognizing that you can always go back and
23 get assistance from anyone else. But if you can kind
24 of designate one person to be the lead person for the
25 questions that I have, that would be useful. And to

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1 have that person near a mic would be the most
2 appropriate way to do it.

3 MR. REID: This is Andrew Reid for the
4 Tribe. While they're getting set up, can I ask a
5 question of the Board, please?

6 CHAIR GIBSON: Yes. Yes, Mr. Reid.

7 MR. REID: I had, and maybe it's because I
8 misunderstood the procedure, I thought that from what
9 I read from the Board's Order that they were going to
10 be taken up in sequence from each one of those
11 Contentions. And because of that, I instructed our
12 expert, Charmaine White Face, not to come until
13 tomorrow. So she's not here today because she's not
14 on one of the early Contentions in that Order.
15 Hopefully, you'll allow her, if this goes on until
16 tomorrow, allow her to testify and sit in at that
17 time.

18 JUDGE WARDWELL: We will occupy all of
19 today and all of tomorrow and part of Wednesday on
20 this. When I get to the part, if I do, where I'm
21 having some questions for her, I'll just postpone
22 those until she arrives tomorrow. And I don't believe
23 we'll get to those today anyhow, so I don't see that
24 as a problem.

25 MR. REID: Thank you very much. I'll take

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1 her name card off the table so you're not confused.

2 CHAIR GIBSON: I didn't hear what you said,
3 Mr. Reid, I'm sorry. The last thing.

4 MR. REID: Just taking her name card off
5 the table so you're not confused and you don't --

6 CHAIR GIBSON: Okay.

7 MR. REID: -- think that she's sitting up
8 here.

9 CHAIR GIBSON: Thank you.

10 MR. REID: Okay.

11 CHAIR GIBSON: Thank you.

12 MS. SIMON: Your honor, I'm sorry. Marcia
13 Simon for the staff. I believe Dr. Fuhrmann is having
14 a little trouble seeing over that monitor. Is there
15 any way we can try to adjust that? Maybe lower it or
16 -- thank you.

17 DR. FUHRMANN: That works, thank you.

18 JUDGE WARDWELL: You could also move a
19 little bit to the side of the table if you wish also.
20 Not the monitor, but yourself. Both items move, both
21 yourself and the monitor, so you can do one or the
22 other.

23 CHAIR GIBSON: Very well. Okay. This will
24 just take a couple minutes, but we're going to have to
25 go through this in order. We'll start with you on the

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1 far right. Would you please stand and raise your
2 right hand, state your full name, sir?

3 MR. SOLIZ: Bryan Soliz.

4 CHAIR GIBSON: Do you affirm that all the
5 testimony you are about to give in this case now
6 before this Board will be the truth, the whole truth,
7 and nothing but the truth? This you affirm under the
8 pains and penalties of perjury?

9 MR. SOLIZ: I do.

10 CHAIR GIBSON: Okay. Let's go to the next
11 one there. Sir, would you please state your full name
12 for the record?

13 MR. LEWIS: Robert Lee Lewis.

14 CHAIR GIBSON: You do affirm that all the
15 testimony you are about to give in this case now
16 before the Board will be the truth, the whole truth,
17 and nothing but the truth? This you affirm under the
18 pains and penalties of perjury?

19 MR. LEWIS: I do.

20 CHAIR GIBSON: Please state your full name
21 for the record, sir.

22 MR. BEINS: Wade Alan Beins.

23 CHAIR GIBSON: You do affirm that all the
24 testimony you are about to give in the case now before
25 the Board will be the truth, the whole truth, and

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1 nothing but the truth? This you do affirm under the
2 pains and penalties of perjury?

3 MR. BEINS: Yes.

4 CHAIR GIBSON: Would you please state your
5 full name, sir?

6 MR. SPURLIN: Matthew Sean Spurlin.

7 CHAIR GIBSON: You do affirm that all the
8 testimony you are about to give in the case now before
9 the Board will be the truth, the whole truth, and
10 nothing but the truth? This you do affirm under the
11 pains and penalties of perjury?

12 MR. SPURLIN: Yes.

13 CHAIR GIBSON: Would you please state your
14 full name, sir?

15 MR. TEAHON: Larry Teahon.

16 CHAIR GIBSON: You do affirm that all the
17 testimony you are about to give in the case now before
18 the Board will be the truth, the whole truth, and
19 nothing but the truth? This you do affirm under the
20 pains and penalties of perjury?

21 MR. TEAHON: I do.

22 CHAIR GIBSON: Please state your full name,
23 sir.

24 MR. FUHRMANN: Mark Fuhrmann.

25 CHAIR GIBSON: You do affirm that all the

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1 testimony you are about to give in the case now before
2 the Board will be the truth, the whole truth, and
3 nothing but the truth? This you do under the pains
4 and penalties of perjury?

5 MR. FUHRMANN: I do.

6 CHAIR GIBSON: Please state your full name.

7 DR. STRIZ: Elise Striz.

8 CHAIR GIBSON: Please raise your right
9 hand. You do affirm that all the testimony you are
10 about to give in the case now before the Board will be
11 the truth, the whole truth, and nothing but the truth?
12 This you do affirm under the pains and penalties of
13 perjury?

14 DR. STRIZ: I do.

15 CHAIR GIBSON: Would you please stand up,
16 sir? Would you please state your full name?

17 MR. BACK: David Back.

18 CHAIR GIBSON: You do affirm that all the
19 testimony you are about to give in the case now before
20 the Board will be the truth, the whole truth, and
21 nothing but the truth? This you do affirm under the
22 pains and penalties of perjury?

23 MR. BACK: I do.

24 CHAIR GIBSON: Yes, sir. Would you please
25 raise your right hand, state your full name?

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1 MR. LANCASTER: Thomas Lancaster.

2 CHAIR GIBSON: You do affirm that all the
3 testimony you are about to give in the case now before
4 the Board will be the truth, the whole truth, and
5 nothing but the truth? This you do affirm under the
6 pains and penalties of perjury?

7 MR. LANCASTER: I do.

8 CHAIR GIBSON: Okay.

9 MS. WHITE PLUME: Wioweya Najin Win, a.k.a.
10 Debra White Plume.

11 CHAIR GIBSON: Okay. Could you set your
12 water down for a second so you could raise your right
13 hand?

14 MS. WHITE PLUME: I'm raising my right
15 hand.

16 CHAIR GIBSON: Okay. You do affirm that
17 all the testimony you are about to give in the case
18 now before this Board will be the truth, the whole
19 truth, and nothing but the truth? This you do affirm
20 under the pains and penalties of perjury?

21 MS. WHITE PLUME: Yes, sir.

22 CHAIR GIBSON: Okay. Thank you. Yes?

23 MS. MCLEAN: Linsey Mary McLean.

24 CHAIR GIBSON: Please raise your right
25 hand. You do affirm that the testimony you are about

1 to give in the case now before this Board will be the
2 truth, the whole truth, and nothing but the truth?
3 This you do affirm under the pains and penalties of
4 perjury?

5 MS. MCLEAN: I do.

6 CHAIR GIBSON: Yes, sir.

7 DR. LAGARRY: Dr. Hannan Earl LaGarry.

8 CHAIR GIBSON: You do affirm that all the
9 testimony you are about to give in the case now before
10 the Board will be the truth, the whole truth, and
11 nothing but the truth? This you do affirm under the
12 pains and penalties of perjury?

13 DR. LAGARRY: I do.

14 CHAIR GIBSON: Yes, sir. Would you please
15 state your full name?

16 MR. WIREMAN: Mickel Wireman.

17 CHAIR GIBSON: You do affirm that all the
18 testimony you are about to give in the case now before
19 the Board will be the truth, the whole truth, and
20 nothing but the truth? This you do affirm under the
21 pains and penalties of perjury?

22 MR. WIREMAN: I do.

23 CHAIR GIBSON: Please state your full name,
24 sir.

25 DR. KREAMER: David Kenneth Kreamer.

1 CHAIR GIBSON: You do affirm that all the
2 testimony you are about to give in the case now before
3 this Board will be the truth, the whole truth, and
4 nothing but the truth? This you do affirm under the
5 pains and penalties of perjury?

6 DR. KREAMER: I do.

7 CHAIR GIBSON: All right. Very well.

8 MS. SIMON: Your honor, I'm sorry. We have
9 two witnesses here who didn't get sworn yet. They're
10 behind the four at the table.

11 CHAIR GIBSON: We have one more witness,
12 I'm terribly sorry.

13 MS. SIMON: We have two.

14 CHAIR GIBSON: Two more witnesses. Okay.
15 Can you please raise your right hand, sir, and state
16 your full name?

17 MR. CAO: Tianqing Cao.

18 CHAIR GIBSON: You do affirm that all the
19 testimony you are about to give in this case now
20 before the Board will be the truth, the whole truth,
21 and nothing but the truth? This you do affirm under
22 the pains and penalties of perjury?

23 MR. CAO: I do.

24 CHAIR GIBSON: Thank you.

25 MR. GOODMAN: Nathan Goodman.

1 CHAIR GIBSON: You do affirm that all the
2 testimony you are about to give in this case now
3 before the Board will be the truth, the whole truth,
4 and nothing but the truth? This you do affirm under
5 the pains and penalties of perjury?

6 MR. GOODMAN: I do.

7 CHAIR GIBSON: Did I miss any other
8 witnesses other than the one that will be showing up
9 later? Very well. Okay. Judge Wardwell?

10 JUDGE WARDWELL: Thank you, Judge Gibson.
11 A couple items I want to discuss before we get into
12 the questioning just so we know what we're doing here
13 and why we're doing it to a certain degree or how
14 we're going to do it is probably a better way to state
15 that. But we've got a lot of stuff to cover in a
16 relatively short time between now and Wednesday. I am
17 going to ask questions of many of you and I'm going to
18 preface it by usually referencing usually your own
19 testimony and it usually is a direct quote. So just
20 listen to that quote just to refresh your memory and
21 you should remember, of course, what that is, it's
22 your testimony, so that it precludes us from having to
23 take the time to pull that up.

24 I'm only going to pull up very selected
25 exhibits where I want to reference something specific

1 on it. If at any time you feel a real need to see an
2 exhibit, then fine, let me know and we'll try to
3 accommodate that. But I don't want to do it for all
4 the questioning because we may have a lot of snow to
5 remove when we leave the area by the time we get done.

6 If I ask a yes/no question, I would
7 appreciate a yes/no answer. I know sometimes that's
8 difficult, but likewise try to adhere to that as best
9 you can. Mainly because I think they're simple and
10 more than likely my next question will go to something
11 you probably wanted to add to that yes/no question.
12 In all cases, make your answers as crisp and direct to
13 the question that I asked as you possibly can. If you
14 start elaborating beyond what I intended, I will
15 probably stop you. Please don't take that as me being
16 rude. I don't mean it to be that. I'm just trying to
17 make sure we're moving this along. It's not being
18 rude. If it's rude to anyone, it's me because then I
19 probably didn't ask the question correctly and I want
20 to make sure we get back on to the question I have.

21 Keep in mind, you've all submitted all
22 your testimony. We've read it all. We've looked it
23 all over. So we know what your positions are. These
24 are clarifying questions that I want to make sure
25 we're pinpointing down that I want a response to. And

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1 so there's no need to repeat stuff that you've already
2 said in your testimony that isn't related to that
3 question. Trust us, we know your testimony. And if
4 you do that, I think we'll move along quite nicely.

5 I think Judge Gibson talked about it
6 earlier, I'd like to reemphasize it again. It may
7 seem like we're focusing on certain witnesses. That's
8 just inevitable. If anything, don't feel slighted if
9 you're not asked much, because what you can take home
10 from that is that your direct testimony was very
11 clear. If there was clarity in everyone's testimony
12 to the degree we felt we needed to establish a record
13 and make our own decision, we wouldn't have any
14 questions and we wouldn't have to deal with an oral
15 hearing. Well, that's not the case. So don't -- I
16 just want to make sure you just don't feel slighted if
17 you seem like you're not there -- not participating.

18 I would ask that no one raise their hands
19 because you've got a burning thing you want to ask in
20 addition. We are the judges of what we need to have
21 for information. If we feel a need, we will ask those
22 clarifying questions. And likewise, don't interrupt
23 and ask whether you would have the chance to clarify
24 something. Please don't do that. It'll just
25 interrupt the proceeding. Write it down on a note to

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1 yourself and provide it to your counsel so that they
2 can then provide it to us at the end to consider for
3 asking ourselves.

4 And that's the best way to do it. And
5 things will move smoothly if we do it that way. We
6 won't wait until the very end of all these Contentions
7 to ask for those written questions. We're going to
8 break it down because otherwise we'd get all slumped
9 and have no idea where we are by the end of this. I
10 will mention that some of my questions may be very
11 specific and require you to look up something in the
12 testimony to a very specific question. Just let me
13 know that and we will hold that in abeyance while you
14 look it up during the break and then we'll start each
15 session when we come back in with catching up on all
16 of those specific points that we happen to have that
17 we decided to delay while you get the information that
18 you really need.

19 I didn't anticipate you to memorize all of
20 the exhibits. So I certainly see that, that'll be a
21 need. And I'll ask the law clerks if they could to
22 keep kind of track of that because I'll forget what
23 those are too. Especially if it happens right early
24 on as we start and then an hour and a half later when
25 we break I completely forgot that we want to tidy up

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1 those little housekeeping things of those things that
2 have been postponed.

3 I'm going to start off asking a lot of
4 general hydrogeologic questions. They pertain to all
5 these groups of Contentions. They won't be specific
6 to any one Contention because it really provides
7 either background or direct information for all of
8 them. And then near the end, I'll get to those actual
9 Contentions. But that probably won't be until
10 tomorrow afternoon or even Wednesday that we talk
11 about a specific Contention. It's just general
12 hydrogeologic information that applies to all of them.
13 And that's where I'll be starting off.

14 And because of that, as I said, if
15 possible, I'd like to have a designated person that I
16 start off that questioning with. And then, certainly,
17 I'll break away and ask others in regards to
18 addressing that. Or if you as the lead person can
19 say, well, that will be best handled by this person,
20 that's the way to pass it off from what we'll call the
21 team captain, if we will, here for this round of
22 general hydrogeologic questioning. Because in most
23 cases, all of you people, and I know that two of the
24 parties, that you kind of back most of the questions
25 anyhow, you're all listed as that.

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1 And if I'm asking the captain a question
2 that isn't within their purview, then feel free to
3 pass it off before you start answering to any one of
4 your panel members and that's fine. I think that's
5 the easiest way to get through this. So if I might,
6 I'll start with Crow Butte. Is there one lead person
7 that would be -- and that's you Mr. Beins? Beins, is
8 that --

9 MR. BEINS: Mr. Beins.

10 JUDGE WARDWELL: Did I pronounce that
11 right?

12 MR. BEINS: Yes.

13 JUDGE WARDWELL: Say it --

14 MR. BEINS: Beins.

15 JUDGE WARDWELL: Beins?

16 MR. BEINS: Beins. Like Heinz ketchup.
17 Beins.

18 JUDGE WARDWELL: Beins. Okay, good. And
19 is that a Mister or is it a Doctor?

20 MR. BEINS: Mister.

21 JUDGE WARDWELL: Okay. For NRC, is there
22 --

23 MR. BACK: David Back.

24 JUDGE WARDWELL: Mister or Doctor?

25 MR. BACK: Mr. Back.

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1 JUDGE WARDWELL: Okay. And for both the
2 Consolidated Intervenors and the Oglala Sioux Tribe,
3 is there one who would --

4 DR. LAGARRY: Dr. Hannan LaGarry.

5 JUDGE WARDWELL: Okay. I think we're ready
6 to get ready. Anything else from the Board members
7 before we charge on in of introductory stuff? Okay.
8 Let me start off. Crow Butte's Exhibit 045 dealt with
9 some testimony, Page 4 of 60, you state that the area
10 of review for the application is 2.5 miles. My
11 question is, where is that area of review defined and
12 what is its legal significance and why is there any
13 difference between that and the license area, the LA?
14 See how well my system works? The very first
15 question. But fine, that's the way to do it, just
16 pass it off. That's great.

17 MR. TEAHON: That's part -- that's
18 identified in --

19 JUDGE WARDWELL: Oh and one other thing,
20 sorry. When you do start asking questions, if you
21 could, just state your name. I think it's -- last
22 name is fine. Just state your last name before you
23 answer so then if it is passed off, we'll be able to
24 get that correct on the transcript.

25 MR. TEAHON: Teahon. That's defined in the

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1 license application as the area of review, the 2.5
2 miles.

3 JUDGE WARDWELL: So did you as Crow Butte
4 designate that distance or is that some type of
5 guidance that you get from the staff is this area of
6 review?

7 MR. TEAHON: That's part of NUREG 15.69
8 requirement.

9 JUDGE WARDWELL: And why -- is there a
10 reason for -- what's the significance of that
11 difference between that and just the license area?

12 MR. TEAHON: I'm not familiar with the
13 background on setting that area for review. It's just
14 the guidance that we follow when setting up the
15 license renewal.

16 JUDGE WARDWELL: Thank you. In your
17 License Renewal Application, and that's Exhibit 011 of
18 Crow Butte, on Page 2-127, in regards to the Pierre
19 Shale, you state that the, and I quote, the black
20 marine shale is an ideal confining bed with measured
21 vertical hydraulic conductivity in the area of review
22 of less than two times ten to the minus nine
23 centimeters per second. That's what was stated in the
24 License Renewal Application, so I may have kind of
25 deked out, Dr. LaGarry, but I actually have a question

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1 for you in regards to this. I didn't pick up much in
2 the testimony from the Consolidated Intervenors in
3 regards to the Pierre Shale. And I was wondering if
4 you assume that you do not have much of an issue in
5 regards to potential migration into that particular
6 body?

7 DR. LAGARRY: That's correct.

8 JUDGE WARDWELL: So you agree that the
9 integrity of the lower confining unit, the Pierre
10 Shale, has not really been contested in this
11 proceeding and is, therefore, not an issue?

12 DR. LAGARRY: That's correct.

13 JUDGE WARDWELL: Thank you. Back to Crow
14 Butte. Referring to a figure that, if you can, and
15 the one I offer as a recommendation is in the License
16 Renewal Application, which is Exhibit 011, Figure
17 3.1-5, Page 317, would be a good example except that
18 particular figure was blank. But the title was
19 intriguing and that's A Typical Well-Field Layout.
20 And that was the heart of my question is, can you
21 refer us to a figure and if not, then at least
22 describe the general pattern and spacing of injection
23 wells and production wells used at this facility?

24 MR. BEINS: Certainly. Wade Beins with
25 Crow Butte. Our well-field design is based typically

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1 on what we call a seven spot well design where you
2 have six injection wells laid out across the ore body
3 in hexagon patterns. And then the seventh spot or
4 seventh well is located central to those six injection
5 wells. Typically it's 75 feet between injection well
6 to producing well.

7 JUDGE WARDWELL: And that's -- the 75 feet
8 is the radius from the production well to the
9 injection well?

10 MR. BEINS: That's correct.

11 JUDGE WARDWELL: And what does that end up
12 to be about spacing around the seven wells without me
13 doing my math in my head which probably I couldn't do
14 anyhow, so I just won't bother.

15 MR. BEINS: Each production pattern roughly
16 is about 14,000 square feet per pattern.

17 JUDGE WARDWELL: And would you know the
18 distance, lateral distance, between the injection
19 wells approximately?

20 MR. BEINS: And that distance is about 75
21 feet, yes.

22 JUDGE WARDWELL: So it ends up about the
23 same? Okay. And is there a reason this is blank on
24 your exhibit, that page?

25 MR. BEINS: I do not know the answer to

1 that.

2 JUDGE WARDWELL: Thank you. Can you also
3 describe the general pattern and the spacing of
4 monitoring wells for the ore body and the upper
5 confining unit used at Crow Butte in the license area?

6 MR. BEINS: I'm sorry. Could you repeat
7 that please?

8 JUDGE WARDWELL: Yes. Can you describe the
9 general pattern and spacing of any additional
10 monitoring wells for excursions or anything else that
11 you happen to have around those production units?

12 MR. BEINS: Certainly. Around the Crow
13 Butte ore body itself, located 300 feet out
14 approximately from the mining well-field is the
15 production monitor ring. These producer or production
16 monitors are screened in the same interval as where
17 the mining takes place. The monitor ring is 300 feet
18 away from the active mining well-field and the
19 distance between the individual monitoring wells is
20 approximately 400 feet, no more than 400.

21 JUDGE WARDWELL: NRC's Exhibit 010 is their
22 Environmental Assessment. And on Page 32, and also
23 shown on the License Renewal Application, which is
24 Crow Butte Exhibit 011 at Page 225, is the CBR
25 facility lies within the watersheds of White Clay

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1 Creek, Squaw Creek, and English Creek, which are all
2 small Southern tributaries to the White River. I now
3 will deke out Dr. LaGarry again by looking to him and
4 say, do you agree with that representation that's
5 presented in the Environmental Assessment and in Crow
6 Butte's License Renewal Application that those are the
7 creeks really surrounding or going through the license
8 area that also discharge into the White River?

9 DR. LAGARRY: I'm going to send this over
10 to one of our hydrologists.

11 JUDGE WARDWELL: Fine.

12 DR. KREAMER: Dr. Dave Kreamer. That's
13 basically correct, but there are a couple additional
14 small creeks. Those include Saw Log Creek --

15 JUDGE WARDWELL: Say it again? Saw Log?

16 DR. KREAMER: Saw Log Creek. Some unnamed
17 creeks in the area. There are several reservoirs in
18 the area, including McDowell Number One Reservoir and
19 Squaw Creek Reservoir.

20 JUDGE WARDWELL: Okay. Thank you. Crow
21 Butte, do you --

22 CHAIR GIBSON: Just one second, Judge
23 Wardwell. Could spell the name of the first creek you
24 said just a second ago?

25 DR. KREAMER: It's Saw Log, like you saw --

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1 CHAIR GIBSON: S-A-W L-O-G?

2 DR. KREAMER: Yes.

3 CHAIR GIBSON: Two words?

4 DR. KREAMER: One.

5 CHAIR GIBSON: One word?

6 DR. KREAMER: Yes.

7 CHAIR GIBSON: Okay. I just wanted to be
8 sure the court reporter got it.

9 DR. KREAMER: No, I'm sorry, it is two
10 words.

11 CHAIR GIBSON: It is two words? Okay,
12 good. I wanted to be sure the court reporter got it.
13 Okay, thanks.

14 JUDGE WARDWELL: And I find you can get
15 pretty close to these mics without any feedback, so
16 try to get as close as you can. But I recognize
17 they're kind of fixed in place and -- do the best you
18 can. Crow Butte, did you have any comments on those
19 additions in regards to surface features that are
20 running through the license area?

21 MR. BEINS: No additional comments, sir.

22 JUDGE WARDWELL: Thank you. The NRC's EA,
23 again it's Exhibit 011 at Pages 31 to 32, and I quote,
24 as described in the staff's EA, the closest boundary
25 of the Pine Ridge Reservation is at least 30 miles

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1 from the northeast boundary of the license area. Dr.
2 LaGarry, do you agree with that approximate distance
3 between the Pine Ridge and the northeastern boundary
4 of the license area?

5 DR. LAGARRY: I do.

6 JUDGE WARDWELL: Thank you. Dr. LaGarry,
7 with no dates or page numbers for that matter on your
8 reports, I just want to verify that your Exhibit
9 INT003 is your 2008 report?

10 DR. LAGARRY: I don't see it on the screen,
11 but I did do a 2008 report, yes.

12 JUDGE WARDWELL: And to your knowledge, is
13 it designated INT003?

14 DR. LAGARRY: As best I can tell, yes.

15 JUDGE WARDWELL: And how about INT013 for
16 your 2015 opinion?

17 DR. LAGARRY: Okay.

18 JUDGE WARDWELL: And how about INT043 for
19 your 2015 report on lineaments?

20 DR. LAGARRY: Correct.

21 JUDGE WARDWELL: Okay. Thank you. Just
22 curious on, is there are a reason you don't like to
23 date your reports or paginate them? For any reason
24 that I should know? Any --

25 DR. LAGARRY: No.

1 JUDGE WARDWELL: -- significant reasons?

2 Okay.

3 DR. LAGARRY: No.

4 JUDGE WARDWELL: Just want to make sure
5 there isn't some hidden meaning there.

6 DR. LAGARRY: None.

7 JUDGE WARDWELL: Thank you. Let's get into
8 talking about some of the strata that are beneath the
9 site. Dr. LaGarry, would you agree that the geologic
10 strata in the license area are mostly associated with
11 sedimentary processes?

12 DR. LAGARRY: That's correct.

13 JUDGE WARDWELL: And what is the difference
14 between a consolidated and an unconsolidated geologic
15 material?

16 DR. LAGARRY: Geological materials become
17 consolidated either through compaction or cementation.
18 So a consolidated material has a condition of what's
19 called indurated, which means it's hard. An
20 unconsolidated sand, like beach sand, one can work
21 with one's hands and it crumbles away.

22 JUDGE WARDWELL: So in my simplistic mind,
23 and that was an excellent answer I thought, my
24 simplistic mind is consolidated rock-like material and
25 unconsolidated more soil-like material?

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1 DR. LAGARRY: Generally speaking, although
2 the sedimentary bedrock, the geological formations, in
3 this area can be both consolidated and unconsolidated.
4 And this creates issues for, say, soil scientists and
5 whomever. When one thinks of bedrock under the land
6 surface, one automatically assumes that it's
7 consolidated or indurated. But the nature of the
8 sedimentary rocks in this region is such that they may
9 be loosely consolidated, poorly indurated, and in
10 places one can work them with one's hands.

11 JUDGE WARDWELL: Okay. Thank you. And I
12 think I did confuse you on that. I didn't mean soil
13 in the agricultural aspect, but more in the
14 engineering aspect if you will, of --

15 DR. LAGARRY: Okay.

16 JUDGE WARDWELL: -- being just what you
17 described. Thank you.

18 DR. LAGARRY: We have an addition.

19 MR. WIREMAN: Yes, just a quick one. Mark
20 Wireman. We also use a term called semi-consolidated.
21 Which really does kind of refer to some of these
22 rocks, particularly at the outcrop, where the rocks
23 are both consolidated in part and sort of not so
24 consolidated in other parts. So that's a term that's
25 commonly used.

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1 JUDGE WARDWELL: So, Dr. LaGarry, if I
2 might ask you, and again, I would hold off on offering
3 additional testimony, again, just to -- a given strata
4 may have a name, but it may easily vary from
5 consolidated to unconsolidated as you spatially go
6 amongst horizontal and vertical distances of that
7 geologic named strata. Is that what you were saying
8 earlier also?

9 DR. LAGARRY: That's correct.

10 JUDGE WARDWELL: Yes. So it can easily
11 vary between this unconsolidated and consolidated
12 material in and out all the time through that same
13 strata?

14 DR. LAGARRY: That's correct.

15 JUDGE WARDWELL: In regards to your
16 testimony in Exhibit 003, that 2008 report, on Page 2,
17 you list the regional geologic features from the
18 youngest to oldest to be the following, and I would
19 like you to listen and see if there's any errors at
20 the end that I have from my list. I think you start
21 off with the modern river alluvial as being the
22 upper-most material. The Ogallala Group being the
23 next, and I have here in my notes the river alluvium,
24 either you said this or I said it from my own notes,
25 I'm not sure which, designated as an Aquifer Four. I

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1 don't know whether you gave it that name or I gave it
2 that name, just numbering it. But --

3 DR. LAGARRY: I did that.

4 JUDGE WARDWELL: Okay, good. So I'll
5 continue with that numbering scheme. The Ogallala
6 Group, I think you named the Aquifer Three. The
7 Arikaree, did I pronounce that correct?

8 DR. LAGARRY: You did.

9 JUDGE WARDWELL: Oh, hey, good. Because
10 it's always hard for me to change after reading all
11 this testimony and pronouncing it that way to myself
12 and when I'm usually wrong with pronunciations, I end
13 up going back to mine anyhow for the rest of the
14 proceeding, so it's good that we're consistent
15 together anyhow. The Arikaree Group is the lower part
16 of Aquifer Three, I think is the way you designated
17 it. And the Ogallala being Aquifer Three, the upper
18 part of it. The Brule Formation being Aquitard Two.
19 The Chadron Formation being Aquitard One. And now,
20 probably the most interesting one, the Chamberlain
21 Pass Formation as Aquifer One, which is the ore body,
22 I believe. And then the Pierre Shale being the
23 Aquitard Number One.

24 DR. LAGARRY: That's correct.

25 JUDGE WARDWELL: All those are correct?

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1 Great, thanks. In NRC testimony, Page 41, and in the
2 NRC Exhibit 024, Page 212, and in the CBR Exhibit 016,
3 Pages 216 to 224, Crow Butte resources and staff have
4 the strata as such, and I'll ask to have
5 clarifications later on. And I've put down here some
6 thicknesses for each of those strata, which I've taken
7 from the Crow Butte testimony in 001, Page 11, A34,
8 and the Crow Butte License Renewal Application, Page
9 2-107, Figure 26-2, which has been called up here.
10 And correct me if I'm wrong for NRC and then I'll ask
11 CBR the same thing, so just giving you a heads up so
12 I don't have to repeat the whole column hopefully when
13 I get done.

14 But you start off with modern river
15 alluvium, the Arikaree Group, which you state is south
16 of the license application, and I think you've
17 designated it about 200 to 400 feet in thickness. You
18 then mention the middle and upper Brule Formation, 200
19 to 400 feet in thickness. The lower Brule Formation,
20 200 to 300 feet. The middle and upper Chadron
21 Formation, which is 120 to 250 feet thick. The Basal
22 Chadron Formation, which is the ore body, of 10 to 80
23 feet in thickness. And the Pierre Shale, which is
24 1,200 to 1,500 feet in thickness. Is there any
25 glaring errors for that generalization that I think I

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1 basically took off of this exhibit, Mr. Back?

2 MR. BACK: No.

3 JUDGE WARDWELL: And, Mr. Beins?

4 MR. BEINS: No.

5 JUDGE WARDWELL: Heinz, Beins?

6 MR. BEINS: Beins.

7 JUDGE WARDWELL: I'll get it. Do you mind
8 if I say Heinz first before I say Beins? We'll just
9 pretend it's --

10 MR. BEINS: Yes, if that suits you, that's
11 find.

12 JUDGE WARDWELL: Pretend that's your first
13 name. Heinz Beins. It's hard to do multitask up
14 here, trust me.

15 MR. BEINS: That's perfectly fine.

16 JUDGE WARDWELL: And do you agree that the
17 modern river alluvium and the Arikaree Group and the
18 middle and upper Brule Formations you consider to be
19 aquifers? Albeit, they may not be high-producing
20 ones, but they are generally aquifers as opposed to an
21 aquitard?

22 MR. BEINS: That's correct.

23 JUDGE WARDWELL: And that the lower Brule
24 would be more of an aquitard?

25 MR. BEINS: That's correct.

1 JUDGE WARDWELL: And the middle and upper
2 Chadron would be also an aquitard?

3 MR. BEINS: That's correct.

4 JUDGE WARDWELL: And the Basal Chadron
5 would be an aquifer?

6 MR. BEINS: Yes, sir.

7 JUDGE WARDWELL: Mr. Back, do you agree
8 with that generalization --

9 MR. BACK: Yes, I agree.

10 JUDGE WARDWELL: -- of what they are? Dr.
11 LaGarry, do the Brule and the Chadron make up the
12 White River Group? So if we see that phrase, is that
13 what we're talking about?

14 DR. LAGARRY: The White River Group
15 consists of, at the base, the Chamberlain Pass
16 Formation. Over which lies the Chadron Formation.
17 Over which lies the Brule Formation.

18 JUDGE WARDWELL: And do you have any issues
19 with the associated approximate depths that were
20 presented on this as I just described all of these in
21 the license area?

22 DR. LAGARRY: Without the benefit of
23 subsurface information of my own in that area, it's
24 about right.

25 JUDGE WARDWELL: Thank you. NRC testimony,

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1 Exhibit 001, at Page 55, its answer for F.4, the staff
2 testifies that the cross-sections provided in Figures
3 2.6-4 to 2.6-11 of the License Renewal Application
4 provides the best depiction of the stratigraphy at and
5 in the vicinity of the Crow Butte ISR facility. And
6 I believe those are on Page, of the License Renewal
7 Application, are on Page 2-11 to 2-125 and you'll see
8 up here is the first Figure 2.6.4 of those
9 cross-sections. So I think I'll start off with Mr.
10 Beins if I might. Do you agree that these strata were
11 sedimentary processes also as Dr. LaGarry's opinion?

12 MR. BEINS: I do.

13 JUDGE WARDWELL: And the question I have
14 is, how do these sets of cross-sections, of which we
15 only see the first of, I don't know, a half dozen or
16 so that were there on the pages to 2-125, how do these
17 relate to those presented in your Exhibit CBR24, which
18 is also shown here? That's the first page of 24,
19 showing the location of the cross-sections and then
20 you go on to show various cross-sections looking like
21 this. So they look different and they're in a
22 different exhibit. How do these cross-sections
23 relate?

24 MR. BEINS: These cross-sections relate,
25 your honor, by --

1 JUDGE WARDWELL: By these, you mean 24? Or
2 the ones that --

3 MR. BEINS: The ones that are on the screen
4 right --

5 JUDGE WARDWELL: Okay.

6 MR. BEINS: -- now --

7 JUDGE WARDWELL: That's 24.

8 MR. BEINS: -- relate to the ones that were
9 on previously in that they show the geologic structure
10 of the region from the area north of Crawford here in
11 the area of our North Trend Expansion Area crossing
12 the White River fold feature heading southeastward to
13 the main license area of Crow Butte.

14 JUDGE WARDWELL: So would you say that 24
15 was related more to the North Trend Expansion Area and
16 spilled over a little bit to the license area? Or
17 were they made for that purpose? Or what else could
18 you use to describe the difference between these and
19 the ones in the license application?

20 MR. BEINS: Both of these sets of
21 cross-sections were used to define the regional
22 geology of the area. This particular one shows the
23 geophysical logs on the cross-sections and with our
24 picks of those individual sedimentary strata that are
25 present.

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1 JUDGE WARDWELL: And by picks, you mean the
2 points at which you say there's a change in geologic
3 materials?

4 MR. BEINS: Yes. The contact between
5 different sedimentary units.

6 JUDGE WARDWELL: Thank you. Does the Brule
7 vary from an aquitard to an aquifer?

8 MR. BEINS: Yes, to some extent. Within
9 the Brule, there are sandy channels that we monitor at
10 the Crow Butte mine site in our shallow monitoring
11 wells. And that particular sand channel is bounded
12 then below and to some extent laterally as well by
13 impermeable or lesser permeable clays as well.

14 JUDGE WARDWELL: And I guess maybe this
15 would be a good time for the sake of our vast audience
16 here, would you define the difference between an
17 aquitard and an aquifer?

18 MR. BEINS: An aquifer is a sedimentary
19 structure that is capable of producing usable amounts
20 of water. An aquitard is going to resist the ability
21 of water to move through that particular substrate.

22 JUDGE WARDWELL: So are you saying none of
23 us poor hard-scrabble woodsmen from the north country
24 of New York have any aquifers because we don't have
25 many sedimentary strata there?

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1 MR. BEINS: Well, my apologies to you.
2 Certainly in hard rocks --

3 JUDGE WARDWELL: Strike that question. We
4 are talking about sedimentary here. That's what's
5 important.

6 MR. BEINS: We don't have a lot of igneous
7 rocks in Nebraska.

8 JUDGE WARDWELL: Thank you. Isn't
9 hydrogeologic jokes fun? They are. They really are
10 great. Right, Dr. LaGarry? Do you have any comments
11 on the Brule varying from an aquifer to an aquitard?

12 DR. LAGARRY: It's broadly recognized by
13 the State of Nebraska and the geological community
14 that works in Nebraska that the Brule Formation is an
15 aquifer where it has a lot of joints and faults, a
16 feature called secondary porosity. And in areas where
17 the secondary porosity of the Brule is prevalent, the
18 boundary of what's called the High Plains or Ogallala
19 Aquifer, it's adjusted downwards to accommodate that.

20 JUDGE WARDWELL: Thank you. Back to Crow
21 Butte, if I might, Mr. Beins. Back to your license
22 application, 011, Joe if we can go back to -- there
23 you go. And -- yes. Let me start with this one.
24 This is the first one in the series and let's look at
25 the next one, Joe, if I might. There's always a blank

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1 page between each one. They're significantly
2 different appearing looking cross-sections. What
3 allowed you to make the one earlier the way it looked
4 and why is this one looking like it's looking?

5 MR. BEINS: Okay. I believe, sir, that
6 this particular cross-section that's on the --

7 JUDGE WARDWELL: That's 2.6-5, correct?

8 MR. BEINS: Yes. 2.6-5 was a cross-section
9 that was submitted with the original license
10 application for the Crow Butte mine site. So we're
11 looking at a depiction here of our understanding at
12 the time that the original Crow Butte permit was
13 submitted back in 1988, 1989 time frame. The previous
14 cross-section was a cross-section that was prepared
15 more recently and, therefore, it looks a little bit
16 different. Is really the only reasoning why the two
17 show a little different structure on the
18 cross-sections.

19 JUDGE WARDWELL: So it's mostly because of
20 the advance of our abilities to make fancier looking
21 diagrams? Is that what --

22 MR. BEINS: Exactly.

23 JUDGE WARDWELL: -- you're -- thank you.

24 MR. BEINS: And more data.

25 JUDGE WARDWELL: On two of the drawings, if

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1 we can go back to the previous one, 2.6-4 on Page 111,
2 and I'll also reference that 2.6-10 on Page 123 also,
3 show a line at the uppermost part of the cross-section
4 with a little colored-in upside-down, well, I don't
5 know if it's an upside-down triangle, it's a triangle
6 on its point. What is that line?

7 MR. BEINS: That line shows the
8 potentiometric surface of the Basal Chadron sandstone,
9 the Chadron Aquifer.

10 JUDGE WARDWELL: And what does that line
11 represent physically?

12 MR. BEINS: That line represents the
13 potentiometric head or the level that the Chadron
14 water table, if you were to penetrate that Basal
15 Chadron sand with a well, it shows the water level
16 that, that aquifer is capable of raising the water
17 table to.

18 JUDGE WARDWELL: And that -- looking at
19 that line at the left-hand side of this figure being
20 above what appears to be the ground surface line, what
21 does that indicate?

22 MR. BEINS: That indicates, sir, that in
23 that particular area covered by that cross-section,
24 that we do have artesian flow to the surface in wells
25 that are uncapped. And so you would have a flowing

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1 well in those areas.

2 JUDGE WARDWELL: And that off to the right
3 where it falls underneath that line, that wouldn't be
4 the case. Is that correct?

5 MR. BEINS: That's correct.

6 JUDGE WARDWELL: Where is the license area
7 on this cross-section? Do you have -- is it to the
8 right?

9 MR. BEINS: The licensed area that we're
10 talking about for the renewal is to the far right of
11 this.

12 JUDGE WARDWELL: So as far as this
13 cross-section is concerned, there is not artesian flow
14 within the license area itself?

15 MR. BEINS: There is not.

16 JUDGE WARDWELL: From the Basal Chadron
17 only?

18 MR. BEINS: Correct.

19 JUDGE WARDWELL: Why does the line end
20 where it ends?

21 MR. BEINS: I do not know the answer to
22 that, sir.

23 JUDGE WARDWELL: Mr. Deucher, if you could
24 go ahead to get to Page 123, 2.6-10, I just want to
25 take a look at that again before I -- I think it's the

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1 very last page, I'm almost -- yes, second to the last
2 page. I think the last page is probably blank. Yes,
3 that's what I thought. The same thing has happened
4 here. And you would say that the licensed area is to
5 the right-hand side of this?

6 MR. BEINS: Yes, it is, sir. It's likely
7 that we don't have a lot of wells right through some
8 of that area perhaps.

9 JUDGE WARDWELL: And so, in some of these
10 sheets of data that represent each data point it looks
11 like that created this cross-section, looks like graph
12 paper with some lines on it. What are those?

13 MR. BEINS: Those are geophysical logs. As
14 we drill each test hole across the area, we run an
15 instrument down the hole, down the bore hole. It
16 takes readings of the resistivity, the self-potential,
17 and the gamma radiation that's present within the bore
18 hole. This is a computer printout of those particular
19 scales.

20 JUDGE WARDWELL: So that's one of the fancy
21 things you were able to do with this next one is put
22 things like that on this diagram? That's why this
23 looks different?

24 MR. BEINS: Yes, sir.

25 JUDGE WARDWELL: Dr. LaGarry, do you have

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1 any comments on anything you've heard that you would
2 like to object to or any differences in any
3 interpretation of these diagrams that were talked
4 about from Crow Butte's standpoint?

5 DR. LAGARRY: Well, your honor, the
6 characterization -- I mean, part of one's training as
7 a scientist is to use the most up-to-date information
8 and be as accurate as possible. So the outdated use
9 of Basal Chadron or Chadron A --

10 JUDGE WARDWELL: Okay, can I interrupt you
11 right there?

12 DR. LAGARRY: Please.

13 JUDGE WARDWELL: I got about probably 15
14 minutes of questions on that topic.

15 DR. LAGARRY: The outdated terms?

16 JUDGE WARDWELL: Yes.

17 DR. LAGARRY: That's it.

18 JUDGE WARDWELL: Yes. Really, we want to
19 get -- other than that --

20 DR. LAGARRY: Other than that --

21 JUDGE WARDWELL: -- there wasn't -- just
22 basic formation of how these cross-sections were made
23 and where the potentiometric surface is and whether --

24 DR. LAGARRY: That's all fine, thank you.

25 JUDGE WARDWELL: Yes, great. Yes. We will

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1 get to that.

2 DR. LAGARRY: Okay.

3 JUDGE WARDWELL: And there's no -- don't
4 feel bad about bringing that up either, Dr. LaGarry.
5 I will, as you can tell, I'm not shy from stopping
6 you. So also -- any witness. If you have a need to
7 say something when I ask that, go ahead, but don't be
8 surprised if I stop you likewise if we're going to
9 cover it later. CBR, your testimony, again, Exhibit
10 001, Page 11 A34, states that Crow Butte recognizes
11 that within these continuous geologic units,
12 lithologic heterogeneities are present. However, the
13 overall interpretation of lateral continuity is not
14 affected by these local lithofacies variations. CBR,
15 if I might ask you -- before I ask you that, could you
16 define some of those terms in that statement of yours?
17 Like heterogeneities, and the lithologic and
18 lithofacies?

19 MR. BEINS: Certainly, the heterogeneities
20 that we talk about there, we're talking about is this
21 a nice uniform unit? If we're talking about a
22 sandstone, is it a nice evenly sized, well-rounded
23 sandstone all the way through across the site? So --

24 JUDGE WARDWELL: By heterogeneities you
25 mean is it different in lateral distance --

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1 MR. BEINS: Correct.

2 JUDGE WARDWELL: -- as you move from point
3 to point?

4 MR. BEINS: Correct. And then in regards
5 to the different lithofacies, we're looking at a
6 fluvial river system where you have both sand channels
7 being deposited in other areas where that sand
8 channel's been deposited away from that area. You're
9 going to see finer grain material, just like you would
10 see in a modern day river setting with the flood
11 sediments, the clays, deposited in one area whereas
12 the sands are deposited in another. And we do see
13 some of those changes across the site. However, for
14 the most part, across the Crow Butte site, we're able
15 to map and follow these particular sand channels
16 across the width of the area there.

17 JUDGE WARDWELL: I think that's a good
18 definition of the lithofacies variations. What is a
19 lithofacies? Faci?

20 MR. BEINS: I would have to say that's that
21 contact zone or that area where you see that gradual
22 change from a sand over into a clay.

23 JUDGE WARDWELL: Dr. LaGarry, anything you
24 want to add to those definitions?

25 DR. LAGARRY: A lithofacies is the product

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1 of a specific subdivision of a depositional
2 environment. So you might have a channel lithofacies,
3 a flood plain lithofacies. But the term facies is a
4 genetic term that talks about the character of what it
5 is you're talking about.

6 JUDGE WARDWELL: Great. Thank you. Back
7 to you, Mr. Beins. While your statement says that you
8 recognize these units -- there's some variation in the
9 geologic units and that the continuity isn't affected
10 by local presence of sandier materials, if I can just
11 put it in more common terms, but wouldn't a gap in the
12 upper confining unit that consisted of all these types
13 of materials, all sand material, or an extensive
14 fracture network through the upper confining unit be
15 of concern to the operation of the facility?

16 MR. BEINS: It certainly would be a concern
17 to the facility.

18 JUDGE WARDWELL: Thank you. Crow Butte, in
19 your testimony on Page 13, A37, and that's again CBR
20 Exhibit 001, I probably don't have to say that anymore
21 when I talk about your testimony, but you discussed
22 bore hole logs and data. Do any of the bore hole logs
23 show an absence of the upper confining layer?

24 MR. BEINS: They do not.

25 JUDGE WARDWELL: So it is continuous across

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1 the whole area as far as your boring logs are
2 concerned?

3 MR. BEINS: It certainly is.

4 JUDGE WARDWELL: Thank you. I'm on a roll,
5 so you can stop me -- this is the time to stop or hold
6 your peace for another 15 to 20 minutes.

7 CHAIR GIBSON: High noon.

8 JUDGE WARDWELL: I know, that's what I
9 said. Well, it isn't -- it is high noon, yes.

10 CHAIR GIBSON: Do you want to go ahead and
11 --

12 JUDGE WARDWELL: It's fine by -- this is a
13 good stopping point if you want to stop at noon.

14 CHAIR GIBSON: All right. If you'll give
15 us a few minutes, we'll run to the restroom, then you
16 all can do as you please and we're going to go recess
17 for -- what? We're just going to recess for lunch.
18 Is that okay?

19 JUDGE WARDWELL: For how long?

20 CHAIR GIBSON: And we'll -- what do you all
21 need? An hour? Forty-five minutes? Hour and 15?
22 What do we need? I just need a --

23 DR. LAGARRY: Probably an hour because some
24 of the places to eat are a little bit far away.

25 CHAIR GIBSON: All right. Let's go with an

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1 hour then. Everybody okay with that? All right.

2 (Whereupon, the above-entitled matter went
3 off the record at 11:58 a.m. and resumed at 1:01 p.m.)

4 CHAIR GIBSON: Very well. Back on the
5 record.

6 JUDGE WARDWELL: Okay. Next block of
7 questioning will deal with the nomenclature for the
8 Basal Chadron versus the Chamberlain Pass. And I'll
9 start with you, Dr. LaGarry, if I might. Do you agree
10 that the only real difference between your strata
11 profile and CBR's is the nomenclature for the aquifer
12 that overlies the Pierre Shale?

13 DR. LAGARRY: Your microphone's not on. Or
14 at least it wasn't just now.

15 JUDGE WARDWELL: I think it was on, I
16 wasn't speaking into it.

17 DR. LAGARRY: Oh, okay. No, that's not
18 correct.

19 JUDGE WARDWELL: Okay.

20 DR. LAGARRY: I mean, the nomenclature
21 labels a basket, right? And so the name carries --
22 it's a way of talking about the basket that all --
23 what we know about a rock unit is in the basket,
24 right? And so, it wasn't just a name change. The
25 name was changed because the rocks were demonstrably

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1 mischaracterized when they were called Basal Chadron.
2 A separate depositional environment, a separate
3 episode of earth history, different volcanos,
4 different environments, different time, different
5 distribution. So the name Chamberlain Pass Formation,
6 which was first proposed in 1994 and then applied to
7 Nebraska in 1998, is just a label on the basket that
8 includes everything that is that formation. So, it's
9 not a nomenclatural issue, it's a conceptual issue.

10 JUDGE WARDWELL: And let me ask NRC, do you
11 agree with Dr. LaGarry's statements?

12 MR. BACK: Maybe from a depositional
13 environment, but in terms of the properties that are
14 most important to performance of the mine, it's
15 immaterial what the unit is called.

16 JUDGE WARDWELL: But if in fact there is a
17 difference in even the assumptions by how it was
18 formed, by naming it a certain name doesn't it give it
19 a certain connotation associated with that?

20 MR. BACK: Not really in the sense that
21 it's all of the field investigative work that defines
22 the actual properties of the unit. Say we didn't call
23 it anything, say we called in Unit X, we would go out
24 and do the investigative work and that's what would
25 define the properties of the unit.

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1 JUDGE WARDWELL: Thank you, Mr. Back. Crow
2 Butte, in your testimony, 001, Page 10, H32, and Page
3 56, Answer to 101, you state that, quote,
4 stratigraphic nomenclature aside, nothing in the
5 naming conventions for the geologic units in Nebraska
6 or at the Crow Butte facility changes the
7 interpretation of the physical or hydrologic features
8 of the rock units.

9 And I just call your attention to
10 something that kind of states that it is a little bit
11 more than that in your subsequent testimony on, again
12 it's Exhibit 001, Page 32, A64, where you state that
13 the primary difference in renaming of the ore body
14 from Basal Chadron Formation to Chamberlain Pass
15 Formation relate to the assumptions regarding the
16 thickness of the ore body as influenced by its
17 depositional history and that the thickness
18 distribution of the Basal Chadron's sandstone is
19 determined by the paleotopography. That is the eroded
20 surface of the underlying Pierre Shale where exposed
21 prior to the deposition of the Basal sandstone layer.
22 So isn't that a reason more than just a nomenclature
23 change to have a different designation of it to make
24 sure that any reader is clear in regards to what you
25 consider to be the depositional history?

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1 MR. BEINS: The fact that the Basal Chadron
2 sandstone has different thicknesses because of the
3 eroded nature of the Pierre Shale still does not
4 change the overall characteristics that are present
5 within that Basal Chadron sandstone. We're able to
6 map those units across the mine site and see the very
7 nature of that fluvial system. The actual name change
8 from Basal Chadron Sandstone to the Chamberlain Pass
9 Formation does not change the physical characteristics
10 of that particular sand body. So, no.

11 JUDGE WARDWELL: So do you disagree with
12 Dr. LaGarry that in fact the basket of materials, as
13 he described it, has a different general
14 characteristics and engineering properties that differ
15 based on the now present understanding of the volcanos
16 and the sedimentary process by which they were formed
17 as they would influence those particular properties?

18 MR. BEINS: I do disagree with that, yes.

19 JUDGE WARDWELL: Thank you. Dr. LaGarry,
20 do you agree that the varying depositional conditions
21 associated with the eroded surface of the Pierre Shale
22 is one of the primary reasons for the name change?

23 DR. LAGARRY: The primary reason for the
24 name change was that the channel facies of the
25 Chamberlain Pass Formation, formerly known as Chadron

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1 A or Basal Chadron, was considered a separate rock
2 stratum from the overbank mudstone facies. The
3 overbank mudstone facies was considered to be part of
4 the underlying Pierre Shale.

5 And so what was done in this -- along with
6 the name change and the redefinition of those rocks,
7 was that the history of the rocks were reinterpreted
8 and it was recognized that the flood plain and channel
9 facies were in fact the same thing, the same basic
10 rock type. And so the expectation was that somehow
11 the channels had a distribution separate from the
12 flood plains. And subsequent work by Evans and Terry
13 in 1994 and then later by Terry in 1998 demonstrated
14 that the flood plains and the channels were
15 intermingled, interstratified, and not the sequential,
16 cyclic, separate character that the Chadron A carried
17 with it.

18 JUDGE WARDWELL: Thank you. Crow Butte, in
19 your License Renewal Application, that's Exhibit 011,
20 Section 2.6.2.2, you state that you did not use the
21 previous thickness assumptions, but rather as stated
22 in your testimony in 001, Page 32, Answer 64, that,
23 quote, the Crow Butte determined the thickness of the
24 Basal Chadron sandstone at the mine site based on the
25 lithologic and geophysical characteristics and that

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1 these determinations are independent of any
2 assumptions regarding the thickness of the unit based
3 on the overlying units. And I'll ask you that, are
4 these lithologic and geophysical characteristics that
5 you talk about associated with the geological modeling
6 that you did?

7 MR. BEINS: Those particular
8 characteristics, sir, are based on the numerous drill
9 hole data set that we have on site. To date, we'd
10 drilled over 10,000 individual bore holes on the site.
11 That's about 4,000 exploration and development holes
12 and then an additional 6,000, over 6,000 wells that
13 we've installed there. For every one of those drill
14 holes or bore holes, we have completed a lithologic
15 analysis of the drill cuttings that are captured
16 during the drilling process, as well as the
17 geophysical log for each hole. That's what we base
18 that up on.

19 JUDGE WARDWELL: And do you have an exhibit
20 that shows the location of these drill holes?

21 MR. BEINS: We do. I'm not sure what the
22 exhibit --

23 JUDGE WARDWELL: Is it --

24 MR. BEINS: -- number --

25 JUDGE WARDWELL: Is it Exhibit CBR056?

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1 MR. BEINS: That sounds correct. Yes, sir.

2 JUDGE WARDWELL: Thank you. Dr. LaGarry,
3 if one was to incorporate your understanding of the
4 Chamberlain Pass as representative of what that ore
5 body is like, is there -- and with that understanding
6 of that, and if one was to characterize both the
7 hydraulic and physical attributes of that ore body,
8 does it really matter what we call it?

9 DR. LAGARRY: Use of the current concepts
10 demonstrates due diligence.

11 JUDGE WARDWELL: I'm sorry, say that again?

12 DR. LAGARRY: Use of current --

13 JUDGE WARDWELL: Could you get a little
14 closer --

15 DR. LAGARRY: Use of current concepts in
16 science demonstrates due diligence, right? So --
17 okay. So you have to -- were it me, I would take the
18 new stratigraphy, the new concepts surrounding the
19 stratigraphy, the new concepts of the tectonics that
20 produced that stratigraphy, and those would change the
21 context in which I was doing my analyses and just how
22 I thought about what it was, all the subsequent
23 information I would gather about it, right? And so
24 it's difficult to determine what the level of
25 difference would be.

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1 Because in my career, and I built my
2 career using the latest stratigraphy, and so that's
3 the inherent bias I come to these proceedings with.
4 I don't have, any longer, or perhaps never had, the
5 inherent bias that came from not having had that. So
6 it's difficult to say. But there's a lot of things.
7 We recognize that the Chamberlain Pass Formation had
8 a much longer, more varied, more chemically reactive
9 history than it was previously assumed when everybody
10 called in Chadron A.

11 JUDGE WARDWELL: And we as a Board have to
12 balance what was used in the past with regards to how
13 we approach and write our decision. And do you
14 understand the need or the advantage somewhat to
15 maintain what has been used at this particular site
16 historically to avoid any confusion when we really are
17 referring to the same deposit? By using the Basal
18 Chadron nomenclature as opposed to the Chamberlain
19 Pass?

20 DR. LAGARRY: Provided the due diligence
21 has been performed, I understand that, yes.

22 JUDGE WARDWELL: Okay. Thank you very
23 much. Staying with and exploring the Basal Chadron,
24 Chamberlain Pass Formation more and, again, if I use
25 the phrase Basal Chadron, I do mean the Chamberlain

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1 Pass also and recognize that, let's talk about the
2 characteristics of that somewhat. And I'll go to Crow
3 Butte again in your License Renewal Application,
4 Figure 2.6-3, Page 2-109. And, Mr. Deucher, was the
5 CBR056 the one that you believe was proprietary?
6 Okay, good. So we're past that. So if you can call
7 up Figure 2.6-3, Page 2-109, I'll ask Mr. Beins, is
8 the license area oriented northwest to southeast
9 direction and is the geologic section through the
10 license area shown on the cross-section NW-SE as
11 presented in the License Renewal Application Figures
12 2.6-11, Page 2-125?

13 MR. BEINS: That particular cross-section
14 --

15 JUDGE WARDWELL: Yes, this shows a plan
16 view of the cross-section going down through the
17 middle of it, does it not?

18 MR. BEINS: Yes, it does.

19 JUDGE WARDWELL: And then the
20 cross-section, if we can go to the next -- I believe
21 that's -- is that the cross-section for it, 2.6-11?
22 It's the northwest-southeast cross-section?

23 MR. BEINS: I believe that's correct, yes.

24 JUDGE WARDWELL: And so does the
25 orientation of the license area correspond to the

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1 orientation of the Basal Chadron Formation,
2 Chamberlain Pass Formation?

3 MR. BEINS: The orientation of this
4 cross-section runs along the length of the permitted
5 area which lies upon top of the buried river channel
6 that laid down the Basal Chadron sandstone, yes.

7 JUDGE WARDWELL: And that's where the ore
8 resides --

9 MR. BEINS: That's correct.

10 JUDGE WARDWELL: -- in your mining
11 operations? And does the Basal Chadron consist of
12 only sandstone or does it also include some of the
13 unconsolidated sand layers that we talked about before
14 in the license area?

15 MR. BEINS: Essentially, the entire sand
16 interval of our production zone, it's unconsolidated
17 sediments. They're loose, they're not cemented
18 together and all. They're interbedded with some clay
19 layers, clay intervals. As the channels meandered
20 back and forth across the valley floor, it would lay
21 down a layer of sand as it's over in this area. Back
22 on one side of the river valley, it would lay down
23 clay sediments in the flood plains back on the other
24 side of the valley, the opposite side. Then over
25 time, that channel would meander back across the

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1 valley floor depositing new channels and additional
2 clay intervals. And so what we end up with at the
3 site is a series of stacked sands, one on top of the
4 other, with clay interbeds in between them.

5 JUDGE WARDWELL: Thank you. Dr. LaGarry,
6 would you like to comment on that representation of
7 that deposit?

8 DR. LAGARRY: Mr. Beins's characterization
9 is accurate to the degree that you would find
10 interbedded sand and clay. And the only thing I would
11 add is that they pinch out, they thin and they thicken
12 in three dimensions.

13 JUDGE WARDWELL: Great, thank you.
14 Intervenors Exhibit 009, Page 2, it's termed the
15 Peterson letter, I quote, uranium mineralization in
16 the Crow Butte area is directly and primarily
17 controlled by near-vertical faults cutting through the
18 area and that the Crow Butte area faults not only
19 exist, but they control mineralization and that the
20 uranium mined by Crow Butte occurs within the faults
21 themselves. That mining could open these faults,
22 providing a passageway for aquifer impacts from
23 uranium laden solvents.

24 Crow Butte's Exhibit 045, testimony, Pages
25 9 through 11, in answer A23, counters this argument

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1 providing a detailed description of a classic
2 roll-front formation of the Crow Butte uranium deposit
3 as verified by detailed drilling, cutting
4 observations, and geophysical surveys, concluding
5 that, quote, no specific evidence is referenced to
6 support the contention that the ore is present within
7 inferred faults or within the current licensing area.

8 NRC's Exhibit 030 at 280 to 81, the staff
9 maintains that based on a comprehensive analysis of
10 over 2,000 uranium exploration bore holes and
11 mineralogical analyses of the sediments, the Crow
12 Butte uranium trend has been unequivocally described
13 as a roll-front deposit. And they reference Figure 8,
14 Page 281 of the NRC Exhibit 030. And this is the
15 schematic shown from that, where it's a map showing
16 the roll-front locations in and near the CBR license
17 area.

18 Dr. LaGarry, in your 2008 opinion on Page
19 4, which submitted the Peterson letter I believe,
20 contended that the uranium mine at CBR cores within
21 the faults themselves and is not a roll-front deposit.
22 Have you submitted any evidence that helps support
23 your case that it's within the faults and not a
24 classic roll-front deposit to counter the evidence
25 provided by the staff and CBR? In the license area

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1 alone, of course.

2 DR. LAGARRY: In the license area alone,
3 no. Because over the length of my geological career,
4 the license area has been off-limits having
5 proprietary data and unavailable to a university
6 researcher. So, within the license area itself, I
7 have no data and no evidence. I've never worked
8 there. However, outside the license area, this area
9 is well known for geothermal activity and there are
10 mineral veins infused in faults and fractures and
11 folds across the region.

12 JUDGE WARDWELL: Have you read the evidence
13 that they submitted in regards to their justification
14 that the ore deposit is a roll-front deposit? And, if
15 so, do you have any reason to dispute their
16 conclusions in regard to the roll-front deposit?

17 DR. LAGARRY: I don't. However, it's
18 plausible that both conditions exist at the site.
19 This area has a well-described and long-known network
20 of fractures that I've opined about. And so without
21 specific studies directed at determining so, it would
22 -- the only thing I have is the Peterson letter that
23 describes these. And in one of my most recent
24 opinions, I believe I showed a map displaying the
25 faults he was referring to in that letter.

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1 JUDGE WARDWELL: If in fact the Chamberlain
2 Pass, Basal Chadron is primarily unconsolidated, would
3 these joints and fractures necessarily exist within a
4 deposit such as that?

5 DR. LAGARRY: Yes. Because geological
6 histories vary. It's entirely possible that the sands
7 were consolidated once upon a time and are no longer
8 consolidated. Meteoric water can dissolve weak
9 carbonate cements. It's entirely possible that
10 subsequent to the deposit being formed at any point in
11 its history some of the local earthquakes could have
12 faulted and fractured it. Even in unconsolidated
13 sediment, you can find joints, faults, and fractures
14 that provide preferred conduits for fluids.

15 JUDGE WARDWELL: Thank you. In regards to
16 the extent of the Basal Chadron, NRC's testimony,
17 again Exhibit 001, Page 32, Answer D4, staff testified
18 that the Basal Chadron sandstone tends southeast from
19 Crawford and that it is the result of the sandstone
20 being deposited by a major drainage feature that was
21 a west to east through flowing valley about 25 miles
22 wide entering present-day Nebraska in northwest Sioux
23 County and turning southeast in western Dawes County.
24 And they reference the NRC document Exhibit 024, Page
25 212 for some additional information. And, Dr.

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1 LaGarry, would you agree that the Basal Chadron,
2 Chamberlain Pass is a paleochannel sedimentary
3 formation that fills a channel in the Pierre Shale?

4 DR. LAGARRY: In part. It also follows
5 this incline that leads South from the Black Hills.
6 But its orientation is as the Crow Butte geologists
7 say it is. The best available map of that is from a
8 publication by Swinehart and others in a publication
9 from the University of Wyoming. It shows a
10 northwest-southeast trending paleovalley with
11 tributaries that enters Nebraska from the northwest
12 and heads towards the North Platte River to the
13 southeast.

14 JUDGE WARDWELL: Thank you. In regards to
15 your discussion or, let's say, critique of the staff
16 and Crow Butte's use of a layer cake methodology for
17 characterizing the geology at the site, is it my
18 understanding that this position of yours is based on
19 separate layers of geologic material of which have
20 constant thicknesses so that the interfaces are all
21 horizontal? Or could it be -- or when you refer to
22 the layer cake methodology, are you referring to the
23 one layer cake I made where the interfaces were not
24 very horizontal and were quite disturbed in fact?
25 Which is it for your interpretation, for us

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1 understanding your interpretation of your criticism in
2 regards to the layer cake methodology?

3 DR. LAGARRY: Okay. So the term layer cake
4 in this particular area of North America has specific
5 connotations. Which came out of geological work done
6 in the 1930s, 1940s, 1950s and early 1960s, in which
7 it was assumed that the rock layers were of uniform
8 thickness, uniform lithology or constituency, and
9 spread out in all directions. So the best way to
10 characterize it was you could take the earth and cut
11 into it and it would look like layers of an onion.
12 Okay. So then the main change that happened following
13 the advent of plate tectonics and recognizing uplifts
14 locally was that we now have an idea that the rocks
15 are a hodgepodge because of the interplay between the
16 various things that form rocks. And that rather than
17 being uniform layers, the expectation now is that
18 they're discontinuous and pinch out and local.

19 JUDGE WARDWELL: And even if they didn't
20 pinch out and were local, if one was to not assume
21 that the interfaces are horizontal and spread out the
22 same way in all one location and are not uniform in
23 thickness, would you characterize that as a non-layer
24 cake model? I.e., would varying thicknesses and
25 varying surface elevations of the top of the geologic

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1 strata under discussion?

2 DR. LAGARRY: That would depend on details
3 of how the geological history was interpreted. It
4 could go either way.

5 JUDGE WARDWELL: Okay. Thank you. In
6 NRC's Exhibit 023, Plate 1, which is PDF Page 3, is a
7 USGS map that shows the extent of the Basal Chadron,
8 Chamberlain Pass. And I guess I'll ask NRC, this is
9 that diagram that I just referenced. And you'll see
10 a topographic map, contour lines typical of a
11 topographic map, and two questions for that, if I
12 might. What are the units of the numbers on the
13 contour lines? And what does that topographic map
14 indicate?

15 MR. BACK: Your honor, these are thickness.
16 So this is the thickness of the Basal Chadron. It's
17 called an isopach map and they're in feet.

18 JUDGE WARDWELL: In feet?

19 MR. BACK: In feet. And so when you --

20 JUDGE WARDWELL: Is that listed anywhere
21 there?

22 MR. BACK: My eyes aren't good enough to
23 pick it up. And that's why as you move west, that
24 Chadron Arch prevented the sand from getting deposited
25 further east. As you move east and you see a zero --

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1 JUDGE WARDWELL: That's fine. You've --

2 MR. BACK: Yes.

3 JUDGE WARDWELL: You've answered my
4 question.

5 MR. BACK: Yes.

6 JUDGE WARDWELL: So it's a thickness map of
7 the Basal Chadron, Chamberlain Pass.

8 MR. BACK: Yes.

9 JUDGE WARDWELL: And you agree there's
10 nothing wrong with calling it the Chamberlain Pass, is
11 that correct?

12 MR. BACK: No, I have no --- no.

13 JUDGE WARDWELL: And if we were starting
14 from scratch today, you would probably use that
15 designation, is that correct?

16 MR. BACK: Absolutely.

17 JUDGE WARDWELL: And, Mr. Beins, you have
18 the same --

19 MR. BEINS: I agree.

20 JUDGE WARDWELL: Okay. So it's a thickness
21 of that ore deposit that we're dealing with?

22 MR. BACK: Yes.

23 JUDGE WARDWELL: And --

24 MR. BACK: Your honor? It's not a
25 thickness of the ore deposit. The ore --

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1 JUDGE WARDWELL: I mean, of the -- I'm
2 sorry. That was my --

3 MR. BACK: Okay.

4 JUDGE WARDWELL: Thank you.

5 MR. BACK: It's the thickness of the Basal
6 Chadron.

7 JUDGE WARDWELL: It's the thickness of the
8 Basal Chadron, yes. And so, the lines that are
9 labeled zero, is that the lateral extent of the Basal
10 Chadron?

11 MR. BACK: Yes, your honor.

12 JUDGE WARDWELL: Okay. And, Joe, are you
13 able to with your arrow point along those zero lines?
14 Do you see where they are? Yes, you're -- you got
15 them right. Yes. So here they are roughly on the
16 left-hand side that he's tracing. And you can go
17 quicker than that, we know you won't get it perfect.
18 Good enough. And then on the other side -- yes. So
19 those are the extent of the Basal Chadron?

20 MR. BACK: Yes, your honor.

21 JUDGE WARDWELL: Dr. LaGarry, do you have
22 any reason to dispute that?

23 DR. LAGARRY: None whatsoever.

24 JUDGE WARDWELL: Thank you. You made
25 several conclusions based on this plate, Mr. Back, and

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1 your testimony on Pages 32 to 33, Answer D4. And I
2 think I'll just go ahead and read them. These are
3 quotes from that. You state that from this plate, the
4 Basal Chadron sandstone is not present beyond about
5 five miles north and east of Crawford. Number two is
6 that, you didn't number them, I'm adding the numbers,
7 because the sandstone pinches out, the Basal Chadron
8 sandstone aquifer is not present between Crow Butte
9 facility and the Pine Ridge Reservation or at the Pine
10 Ridge Reservation.

11 The third item you mentioned was the
12 remainder of the Chadron Formation between the pinch
13 out of the Basal Chadron sandstone and the Pine Ridge
14 Reservation is described as low permeability
15 siltstones and mudstones, which will not transmit
16 appreciable flow, as discussed by Wyoming Geologic
17 Association and referencing NRC Exhibit 030 at Page
18 279. And then, lastly, that there's at least a 25
19 mile barrier to flow within the Chadron Formation that
20 separates the Basal Chadron's sandstone aquifer in the
21 license area from any aquifers that supply drinking
22 water at the Pine Ridge Reservation. And, Dr.
23 LaGarry, do you have or have you submitted any
24 evidence or have any evidence that would contradict
25 those conclusions that NRC made?

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1 DR. LAGARRY: Yes. I mentioned earlier
2 that modern concepts of stratigraphy do not preclude
3 the possibility of complex surfaces on which deposits
4 form. So while it is absolutely true that in the
5 subsurface data that we're looking at here on the
6 screen is most likely accurate, unless I were to redo
7 it myself and review it, the Chamberlain Pass
8 Formation as described by Evans and Terry in 1994, and
9 then later by Terry in 1998, occurs in a semicircle
10 around the southeast and northern flanks of the Black
11 Hills. So the Chamberlain Pass Formation occurs at
12 the land surface on the Pine Ridge Reservation and in
13 the butte tops north of the Black Hills in the Belle
14 Fourche and Harding County areas.

15 So while it's true that this particular
16 drainage in this particular area deposited Chamberlain
17 Pass Formation as it's depicted here, this is not it's
18 complete aerial extent. You can drive around north of
19 the Pine Ridge Escarpment in the Badlands areas and
20 find it as the bases of the Badlands outside this map
21 area. In fact, I've published and presented at
22 national conferences a couple of papers along with
23 students where we talk about the broad aerial extent
24 of these rocks. They occur as far east as Springview,
25 Nebraska and as far north as southwestern North

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1 Dakota.

2 JUDGE WARDWELL: Thank you very much. NRC
3 testified on Page 21, Answer C-5, that, quote, as
4 demonstrated in the cross-sections provided in Figures
5 2.6-4 and 2.6-11 of the License Renewal Application,
6 and that's the same as -- and that's referencing Pages
7 2-111 to 2-125 that we talked about before, the Basal
8 Chadron sandstone does not outcrop anywhere in the
9 license area or in the proposed North Trend Expansion
10 Area site northwest of the license area. And these
11 cross-sections indicate that the Basal Chadron
12 sandstone is located 200 to 700 feet below the ground
13 surface. And, again, do you have any evidence that
14 within the license area, Dr. LaGarry, that isn't a
15 correct statement?

16 DR. LAGARRY: For the license area, that's
17 a correct statement.

18 JUDGE WARDWELL: Thank you. Dr. LaGarry,
19 in your testimony, Exhibit 003, Page 3, and that's
20 your 2008 opinion, you allege that the White River
21 alluvium can receive containments from waters
22 transmitted through the Chamberlain Pass Formation
23 where it is exposed at the land surface. And assuming
24 what you said is correct that the -- you also have no
25 information to believe that the Basal Chadron outcrops

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1 to the surface or to the modern river alluvium
2 anywhere along White Clay Creek, Squaw Creek, English
3 Creek, or the White River, is that correct?

4 DR. LAGARRY: In the 1990s, I along with
5 the Nebraska Geological Survey mapped the Chamberlain
6 Pass Formation under White River alluvium 12 to 15
7 miles north of Crawford at a small community called
8 Horn.

9 JUDGE WARDWELL: And how far, say, and in
10 what direction from the town of Crawford was that?

11 DR. LAGARRY: That would be north.

12 JUDGE WARDWELL: North approximately how
13 far?

14 DR. LAGARRY: Twelve to 15 miles.

15 JUDGE WARDWELL: Okay. You said that.
16 Thank you. Staff also state that they are only aware
17 of two reported field observations of outcrop of the
18 Basal Chadron sandstone. Both of which are located in
19 the Whitehead Creek and northern Sioux County,
20 referencing NRC Exhibit 021 at 7 to 8, which is
21 approximately 12 miles northwest of the city of
22 Crawford. And so that sounds like the area you were
23 speaking of?

24 DR. LAGARRY: I'm familiar with the one
25 that they cite. There are in fact others. However,

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1 the one that they cite is one of them.

2 JUDGE WARDWELL: Great, thanks. Crow Butte
3 Exhibit 008, Page 20, Answer 33, in regards to the
4 MODFLOW groundwater model used in the model-based
5 restoration plan, you state that, quote, the
6 groundwater flow model was calibrated to premining
7 conditions using water level data collected prior to
8 the mining activities in January 1983. And I guess I
9 would ask you, what is the source of the premining
10 water levels and where are they documented?

11 MR. LEWIS: This is Lewis at Crow Butte.
12 That data comes from a map that was in the LRA report,
13 I believe, showing the --

14 JUDGE WARDWELL: Say again? Can you get a
15 little closer to your microphone just so I can hear
16 you a little bit better?

17 MR. LEWIS: I'm sorry. There was a map
18 that was put together, I believe it's presented in the
19 LRA, which showed the groundwater elevations in the
20 Basal Chadron Formation prior to development.

21 JUDGE WARDWELL: And who prepared that map
22 and do you have an exhibit number for that map? And
23 if you need to look it up, then we'll defer it to
24 later.

25 MR. LEWIS: It would have been Crow Butte's

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1 contract. I'm just not certain which one.

2 JUDGE WARDWELL: And do you believe it's in
3 the License Renewal Application?

4 MR. LEWIS: I do.

5 JUDGE WARDWELL: Would you be able to come
6 up with some page numbers by --

7 MR. LEWIS: I could --

8 JUDGE WARDWELL: -- and we'll --

9 MR. LEWIS: -- at the break.

10 JUDGE WARDWELL: -- get that at the next
11 break? And do you recall offhand without being able
12 to see what that map looks like, what the original
13 flow direction in the Basal Chadron through the North
14 Trend Expansion Area and the license application area
15 was prior to any mining in 1983?

16 MR. LEWIS: Can you repeat that please?

17 JUDGE WARDWELL: What were the flow
18 directions in the Basal Chadron prior to mining?

19 MR. LEWIS: Generally toward the northwest.

20 JUDGE WARDWELL: Towards the northwest?

21 Okay. Thank you.

22 MR. LEWIS: That would be across the
23 current license area.

24 JUDGE WARDWELL: Across the license area,
25 what do you mean? You confused me with that

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1 statement.

2 MR. LEWIS: The groundwater flow direction
3 across the current license area is generally towards
4 the northwest.

5 JUDGE WARDWELL: So that would be along the
6 long axis of the --

7 MR. LEWIS: Yes.

8 JUDGE WARDWELL: -- license area?

9 MR. LEWIS: That's correct.

10 JUDGE WARDWELL: Okay. When you said
11 across, I was picturing it --

12 MR. LEWIS: The reference for the
13 groundwater elevations, that was Page 232.

14 JUDGE WARDWELL: Of the License Renewal
15 Application?

16 MR. LEWIS: Yes.

17 JUDGE WARDWELL: Let's, if we can, call
18 that up, Mr. Deucher, I'd appreciate it.

19 MR. LEWIS: It's of the -- 232 of the PDF.

20 JUDGE WARDWELL: That's fine. We can
21 handle that. Yes. So is that what you're referring
22 to?

23 MR. LEWIS: Yes.

24 JUDGE WARDWELL: And that's the limit that
25 -- those are the wells that are defining this and the

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1 values that are defining the preoperational levels?

2 MR. LEWIS: To my knowledge, those were the
3 available data prior to the development, yes.

4 JUDGE WARDWELL: And you had no other data
5 before you got a license to -- what did you use to
6 support your license application at that time in
7 regards to premining groundwater conditions? I mean,
8 I look at that and convince me why that's not somewhat
9 sparse in regards to data.

10 MR. LEWIS: I understand, sir. This was
11 the data that was presented in the original Crow Butte
12 license application. It was based off the
13 availability of existing wells across the area there
14 as well as a few regional wells that Crow Butte
15 installed as well to support their position on this.

16 JUDGE WARDWELL: And so the only wells
17 we're talking about are the ones that have an actual
18 elevation number next to them? And is that elevation
19 number the potentiometric level in that well?

20 MR. LEWIS: Yes, it is.

21 JUDGE WARDWELL: So we're talking, one,
22 two, three, four, five points within the license area
23 and three outside of it, is that correct?

24 MR. LEWIS: I believe that's correct.

25 JUDGE WARDWELL: Mr. Back, any idea of how

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1 the staff accepted such an unambitious effort for this
2 initial mining effort?

3 MR. BACK: Your honor, absolutely. There's
4 a lot -- there's more regional data than is presented
5 here in the license area. Actually down in Marsland,
6 there's additional data there. There's data here.
7 And conceptually, what the hydrogeologists have felt
8 is that the water is actually moving from the
9 northwest, you know how we talked about the Basal
10 Chadron going down, it's moving from the southeast to
11 the northwest. To those discharge areas that we
12 talked about. So it fits into the conceptual model
13 that --

14 JUDGE WARDWELL: What discharge areas are
15 those?

16 MR. BACK: Well, where the Basal Chadron
17 outcrops, that's conceptualized as a discharge area.
18 And so --

19 JUDGE WARDWELL: And that would be to the
20 northwest? That --

21 MR. BACK: To the --

22 JUDGE WARDWELL: -- 12 miles northwest.

23 MR. BACK: -- northwest.

24 JUDGE WARDWELL: Okay.

25 MR. BACK: That's exactly right. And so it

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1 fit into the whole conceptual model that -- we had
2 data from Marsland, which is on the other side of the
3 Pine Ridge. The Pine Ridge does not act as a
4 hydraulic divide for the Basal Chadron. And it just
5 all moves to the northwest, to the discharge area.
6 And so, conceptually --

7 JUDGE WARDWELL: And you're saying that's
8 what you had available in 1983? Or that's what you
9 have now?

10 MR. BACK: Sir, I can't answer 1983, I can
11 only answer for the most recent licensing.

12 JUDGE WARDWELL: I know. I was sorry. I
13 confused you, I think. My question was --

14 CHAIR GIBSON: Could I just ask one
15 question, Rich? I don't want to --

16 JUDGE WARDWELL: Yes.

17 CHAIR GIBSON: I just want to be sure, you
18 mentioned Marsland a second ago. You're talking about
19 now, you're not talking about in 1983, right?

20 MR. BACK: No. Absolutely not.

21 CHAIR GIBSON: Okay.

22 MR. BACK: I'm just saying, when this data
23 came in with the most current licensing, it was
24 putting together a conceptual understanding because,
25 I know you don't want me to get into it, but the flow

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1 has actually reversed in the Basal Chadron through
2 time. So we have a good understanding of what's going
3 on.

4 JUDGE WARDWELL: Presently?

5 MR. BACK: Presently.

6 JUDGE WARDWELL: But my questioning was,
7 what did you have -- I'm interested in getting as much
8 a picture of what the premining conditions were in the
9 Basal Chadron, in the license area, and so far, this
10 is what's been presented to me as the justification
11 for original licensing between '83 and, what was it,
12 '88 or '89. What other information did you have at
13 that time and is that --

14 MR. BACK: I think --

15 JUDGE WARDWELL: -- available to us?

16 MR. BACK: Dr. Striz is going to add
17 something.

18 JUDGE WARDWELL: Thank you.

19 DR. STRIZ: Thank you, your honor. What
20 happens is the application comes in with
21 preoperational --

22 JUDGE WARDWELL: Can you pull that --

23 DR. STRIZ: Oh, I'm sorry.

24 JUDGE WARDWELL: Yank right on it.

25 DR. STRIZ: Okay.

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1 JUDGE WARDWELL: Grab right on to her and
2 pull it right up.

3 DR. STRIZ: It comes in with preoperational
4 data --

5 JUDGE WARDWELL: Yes.

6 DR. STRIZ: -- that the applications --

7 JUDGE WARDWELL: Sure.

8 DR. STRIZ: I can't speak to exactly what
9 happened because I didn't work on that license renewal
10 that far back. But the application comes in with the
11 preoperational data and what they do is they use the
12 available sites. Because we're not -- we don't want
13 them to put in a lot of wells and disturb a lot of the
14 site if they can avoid it. And so they use what's
15 preoperationally available and they bring it into us.
16 But then, once they're licensed, they go in and they
17 do the pumping tests and further characterization in
18 the mine units to truly characterize and to see if
19 that very intensive information within the license
20 area refutes what the original preoperational data
21 was. And that's the process that we use today.

22 JUDGE WARDWELL: Okay, thank you. So then
23 that conclusion is this is what we've got available
24 for preoperational?

25 DR. STRIZ: Typically we don't have a

1 tremendous amount of water level data for
2 characterizing the groundwater flow field
3 preoperationally. But then it is done after licensing
4 based on that and they can see whether it refutes what
5 was determined with the preoperational licensing.

6 JUDGE WARDWELL: Thank you. In your
7 license application, Crow Butte, at 2-185 to 191,
8 Figure 2.7-4b to 4d, shows potentiometric contours of
9 the Basal Chadron, the Chamberlain Pass Formation from
10 2008 to 2009. Were these maps prepared using the data
11 from the 11 wells in Table 2.7-6, Page 2-195 of your
12 License Renewal Application? Or were more wells than
13 that used to derive this potentiometric contours that
14 existed from 2008 to 2009?

15 MR. BEINS: This particular map, your
16 honor, represents the monitor well ring within the
17 production zone. So we're looking at however many
18 well points are on there. I'm going to say it's 175
19 wells, somewhere in that neighborhood.

20 JUDGE WARDWELL: So each of the dots are a
21 well?

22 MR. BEINS: Each of those dots are a well
23 that we had water level data available upon. Because
24 these water levels were taken during a time period
25 where the mine was in operation, you can see that the

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1 flow pattern has changed significantly from that 1982
2 map. On this particular map, those flow directions
3 have changed because we're required to maintain an
4 inward hydraulic bleed on our well-field. And so, as
5 we begin to pull a little more water out of the Basal
6 Chadron than what we're putting back in, in our
7 injection wells, we create a cone of depression within
8 the mining units there.

9 And so as we begin to do that, you can see
10 that the north end of the mine, we've actually
11 reversed that flow direction from the northwest back
12 towards the southeast. And then the southern
13 two-thirds of the mine is still flowing primarily
14 northeasterly. So that's the difference between those
15 two water level maps.

16 JUDGE WARDWELL: And I let you ramble
17 beyond what I asked, but that's because the next two
18 questions were asking that very thing about --

19 MR. BEINS: My apologies.

20 JUDGE WARDWELL: -- the groundwater sinks
21 and the general flow. So let me say it again to make
22 sure I heard you correctly because this is what I have
23 down here. Is it safe to say that the flow is
24 southeast along the North Trend Expansion Area beneath
25 the White River to the northwest section of the

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1 license application and then turns northeast towards
2 sinks caused by the mining activities?

3 MR. SOLIZ: Just to be sure it's clear,
4 it's on the --

5 JUDGE WARDWELL: Just introduce your name
6 before you answer.

7 MR. SOLIZ: Bryan Soliz, Crow Butte. Yes,
8 just to clarify, that southeasterly flow is on the
9 north end of the -- on the project site, yes. Within
10 the license area.

11 JUDGE WARDWELL: And what would it be
12 beyond that northwestern corner of the license area as
13 it's coming under the White River and the southeast
14 corner of the North Trend Expansion Area?

15 MR. BEINS: Yes. At the North Trend
16 Expansion Area, the flow is also southeasterly there.

17 JUDGE WARDWELL: Thank you. And Dr.
18 LaGarry, or any of your cohorts, would like to comment
19 on what they heard about the direction of flows?

20 MR. WIREMAN: Mike Wireman. I was a little
21 unclear about the North Trend Area direction of flow.
22 Was that back to the southeast?

23 JUDGE WARDWELL: Their testimony as I heard
24 it was that it was towards the southeast in that lower
25 part, the southeast corner of the North Trend

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1 Expansion Area.

2 MR. WIREMAN: So, I would --

3 JUDGE WARDWELL: Is that correct, Crow
4 Butte? Did I paraphrase you correctly?

5 MR. BEINS: I'm sorry, your honor. Could
6 you repeat the question there?

7 JUDGE WARDWELL: I doubt it.

8 MR. BEINS: Okay.

9 JUDGE WARDWELL: I'll ask you again. What
10 is the flow in the southeast corner of the North Trend
11 Expansion Area as it approaches the White River and
12 beneath that towards the northwest corner of the
13 license area?

14 MR. BEINS: The flow at North Trend there
15 in the southern portion of North Trend is to the
16 southeast towards the current license area.

17 JUDGE WARDWELL: And do you have any
18 evidence to refute that statement --

19 MR. WIREMAN: No. Because --

20 JUDGE WARDWELL: -- is it Mr. Wireman or
21 Dr. Wireman?

22 MR. WIREMAN: Mr. Wireman. Yes.

23 JUDGE WARDWELL: Mister, okay.

24 MR. WIREMAN: I've seen no potentiometric
25 surface data for wells in the North Trend area. So

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1 that hasn't been made available to us. I take that to
2 mean that the operation of the northwesternmost mine
3 unit is affecting the potentiometric surface in the
4 Basal Chadron as far northwest as the proposed
5 extension. That's how I would interpret that. But I
6 have seen no data because that's not the matter of
7 this proceeding.

8 JUDGE WARDWELL: And --

9 DR. KREAMER: May I say something as well?
10 Dr. Dave Kreamer. Nor have we seen any measurements
11 at all as to if there's been any change in discharge
12 to the White River region due to the reversal in flow.

13 JUDGE WARDWELL: Mr. Beins, did you present
14 any of that information in your License Renewal
15 Application to demonstrate the flow conclusions that
16 you've reached here that are presented in 2.7-4b?

17 MR. BEINS: I believe we did present that,
18 sir, but I'll have to get back to you with that figure
19 number.

20 JUDGE WARDWELL: Thank you.

21 JUDGE HAJEK: Judge Wardwell, can I jump in
22 here with a question? Okay. So what I'm
23 understanding this Figure 2.7-4 Bravo to be is a
24 moment in time. Is that correct?

25 MR. BEINS: That's correct.

1 JUDGE HAJEK: Okay. So prior to mining,
2 before mining, what was the direction of flow?

3 MR. BEINS: Prior to the mining time period
4 --

5 JUDGE HAJEK: Back in 1983, let's say.

6 MR. BEINS: Yes. Prior to mining, the
7 direction of flow was to the northwest.

8 JUDGE HAJEK: To the northwest? Okay. And
9 then with -- in terms of this particular figure being
10 a capture of a moment in time, that moment in time
11 would be affected by which mine units were currently
12 in operation. Is that correct?

13 MR. BEINS: That's correct.

14 JUDGE HAJEK: And so in this particular
15 moment in time, which specific mine units were in
16 operation?

17 MR. BEINS: Let's see, I believe it would
18 have been Mine Units 2, 3, 4, 5, 6, 7, 8, 9, and 10.

19 JUDGE HAJEK: Well, that's too many.
20 You're only --

21 MR. BEINS: A number of those were --

22 JUDGE HAJEK: You're ND2 --

23 MR. BEINS: -- in restoration.

24 JUDGE HAJEK: -- permit only gives you five
25 mines. I thought I heard more than five being --

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1 MR. TEAHON: This is Teahon from Crow
2 Butte. Yes, we had five mine units in restoration.
3 Those would be Mine Units 2, 3, 4, 5, and 6. And then
4 we had Mine Units 7, 8, 9, and 10 in production.

5 JUDGE HAJEK: Okay.

6 MR. TEAHON: So we had five in restoration
7 and four in production.

8 JUDGE HAJEK: Okay. We're going to get
9 into this again, I'm certain. But this moment in time
10 then, and this is 2006 through 2008 --

11 JUDGE WARDWELL: No, this is, I believe
12 it's March of 2008, isn't it?

13 JUDGE HAJEK: I have March of -- oh, is
14 that 8?

15 JUDGE WARDWELL: Well, Crow Butte, what is
16 it?

17 MR. BEINS: I believe it's 2008, sir.

18 JUDGE HAJEK: 2008? Okay. So it's one
19 month in 2008?

20 MR. BEINS: That's correct.

21 JUDGE HAJEK: So, in 2009, a year later,
22 then this direction map would have been different, is
23 that correct?

24 MR. BEINS: It would have been slightly
25 different just because flow rates change somewhat over

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1 time as we turn wells on and off. However, the same
2 mine units that were in operation at this moment in
3 time would have also been in operation in 2009.

4 JUDGE HAJEK: Okay.

5 MR. BEINS: And until we turned on some
6 additional mine units there --

7 JUDGE HAJEK: And just to clarify, the term
8 in operation, you are including both restoration and
9 mining --

10 MR. BEINS: Yes, I --

11 JUDGE HAJEK: -- activities in, in
12 operation?

13 MR. BEINS: -- am.

14 JUDGE HAJEK: Is that correct?

15 MR. BEINS: Yes.

16 JUDGE HAJEK: Okay, thank you.

17 JUDGE WARDWELL: Moving on to the upper
18 Chadron, lower Brule. Dr. LaGarry, do you agree that
19 the upper confining unit consists of both the upper
20 Chadron and the lower Brule?

21 DR. LAGARRY: Yes.

22 JUDGE WARDWELL: And CBR, do you -- Crow
23 Butte, you do also? Do you mind if I call you CBR
24 occasionally?

25 MR. BEINS: That's perfectly fine.

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1 JUDGE WARDWELL: Okay.

2 MR. BEINS: Yes, we agree with that.

3 JUDGE WARDWELL: Can I just call you CB?

4 (Laughter.)

5 JUDGE WARDWELL: You do agree?

6 MR. BEINS: I do agree.

7 JUDGE WARDWELL: Staff, I assume you agree

8 too?

9 MR. BACK: Yes, we agree.

10 JUDGE WARDWELL: Thanks. Looking at the
11 extent of that upper confining unit, Crow Butte's
12 testimony, Exhibit 01, Page 20, Answer to 47, you
13 state that the thickness of the upper confining layer
14 ranges from approximately 100 feet along the northeast
15 boundary of the area of review, and to refresh our
16 memories that area of review is two and a half miles
17 around the license area, is that correct?

18 MR. TEAHON: Yes, sir. It's around the
19 permit area. From the permit boundary out two and a
20 half miles around from the permit boundary.

21 JUDGE WARDWELL: So you take that little
22 license area --

23 MR. TEAHON: Yes.

24 JUDGE WARDWELL: -- and you draw lines two
25 and a half miles away from that?

1 MR. TEAHON: That's correct.

2 JUDGE WARDWELL: Okay. To over 500 feet in
3 the immediate vicinity of the well-field area. And
4 the thickness of the upper confining layer ranges from
5 200 feet on the north to 500 feet on the south. My
6 first question is, is this well-field area the license
7 area or is it some specific well-fields that you are
8 in production in, when you use the term well-field
9 area?

10 MR. TEAHON: The well-fields are all inside
11 of the permit boundary, the license boundary.

12 JUDGE WARDWELL: So it is the license area
13 you're referring to here?

14 MR. TEAHON: Yes, sir.

15 JUDGE WARDWELL: Is that correct?

16 MR. TEAHON: Yes, sir.

17 JUDGE WARDWELL: Thank you. And in your
18 thickness estimates, well, in all your distance
19 estimates that I just quoted on from Page 20, A47, are
20 you referring to both the Chadron and the lower Brule
21 in regards to the location and thicknesses of those?

22 MR. BEINS: I believe so, sir.

23 JUDGE WARDWELL: And what evidence did you
24 use to derive these thicknesses?

25 MR. BEINS: Those thicknesses are derived

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1 from, again, the large number of geophysical bore
2 holes that we have present at the site. With each
3 drill hole, taking that geophysical data and then
4 interpreting that to get that thickness.

5 JUDGE WARDWELL: Thank you. Intervenors
6 Exhibit 047 on Page 6, Mr. Wireman, you state that in
7 regards to the Brule Formation, the hydraulic
8 properties of the Brule Formation, both the upper
9 confining unit and the overlying aquifer should be
10 estimated based on more appropriate, more empirical
11 methods, which use data from outcrops, that's fracture
12 frequency, orientation, and aperture width. That's a
13 quote. Does that --

14 MR. WIREMAN: Yes.

15 JUDGE WARDWELL: -- ring a bell to you?

16 MR. WIREMAN: Yes, it does.

17 JUDGE WARDWELL: Considering I assume you
18 wrote that?

19 MR. WIREMAN: Yes, I did.

20 JUDGE WARDWELL: Could you explain to me
21 how mapping sections or structural features of the
22 Brule Formation at an outcrop area can possibly
23 represent what that same formation is like when it's
24 several hundred feet underground and saturated with
25 water and the stresses associated with all the

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1 materials above it?

2 MR. WIREMAN: Yes. That statement, first
3 of all, was made in light of the knowledge that
4 there's been no direct testing of the upper Brule. In
5 other words, there's been no pump test done in the
6 upper Brule, getting timed draw down or timed distance
7 data with which you can then estimate hydraulic
8 conductivity and transmissivity. In the absence of
9 that, one of the techniques that is used is to go to
10 an outcrop of the formation, measure aperture width of
11 fractures, orientation of fractures, density of
12 fractures, and then there is an algorithm that one can
13 use to estimate transmissivity.

14 I will readily say, it is an estimate. It
15 is never to be used alone. But it is a piece of
16 evidence and a line of evidence that can be used if
17 you have no data from a real pump test. So it was
18 made in that context. But it is a method that's used.
19 It's used more commonly in fractured igneous and
20 metamorphic rocks and mountainous terrains. And it's
21 commonly used there to get those estimates of a sort
22 of a large area transmissivity hydraulic conductivity.

23 JUDGE WARDWELL: But in this application as
24 you're suggesting this should be used, I guess I'm
25 still a little confused on why it would provide any

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1 useful data because I would estimate that those
2 fractures would be in -- the spacing of them and the
3 distances and everything under all that effort would
4 be completely different and, likewise, they may not be
5 even open down there. How does that really provide
6 even any modicum of information in regards to trying
7 to define the properties of this upper confining unit?

8 MR. WIREMAN: It provides one technique for
9 estimating hydraulic properties of the rock. That's
10 all it does. And as I said, using it alone is really
11 not a good scientific decision to make. But in the
12 absence of any other information, it does provide one
13 number. And if there are other numbers, it can be
14 compared. So it has limited use, I don't disagree
15 with that.

16 JUDGE WARDWELL: As I interpret your first
17 statement -- your statement to my first question is a
18 better way to word it, that you would agree that a
19 pump test would be the best way to do it and far
20 superior to measuring these structural features at the
21 surface?

22 MR. WIREMAN: Absolutely.

23 JUDGE WARDWELL: Thank you. The next group
24 of questions kind of looks at the characteristics of
25 the upper Chadron portion of this aquitard and

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1 specifically characteristics of the
2 clay/siltstone/mudstone that's been reported here.
3 And I'll start off with Crow Butte's testimony on Page
4 21, Answer 48, you state that the sediments overlying
5 the mined aquifer have not undergone complete
6 lithification (a process by which sediments are
7 converted into rock) as observed in cores and drill
8 cuttings during drilling investigations. And I'd like
9 to first ask, where is the data to support this
10 position in any of the testimony that we have before
11 us?

12 MR. BEINS: I'm not sure that we presented
13 that data in a table format necessarily for the core
14 that we've collected on the site. However, the site
15 specific core data is what we do present as we present
16 the hydraulic conductivities of some of the various
17 units that are there.

18 JUDGE WARDWELL: Is it your position that
19 the entire upper Chadron is an unconsolidated material
20 composed of very fine grain silts and clays as opposed
21 to a more rock-like material that would be generally
22 characterized -- that may be characterized as a
23 siltstone or a mudstone?

24 MR. BEINS: The upper Chadron is primarily
25 unconsolidated clays, however there are a few layers

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1 that are much more dense and compacted, lithified so
2 to speak. I know based off doing some of our drill
3 data that we've done, lithology-wise, and being out at
4 the drill rigs as they're drilling through it, you get
5 varying penetration rates at times in certain zones or
6 layers, in certain areas of the mine.

7 JUDGE WARDWELL: And is the term mudstone
8 and claystone and siltstone always exclusively used to
9 refer to a consolidated material? Is it always used
10 for a consolidated material?

11 MR. BEINS: Perhaps a better term would be
12 semi-consolidated.

13 JUDGE WARDWELL: Have you reviewed all of
14 the drilling data that's been in the license area and
15 are able to reach a conclusion that every drill hole
16 encountered either the clays that you talk about, the
17 unconsolidated material, and/or consolidated mudstones
18 or claystones or siltstones?

19 MR. BEINS: While I haven't been present,
20 employed at the mine site during the entire time span
21 there, certainly during the time period that I have,
22 which is over 20 years there, probably been there for
23 over 12,000 of the drill holes. Every hole that we've
24 drilled on the site has encountered the upper Chadron
25 and the middle Chadron clays, yes.

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1 JUDGE WARDWELL: Were you involved with the
2 preparation of your License Renewal Application?

3 MR. BEINS: Yes, I was.

4 JUDGE WARDWELL: Do you count on that clay
5 layer to be present or siltstone, claystone layer to
6 be present everywhere in order to reach the conclusion
7 that in fact the upper -- in order to reach the
8 conclusion in part that there is no direct
9 communication between the Basal Chadron and the
10 upper-lying aquifers?

11 MR. BEINS: I not only count upon it, sir,
12 but it's confirmed by our cross-sections that show
13 that it's present.

14 JUDGE WARDWELL: If in fact fractures were
15 present in that upper confining layer, would they be
16 restricted to only the stone type materials or would
17 they also exist within the clay structure?

18 MR. BEINS: While we at Crow Butte realize
19 that there may be some joints and fractures in the
20 Brule portion, the upper Brule Formation and
21 everything, we don't feel that those fractures extend
22 at depth down into the lower Brule and into the
23 Chadron Formation. And so, because of the plasticity
24 or the plastic nature of those sediments, any fracture
25 that is present there, if there were to be movement,

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1 is likely to seal itself off. The clays that we're
2 talking about have a high percentage of
3 montmorillonite clay in it. As those become wet, they
4 tend to swell.

5 That's something that we see on quite a
6 few occasions with our drill data. If we open up a
7 drill bore hole and for whatever reason if we're not
8 able to get that particular hole logged within
9 typically three, four hours, those clays will begin to
10 swell and they will seal the hole off. So any
11 fracture or feature that's present there that could
12 open up is likely going to seal itself off, again,
13 because of the plastic nature of the sediments, as
14 well as the swelling clays that are there.

15 JUDGE WARDWELL: But would you anticipate
16 those sections that are more consolidated into
17 mudstones and claystones to have that same plasticity?

18 MR. BEINS: No, sir, they would not.

19 JUDGE WARDWELL: They would transmit those
20 types of fractures, would they not?

21 MR. BEINS: The fracture may extend through
22 that feature, yes.

23 JUDGE WARDWELL: And you used the phrase
24 become wet. Isn't everything under water there now?

25 MR. BEINS: To an extent.

1 JUDGE WARDWELL: In the upper confining
2 unit?

3 MR. BEINS: Yes, sir.

4 JUDGE WARDWELL: I mean, so there's no
5 wetness to be gained anywhere. It is saturated now,
6 is it not? Do you have any reason to believe it isn't
7 saturated?

8 MR. BEINS: No.

9 JUDGE WARDWELL: Dr. LaGarry or your team,
10 would you like to comment on that interpretation of
11 the upper confining unit in regards to its
12 consolidated nature, the plasticity associated with
13 it, and the self-healing properties specifically?

14 DR. LAGARRY: Well, I've never been able to
15 get onto the license area to examine those rocks
16 specifically. Everywhere else that those rocks occur
17 at the land surface, they are full of joints and
18 fractures and ancient mineralizations that have
19 occurred over the last several million years. These
20 are published in a reference that I used in my latest
21 opinion. I believe it's Number 3, the one from -- the
22 second one in 2015, where I cite Harmon Maher from the
23 University of Omaha Nebraska. I presented a paper in
24 which he showed plates of these joints and fractures
25 in a Chadron Formation shot through with

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1 mineralizations. The Nebraska State Gemstone and
2 State Rock is called the Nebraska Blue Agate. It's
3 one such mineral filling within the Chadron Formation.

4 JUDGE WARDWELL: If for the sake of
5 argument there were unconsolidated clays down there as
6 opposed to a mudstone or a siltstone that likely were
7 observed in what you just described, would you not
8 believe that those clays would have some of the
9 plasticity referenced and the self-healing properties
10 if in fact either a fracture tried to transmit itself
11 through it or was created by some other external force
12 like an earthquake?

13 DR. LAGARRY: In my experience, meteoric
14 water, like rain and stuff, hits the surface of
15 outcrops, caused the sediments composed of hydrophilic
16 clay and so it'll absorb the water and puff up, just
17 like Mr. Beins explained. However, when I dig below
18 that, usually it's a six to eight inch layer of what's
19 called popcorn weathering, it produces the gumbo
20 that's famous locally, the mud that everybody
21 dislikes. But you can dig through that and then you
22 can get to rock. So, I mean, in my experience, once
23 you dig past the weathering surface, you get into hard
24 consolidated rock that's full of joints, faults, and
25 fractures.

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1 JUDGE WARDWELL: Thank you. Back to Crow
2 Butte. With no evidence that the materials are not
3 saturated, so that we assume it is, wouldn't there be
4 minimal conditions that support any swelling of the
5 clays? Because isn't swelling associated with the
6 clays now absorbing some type of water that it didn't
7 have before?

8 MR. BEINS: That would be true, yes, sir.

9 JUDGE WARDWELL: Thank you. It was brought
10 up and also stated in your License Renewal
11 Application, Page 2-127 to 128, that the Chadron
12 Formation is primarily composed of 44 percent
13 montmorillonite and, quote, is light green-grey
14 bentonitic clay grading downward to green and
15 frequently red clay. And I assume the basis for this
16 is the drilling that you've performed there that
17 allows you to designate and gave it this type of
18 classification?

19 MR. BEINS: Part of it's based, yes, sir,
20 on drill cuttings and observations on lithologic logs
21 as well as some core data.

22 JUDGE WARDWELL: What is the other 56
23 percent? If it's only 44 percent, that says less than
24 half of it's clay. And why would you call it a clay
25 if it was only less than half percent clay?

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1 MR. SPURLIN: This is Matt Spurlin with
2 Crow Butte. Given the heterogeneous nature --

3 JUDGE WARDWELL: Can you speak into your
4 mic a little bit and --

5 MR. SPURLIN: Yes.

6 JUDGE WARDWELL: -- your name again?

7 MR. SPURLIN: This is Matt Spurlin with
8 Crow Butte. Given the heterogeneous nature of any
9 formation, you're going to have alternating
10 lithologies. The takeaway is that there are a
11 predominance of silt and clay interbeds in the upper
12 confining unit there. So you can find potentially
13 high sand content units. But when you think of the
14 general thickness across the site that on average is
15 300 feet of upper confining materials, there's a
16 predominance of low permeability silts and clays that
17 in essence are more than 100 feet of clay materials
18 within that zone.

19 JUDGE WARDWELL: And do you agree with
20 staff's EA, Exhibit 010 again on Page 26, which states
21 that the clay unit is approximately 25 feet thick?
22 Just the clay unit of the upper confining unit?

23 MR. SPURLIN: Are you referring to a clay
24 unit within the upper confining zone?

25 JUDGE WARDWELL: Well, that's where I was

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1 going to go next. I was going to ask staff where they
2 wanted to it, but I happened to word it this way and
3 so I will strike that question, go to staff first, and
4 then come back to you. Staff, what did you mean in
5 your EA on Page 26 that the clay unit is approximately
6 28 feet thick? If I got that correctly.

7 MR. BACK: That's on Page 26 of the actual
8 EA or on the redline or the red numbered 26?

9 JUDGE WARDWELL: No, it's on -- I thought
10 they were actually the same in the EA, but I believe
11 that's the page -- well, I don't know.

12 MR. BACK: And are we talking about the
13 middle Chadron now being 28 approximately?

14 JUDGE WARDWELL: Let me get back to you on
15 that so I can make sure I got my reference correct.

16 MR. BACK: Okay. In the --

17 JUDGE WARDWELL: I will find that.

18 MR. BACK: -- meantime, we'll check too.

19 Because --

20 JUDGE WARDWELL: Yes.

21 MR. BACK: -- pretty much --

22 JUDGE WARDWELL: I have that, that you have
23 claimed that the clay unit, not the upper confining
24 unit, but just the clay portion of it was 28 feet.
25 And I was curious on how you got that number. And

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1 then I was curious on whether Crow Butte agreed. So
2 it's Page 26, but PDF -- oh, it's PDF Page 26, Page
3 13. Section 2.5.1. And why don't you just go ahead
4 and look that up and we'll get back to you --

5 MR. BACK: Okay.

6 JUDGE WARDWELL: -- after the break.
7 Because I assume we'll take a break here shortly. I
8 can't read all that, you've got to -- let me just
9 finish this line of question and then take a break.
10 Yes. And then we'll come back to that. Back to Crow
11 Butte, it is correct that not the entire upper
12 confining unit consists of this dominance of clay, is
13 that correct?

14 MR. SPURLIN: That is correct.

15 JUDGE WARDWELL: And is the clay at a
16 certain location within the upper confining unit?
17 And, if so, where is it generally found? Lower,
18 middle, upper, whatever?

19 MR. SPURLIN: There is a clay unit that is
20 formally referred to in the recent nomenclature as the
21 upper interior paleosol. It's referred to as the red
22 clay horizon in the License Renewal Application. This
23 particular paleosol is clay sized particles, which is
24 relatively uniform across the site, present above the
25 production zone. And generally --

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1 JUDGE WARDWELL: It's above what?

2 MR. SPURLIN: Generally immediately above
3 the Basal Chadron sandstone.

4 JUDGE WARDWELL: So it's in a lower part of
5 the upper confining unit?

6 MR. SPURLIN: It's in the lower part of the
7 upper confining unit and on average, it's 25 feet
8 thick.

9 JUDGE WARDWELL: Twenty-five feet thick?

10 MR. SPURLIN: Right.

11 JUDGE WARDWELL: Okay. As opposed to the
12 28 that I had written down or that I thought staff had
13 told me to write -- that I got from staff --

14 MR. SPURLIN: That's in the right ballpark.

15 JUDGE WARDWELL: -- in their EA.

16 MR. SPURLIN: Yes.

17 JUDGE WARDWELL: What is the upper
18 confining unit composed of above that clay layer?

19 MR. SPURLIN: The remainder of the upper
20 confining unit above the upper interior paleosol, also
21 known as the red clay horizon, is interbedded silts
22 and clays that are of varying composition. But we
23 also have samples from those zones that have more than
24 50 percent clay in it, indicating there are competent
25 clay intervals in there.

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1 JUDGE WARDWELL: And do any of these
2 transition into a claystone, siltstone, mudstone?

3 MR. SPURLIN: Can you --

4 JUDGE WARDWELL: Or is it all
5 unconsolidated material?

6 MR. SPURLIN: It's all unconsolidated
7 material onsite. It's the age of the unit that calls
8 into question these confusing terms for well-lithified
9 versus non-lithified units, claystone versus clays.
10 Onsite, as Dr. LaGarry indicated earlier, the history
11 of the Basal Chadron sandstone as well as the Chadron
12 can go through different stages of cementation and
13 non-cementation. Within the current licensed area,
14 that section of the Basal Chadron sandstone and the
15 upper confinement is currently unconsolidated.

16 JUDGE WARDWELL: Say that last sentence
17 again?

18 MR. SPURLIN: The upper confinement zone,
19 which is what we're talking about, I'll specify, is
20 predominately unconsolidated to semi-consolidated
21 materials. There are stringers of more lithified
22 materials in there that are of very minor thickness.

23 JUDGE WARDWELL: And then how do you
24 differentiate between that and that lower portion that
25 you also call unconsolidated clay? Is it --

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1 MR. SPURLIN: The geophysical logging at
2 the site has distinct signatures that call up, say,
3 the Basal Chadron sandstone from the overlying clay
4 materials. The distinguishing of silt and clay
5 materials is pretty subtle on a geophysical log, but
6 the sampling done at the site has shown that there's
7 a predominance of silt and clay material in that upper
8 confining zone. In particular, the upper portion.

9 JUDGE WARDWELL: But it seemed like your
10 License Renewal Application spent a lot of time
11 talking about and promoting this red clay layer. And
12 I don't hear much difference between that portion of
13 the upper confining unit that differentiates the
14 behavior of that material from the red clay unit.

15 MR. SPURLIN: There may not be much
16 behavioral difference just in terms of clay size.
17 There's a color --

18 JUDGE WARDWELL: How about water
19 transmission, which is what we're really interested
20 in?

21 MR. SPURLIN: Right. It's more permeable
22 than the lower red clay, which is 25 feet thick, just
23 because it's more heterogeneous. It's not a 100
24 percent thick section of clay materials.

25 JUDGE WARDWELL: What testing have you done

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1 to demonstrate this difference in conductivity?

2 MR. SPURLIN: We've --

3 JUDGE WARDWELL: Hydraulic conductivity?

4 MR. SPURLIN: Yes. We've collected samples
5 throughout the upper confining zone which have been
6 reported, hopefully, in the license renewal. Samples
7 have been collected and we've done particle size
8 distribution tests --

9 JUDGE WARDWELL: And it was reported where?
10 I didn't hear your whispers.

11 MR. SPURLIN: It's in --

12 JUDGE WARDWELL: Probably why you
13 whispered.

14 MR. SPURLIN: I asked for confirmation. We
15 have to find where they're located in the LRA, in the
16 license renewal. And we'll get back to you on that.

17 JUDGE WARDWELL: Okay. Let's do that too.

18 MR. SPURLIN: Okay. In terms of the
19 testing, we've collected soil core samples and
20 submitted them for particle size distribution analyses
21 to confirm that we have the presence of low
22 permeability materials in there that would act as an
23 aquitard. And the results of that sampling has
24 indicated a predominance of clay dominated materials.

25 JUDGE WARDWELL: Okay. In your testimony

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1 on 045, which I believe is your Reply, Page 32, Answer
2 56, quote, the red clay marker horizon is laterally
3 persistent across the region and has been observed in
4 drill cuttings as well as the geophysical logs from
5 all across the permit area. And could you explain
6 quickly again the difference between the red clay
7 layer and the green-gray clay layer? Is it just a
8 matter of small subtleties and mineralization? Or is
9 there some overriding behavioral difference between
10 those two materials that would influence the hydraulic
11 connection between the Basal Chadron, Chamberlain Pass
12 and the upper aquifer?

13 MR. SPURLIN: From a hydraulic standpoint,
14 there would be subtle differences, if any. It's
15 primarily the color difference.

16 JUDGE WARDWELL: What does the phrase
17 laterally persistent mean? That doesn't give me a
18 warm fuzzy feeling if I really want to prevent any of
19 my upward migration of --

20 MR. SPURLIN: Sure.

21 JUDGE WARDWELL: -- anything.

22 MR. SPURLIN: That would be equivalent to
23 saying laterally continuous.

24 JUDGE WARDWELL: But it wasn't used. Would
25 you be able to exchange laterally persistent with

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1 laterally there everywhere?

2 MR. BEINS: Not within the license area, I
3 would not.

4 JUDGE WARDWELL: Not within the what,
5 sorry?

6 MR. BEINS: Not within the license area, I
7 would not have a problem saying that.

8 JUDGE WARDWELL: You believe it is a
9 continuous layer across the entire license area?

10 MR. BEINS: Yes, sir.

11 JUDGE WARDWELL: Thank you. This is
12 probably a pretty good time to break. This is a good
13 time for everyone else?

14 CHAIR GIBSON: Stand in recess. We'll --

15 JUDGE WARDWELL: Start off with a couple
16 pieces of information and then --

17 CHAIR GIBSON: Yes. And hopefully we'll
18 get the other information straightened out. And per
19 our protocol, we'll go use the restroom, then you all
20 can have it.

21 (Whereupon, the above-entitled matter went
22 off the record at 2:30 p.m. and resumed at 2:42 p.m.)

23 CHAIR GIBSON: Back on the record.

24 JUDGE WARDWELL: We've got some questions
25 to be answered. What were they?

1 MR. BEINS: One of those, Judge Wardwell
2 -- Wade Beins here from Crow Butte. The question had
3 come up about the potentiometric surface direction at
4 North Trend. That is shown in Figure 2.7-4E of the
5 license renewal. It is page 240 or, I believe page
6 685 on the PDF.

7 JUDGE WARDWELL: And that direction is?

8 MR. BEINS: The flow direction is to the
9 southeast, towards the current area.

10 JUDGE WARDWELL: That was during -- that
11 was in what time frame?

12 MR. BEINS: I believe that was taken back
13 in 2004. I would have to check on it to make sure.

14 JUDGE WARDWELL: The only thing is --
15 during mining operations.

16 MR. BEINS: During mining operations, yes.

17 JUDGE WARDWELL: Correct, okay.

18 JUDGE HAJEK: I'm sorry. Can you give
19 that page number again? I'm really having a hard time
20 hearing.

21 MR. BEINS: The page number for that one
22 is page 240 and 685 on the PDF. Excuse me it is page
23 240 out of 685 on the PDF.

24 JUDGE HAJEK: Thank you.

25 CHAIR GIBSON: That makes a little more

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1 sense.

2 MR. BEINS: Yes.

3 JUDGE WARDWELL: And did we have another
4 question? Were you going find something, Mr. Back?

5 MR. BACK: We did, Your Honor. It was the
6 source of the assumption of the 28-foot thickness.
7 And we are going to have to dig a little more.

8 JUDGE WARDWELL: Try just what I said,
9 3.4.1.5 page 26.

10 MR. BACK: Oh, no, we have that, Your
11 Honor.

12 JUDGE WARDWELL: Oh, okay.

13 MR. BACK: The reference for the later is
14 Terry, for the later part of that sentence. And so we
15 need to get that original reference.

16 CHAIR GIBSON: In regards to my question
17 of what is the basis for that number.

18 MR. BACK: Yes.

19 JUDGE WARDWELL: Yes, I see. Yes, that's
20 right. Okay, thanks.

21 CHAIR GIBSON: Did you say it was Terry?

22 MR. BACK: Yes, the later part.

23 CHAIR GIBSON: Is that the same Terry to
24 which Mr. LaGarry has been referring several times?

25 MR. BACK: Your Honor, I believe so.

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1 CHAIR GIBSON: The same publication?

2 MR. BACK: I don't -- there were several
3 publications, so I am not sure.

4 CHAIR GIBSON: Okay. Well, okay. It just
5 might be useful to get that provided to all concerned.
6 I don't know whether you can work with Mr. LaGarry and
7 you all can try to sort that out. But just for
8 purposes of making the record clear, it would be good
9 if we knew the publication and we had a copy of it and
10 everybody had a copy of that. Would that be possible?

11 DR. LAGARRY: I will gladly do that.

12 CHAIR GIBSON: Thank you, Dr. LaGarry.
13 Okay. Back to you, Judge Wardwell.

14 JUDGE WARDWELL: Okay. In your license
15 application, Crow Butte, page 2-131 in regards to the
16 upper confining unit, you state that the measured
17 vertical hydraulic connectivity of the upper
18 confinement is less than one times ten to the minus
19 ten centimeters per second.

20 My question to you is what were those
21 tests and calculations that were used as the basis for
22 the derivation of this hydraulic conductivity value
23 and how was it determined and where is the data
24 supporting this value in your license application.

25 MR. BEINS: That was before my time, Dr.

1 Wardwell but my understanding is that it is based on
2 core data that was gathered and compaction tests run
3 upon that data.

4 JUDGE WARDWELL: But did you say you were
5 involved with the preparation of the license renewal
6 application?

7 MR. BEINS: I was, yes.

8 JUDGE WARDWELL: Yes, and this is where
9 this number was I quoted from. So, that wasn't before
10 your time, was it?

11 MR. BEINS: The collection of the core and
12 the testing that was done predated my employment
13 there. But yes, that was the number that we have used
14 in the original license and have continued to use for
15 the site.

16 JUDGE WARDWELL: You use the phrase it was
17 a compaction test. That seems like a strange name for
18 the test that might be run on this to determine
19 hydraulic conductivity. Do you know what was involved
20 with that test?

21 MR. LEWIS: This is Lewis with Crow Butte.
22 We talked about the reconsolidation of the material
23 for this testing. And we will have to look into the
24 details of how that testing was done. I suspect it
25 was a falling head permeameter, this type of testing.

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1 JUDGE WARDWELL: What type of test again?

2 MR. LEWIS: A falling head permeameter or
3 similar, after recompaction of the sample. That is my
4 suspicion but we need to dig into that and verify
5 that.

6 JUDGE WARDWELL: Okay, do that. And also
7 look to see what the name of the test was, whether
8 compaction is the right word or consolidation is the
9 right word or settlement is the right word or
10 something like that would be useful.

11 NRC, in your review of the license renewal
12 application, did you inspect any of the cuttings or
13 coring that was done or did you just take their word
14 for it that that clay layer was there?

15 MR. BACK: Your Honor, we took their word
16 for it that that layer was there. We did not actually
17 --

18 JUDGE WARDWELL: I'm sorry?

19 MR. BACK: We did not actually inspect the
20 core. We took their word for it that it was actually
21 there.

22 JUDGE WARDWELL: Back to Crow Butte, when
23 we talk about coring this, is it the same -- coring
24 this clay, is the same as coring rock or is it a
25 different type of stuff or how would the samples be

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1 preserved if they were preserved?

2 MR. BEINS: The coring that we are
3 referring to is done with a drill rig, where we go in
4 and remove a sample of the clay that is present. We
5 use a split tube Randolph-type core barrel. It gives
6 us about a two-inch sample in diameter.

7 JUDGE WARDWELL: Mr. Wireman, in your
8 testimony Exhibit 047, I believe, page 2, you state
9 that an approximate characterization program to
10 quantify the secondary permeability of the upper
11 confining unit and the upper aquifer. The parameter
12 that controls groundwater flow -- which is a parameter
13 that controls groundwater flow in these formations,
14 has not been completed. CBR and NRC define the upper
15 confining unit as including the middle and upper
16 members of the Chadron formation and the lower member,
17 parenthesis, Orella, of the Brule formation.

18 And my question to you is do you claim
19 that all the materials of the upper confining units
20 are rock and not soil-like unconsolidated strata?

21 MR. WIREMAN: No, I do not claim that.

22 JUDGE WARDWELL: Okay. So, you are not
23 disputing the presence of the high percentage of clay
24 in these materials?

25 MR. WIREMAN: I don't dispute that there

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1 is clay in these materials, no.

2 JUDGE WARDWELL: In your reference to the
3 secondary permeability, are you referring to the
4 potential faults, fractures, cracks, whatever we want
5 to call them that might exist within this upper
6 confining unit that Dr. LaGarry has referenced
7 earlier?

8 MR. WIREMAN: You know, there is at least
9 two types of what I would call preferential flow areas
10 or volumes --

11 JUDGE WARDWELL: If you could get a little
12 closer and speak a little higher, it just helps me.

13 MR. WIREMAN: Obviously, a portion of this
14 rock that is highly fractured and highly jointed would
15 have a secondary porosity associated with it and some
16 degree of secondary permeability, depending on the
17 connection of the porous zones.

18 Also, if you have sand or silt lenses
19 within a clay or claystone, those become, in a sense,
20 preferential flow pass because they have higher
21 permeabilities, the water will want to go there.

22 So, I look at it as a preferential flow
23 through an overall low permeability rock mass or rock
24 unit and these preferential flow paths can be
25 comprised of dense fractures, open vaults, or lenses

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1 in areas of higher permeability materials such as silt
2 or sand.

3 JUDGE WARDWELL: Well, wouldn't those
4 lenses have to be continuous to some outlet area to
5 really influence the permeability? Just a lens of
6 sand encapsulated within a clay layer wouldn't seem to
7 me to add much to the overall hydraulic conductivity
8 transmissivity of that layer, would it?

9 MR. WIREMAN: That's correct.
10 Permeability is simply connecting up porous zones so
11 you can move water between them.

12 JUDGE WARDWELL: So the lenses would have
13 to be continuous is what I am saying, in order for it
14 to be influential, wouldn't it?

15 MR. WIREMAN: Being continuous would be
16 one way, you are correct, for that to happen. Another
17 way might be to sand lenses are relatively higher
18 permeability, silt lenses could be connected by
19 fractures.

20 JUDGE WARDWELL: Right.

21 MR. WIREMAN: So, there are other ways to
22 do that. But you are correct in that they would have
23 to be connected.

24 JUDGE WARDWELL: So, it is pretty much
25 this fractured area that is the predominate issue in

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1 regards to secondary permeability that we are dealing
2 with at this site?

3 MR. WIREMAN: Based on my review and my
4 reading of all this, I would say yes, that dense
5 fractures sets in areas of dense fractures would
6 likely comprise the dominant secondary porosity, yes.

7 JUDGE WARDWELL: Dr. LaGarry, would you
8 agree with that also?

9 DR. LAGARRY: Yes, I do.

10 JUDGE WARDWELL: Okay, great. Thanks.

11 Mr. Wireman, what would you suggest to be
12 a program to help quantify what is the secondary
13 permeability at a site such as this?

14 MR. WIREMAN: First of all, I would go
15 back to maybe a different type of core, so that you
16 could look at the rock in boreholes and cores and be
17 able to have what are called oriented cores or cores
18 that haven't been rotated and moved, where you can
19 actually look to see if the fractures are there. That
20 is one way.

21 Secondly, would be to do a series of pump
22 tests in this, either the Brule aquifer or the Brule
23 upper confining unit, where you know there are sand
24 lenses, based on either domestic wells or based on
25 other types of information you have and then pump

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1 those. Do a standard time drawdown or distance
2 drawdown data and plot that data out. That gives you
3 some idea about the connection of a sandy portion of
4 this Brule, if you screen -- And if you continue to
5 get a low slope and you continued have less drawdown,
6 that you can look to see if there is connection and
7 how far out that goes before you stop, before you run
8 into rock that isn't giving you any more water.

9 But the key here is you can't just do it
10 in one place. We have all heard how heterogeneous this
11 rock is, siltstone, clays, sands. So, doing it in one
12 place doesn't represent a very large portion of this
13 rock.

14 So, a series of tests across the
15 appropriate areas, with tide and drawdown data,
16 calculating hydraulic conductivity and transmissivity
17 and then seeing how that varies, what the ranges are,
18 and what the distances are before you reach some kind
19 of a boundary. That is what I would suggest.

20 JUDGE WARDWELL: I think I have got a
21 pretty good understanding of the pump tests that you
22 are referring to and advocating. How successful would
23 this orientation of the coring be successful in
24 regards to that? Is that considered a fairly -- I
25 assume it is fairly much more expensive to do it that

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1 way than it is just normal coring, in order to get
2 that orientation.

3 MR. WIREMAN: You are absolutely correct.
4 It is very expensive. And I am not necessarily
5 advocating that as a sole method. It is expensive.
6 And in these types of rocks, it is not as successful
7 as it would be in truly hard indurated rock. So, it
8 is not something -- I would go to the pump test first,
9 I absolutely would, and do those.

10 And if I may, the reading I have done
11 seems to indicate that there is some knowledge in the
12 Brule about where these sandy areas are. There are
13 some domestic wells out there. The work that Crow
14 Butte has done has identified some areas where there
15 is silt, maybe not sand, but not clay. And that would
16 guide you as to where you might want to do these
17 tests.

18 JUDGE WARDWELL: Thank you.

19 I think I would like to turn to staff now
20 and explore a little bit more similar stuff I did with
21 Crow Butte and that deals with your testimony on page
22 111, answer 14.6, where you testified that because of
23 saturated clays and these formations are not brittle,
24 if they are subject to an earthquake large enough to
25 generate small fractures in these layers, the layers

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1 would self-heal and not undergo any permanent changes
2 in secondary porosity.

3 But as a siltstone or a mudstone or a
4 claystone, wouldn't these materials be more brittle
5 than they would be plastic?

6 MR. BACK: I'm going to hand this
7 discussion off to my colleague.

8 JUDGE WARDWELL: Sure.

9 MR. CAO: Can you repeat the question
10 again?

11 JUDGE WARDWELL: Yes. In your testimony
12 you talk about basically the self-healing
13 characteristics of the upper confining unit,
14 specifically the clays associated with it. But yet,
15 you describe them as siltstones, mudstones, and
16 claystones and that connotes to me a certain
17 brittleness associated with those types of materials,
18 such if they did fracture due to an earthquake or any
19 other loading or had cell fractures from their initial
20 formation, why would they necessarily heal similar to
21 what a clay deposit might heal?

22 MR. CAO: Your Honor, first if the
23 earthquake is not large enough, the stress created by
24 the seismic wave is very low, even those
25 unconsolidated, like you said, the siltstone, the

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1 sandstone, these cracks probably were not being opened
2 or expanded or creating new cracks.

3 JUDGE WARDWELL: Yes, but let's take for
4 assumption that somehow it cracked. Let's forget
5 about how it cracked. Let's say the cracks are there.

6 MR. CAO: Okay.

7 JUDGE WARDWELL: Why would they heal if it
8 was a brittle type material, like a mudstone,
9 sandstone -- I'm sorry -- mudstone, siltstone, or
10 claystone seems to convey to me.

11 MR. CAO: Those under pressure, the cracks
12 can close. So, it is kind of healing.

13 JUDGE WARDWELL: But if they close, there
14 would still be a space between them. I mean they are
15 not going to heal completely compared to what they
16 were before. Won't you have a larger secondary
17 conductivity associated with those fractures?

18 MR. CAO: It can close to pretty tight and
19 probably the transmissivity is negligible.

20 JUDGE WARDWELL: And what evidence do you
21 have of that or have you submitted in that area?

22 MR. CAO: I think that evidence from
23 seismological point of view, we don't have any
24 evidence. It is they hydrological evidence is
25 provided in our testimony.

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1 JUDGE WARDWELL: Okay, thank you. Looking
2 at the Brule formation, NRC testimony page 29 answer
3 D3, you cite your EA and that is Exhibit 011 of
4 Section 3.4.1 that the lower portion of the Brule
5 formation consists of interbedded siltstone, mudstone,
6 and claystone with occasional sandstones, while the
7 upper Brule formation includes browns, siltstones, and
8 sandstone members. Aren't all of these materials
9 considered consolidated materials?

10 MR. BACK: Your Honor, when we read the
11 literature, that is how it is classified, as
12 sandstones, and mudstones, and siltstones. However,
13 when we hear the descriptions of people actually
14 taking the logs, then it becomes clearer that a lot of
15 this is unconsolidated. So, we have to go -- since we
16 are not physically observing, we have to go with what
17 we are actually reading.

18 JUDGE WARDWELL: And would you
19 characterize this as getting less and less clay-like
20 and more and more sand-like as you proceed vertically
21 upward in the upper confining unit, especially in
22 regards to the Brule formation?

23 MR. BACK: Your Honor, that would make
24 sense, in terms of how the hydraulic conductivities
25 change as you move further upward.

1 JUDGE WARDWELL: And does the Brule, in
2 fact, end up to be kind of a poor aquifer near the
3 upper surfaces of that?

4 MR. BACK: Where it is fractured in the
5 secondary permeability, that tends to be where more
6 water is derived, yes.

7 JUDGE WARDWELL: Thank you.

8 Dr. LaGarry, could you describe the
9 formation of the Brule and your characterization of
10 it, at least from a regional, if not the site-specific
11 because of your lack of access to that, necessarily,
12 but on a regional basis describe that formation?

13 DR. LAGARRY: Sure. Sure, I'm the most
14 recent one to publish on that.

15 The Orella member of the Brule formation
16 is restricted to synclines extending south from the
17 Black Hills. It is a river system. It has channel
18 sandstones and overbank siltstones, and minor amounts
19 of clay.

20 JUDGE WARDWELL: May I interrupt, quickly?

21 DR. LAGARRY: Pardon?

22 JUDGE WARDWELL: Can I interrupt quickly?

23 DR. LAGARRY: Please.

24 JUDGE WARDWELL: Good, because I had
25 already anyhow but thank you for allowing me to.

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1 (Laughter.)

2 JUDGE WARDWELL: Would you consider those
3 blank stones, whatever you want to put a preference in
4 front of them, to be consolidated materials?

5 DR. LAGARRY: Yes.

6 JUDGE WARDWELL: And while I think of it
7 because I keep forgetting to ask this question, what
8 is the difference between a mudstone and a siltstone
9 or a claystone? I understand siltstone from claystone
10 and sandstone from siltstone from claystone. I don't
11 know what a mudstone is.

12 DR. LAGARRY: Mudstone assumes nearly
13 equal amounts of silt and clay.

14 JUDGE WARDWELL: Okay, thank you. Now
15 proceed with the Brule.

16 DR. LAGARRY: Okay. So, the lower part of
17 the basal member, lower member of the Brule is fluvial
18 valley fill, consisting of channel sands, overbank
19 sands, overbank silts, and minor amounts of clay.

20 That grades upwards into a widespread
21 upper part of the Brule, which consists of silt-sized
22 volcanic ash that fell from the sky back then. It is
23 thick and it is widespread everywhere. Both of those
24 members, the lower Orella and the upper Whitney
25 members of the Brule are calcium carbonate cemented.

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1 They are semi-consolidated.

2 JUDGE WARDWELL: So, you like that term,
3 also, semi-consolidated.

4 DR. LAGARRY: Well, it is a relative term.
5 I mean to me, they are rock. But to somebody who did
6 geology in the Rocky Mountains or the Adirondacks, or
7 wherever, it might not seem like rock to them. But it
8 is soft rock.

9 JUDGE WARDWELL: The best rock you have
10 got out here, eh?

11 DR. LAGARRY: Well, I like it. I've spent
12 my career on it.

13 JUDGE WARDWELL: In regards to the lower
14 portion of the upper confining unit, where it gets
15 more clay-like, do you agree it gets more clay-like at
16 the lower levels?

17 DR. LAGARRY: Yes, the Crow Butte
18 geologist is correct when he said it is originally
19 called the interior paleosol. This is one of the --
20 remember in my earlier comments, in my earlier
21 testimony, I stated that the Chamberlain Pass
22 formation was combined the basal Chadron sandstone
23 with a rock unit or some sediment assumed to be with
24 the Pierre Shale that contribution from the Pierre
25 Shale is that red clay.

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1 So, it used to be thought that it was the
2 red clay, then the sand in its geological history.
3 But then Evans and Terry in '94 and then Dennis Terry
4 in '98 published evidence that showed that the red
5 clay and the white ore bearing sand are, in fact,
6 intermingled.

7 And so the red clay consists of
8 devitrified volcanic glass. Devitrified, it means it
9 has been converted from glass into clay. The
10 overlying Chadron formation is partly devitrified
11 volcanic ash. It is only between 40 and 60 percent
12 converted to clay.

13 Because it was volcanic ash and converted
14 to clay and it is dominantly clay in a lot of places,
15 it carries the name claystone.

16 JUDGE WARDWELL: Would you agree that it
17 has some self-healing properties, should it be cracked
18 or --

19 DR. LAGARRY: Not in my experience at all.

20 JUDGE WARDWELL: Thank you.

21 Then let me go back to NRC in regards to
22 where I think we were before I went back over to Dr.
23 LaGarry. And that is in your same statement there on
24 page 111, answer 14.6, in regards to self-healing
25 properties, what is the mechanisms by which it would

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1 self-heal? Why is Dr. LaGarry in error in regards to
2 not understanding your concepts of that mechanism?

3 MR. BACK: Your Honor, when we looked
4 through all of the information and we understood that
5 there are a number of faults and joints in the area,
6 if these faults and joints are so pervasive and the
7 fractures and joints do not self-heal, then the basal
8 Chadron would not remain confined. And so, to us, it
9 just seems to make sense that if they don't self-heal,
10 you would interconnect the aquifers, since there are
11 so many faults and joints in the area to where there
12 had to be another mechanism and, just from deduction,
13 it seemed to make sense that they self-heal.

14 JUDGE WARDWELL: So you are saying that
15 this clay layer self-heals because the basal Chadron
16 doesn't indicate any indications of communication with
17 the upper layers and, therefore, you can use this clay
18 layer to demonstrate that there is no connection with
19 the upper layers.

20 Is that a bit of circular reasoning?

21 MR. BACK: No, Your Honor. The reasoning
22 is this, is that there is, we know from multiple lines
23 of evidence, that there is not an intercommunication
24 between the basal Chadron and the overlying units.
25 And so, if the system has been faulted and fractured

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1 as much as other geologists are indicating, then all
2 these fractures and faults would have had to have
3 self-healed. Otherwise, there would be
4 intercommunication among the aquifers.

5 JUDGE WARDWELL: So you believe those
6 fractures were there in the clay at some point and you
7 were counting on this self-healing as the mechanism by
8 which the demonstration of no communication takes
9 place between the strata.

10 MR. BACK: Your Honor, we don't have
11 evidence that there has been this faulting, certainly
12 not within the licensed area to communicate the
13 different aquifers.

14 However, you asked what the process was
15 for this self-healing. In our testimony, we say it is
16 the large volumes of clay that largely the
17 montmorillonite that acts to self-heal. And when they
18 are drilling these units, in my experience, things
19 have been pretty dry as you are going through and
20 actually drilling. But if you introduce a fluid
21 because now if the hypothesis is that fluids are going
22 to be moving up these fractures, that would introduce
23 the water and the clays would self-heal. And we have
24 seen that on other sites.

25 JUDGE WARDWELL: You use a phrase dry but

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1 is not that layer saturated? I mean it may not have
2 any free water while you are sampling it but wouldn't
3 fine-grained materials like a clay would hold that
4 water in? It wouldn't necessarily let it out. So,
5 that is not surprising, is it?

6 MR. BACK: Well, you would be surprised at
7 how dry things can look when you are drilling through
8 a really tight clay.

9 JUDGE WARDWELL: Did you take a -- did you
10 know if they took a water content sample of that to
11 see how much water was actually in this dry material?

12 MR. BACK: No, Your Honor, I don't know.

13 JUDGE WARDWELL: Well, Butte, have you
14 ever alleged any dry material at the site in your logs
15 that you have reviewed?

16 MR. BEINS: We do not have that data, sir.
17 We drill using a direct rotary method. So, we are
18 already introducing some fresh water into the
19 formation and that is likely part of why we suffer the
20 swelling clays in our drill holes is you are
21 introducing a fresh water constituent into the
22 formation there that interacts with those clays that
23 causes them to react differently than they do from the
24 little bit of water that is tied up there to begin
25 with.

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1 JUDGE WARDWELL: In any of your core
2 samples, did any of the water contents indicate that
3 that material is dry?

4 MR. BEINS: No, sir.

5 JUDGE WARDWELL: Thank you.

6 JUDGE WARDWELL: So, back to NRC. Just to
7 make sure, I want to fix this point, that you don't
8 have any direct indications or hypothesis mechanism by
9 which this healing would take place. It is mostly
10 derived from the observations of its performance in
11 the field. Is that a fair assessment?

12 MR. BACK: That is a large part of it.
13 However, in our testimony, we do talk about the large
14 clay content and if it is wet, it is going to
15 self-heal.

16 JUDGE WARDWELL: And by what mechanism?

17 MR. BACK: Well, for one thing, there
18 would be a smear zone to begin with. I mean we know
19 that when plates move across one another, they create
20 a smear zone. More often than not, a faulting creates
21 a no-flow boundary, rather than enhancing flow. And
22 so, that would be one mechanism.

23 JUDGE WARDWELL: Thank you.

24 Crow Butte, in your license renewal
25 applications, pages 2-173 to 2-179, Figure 2.7-3A to

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1 3E provide potentiometric contours of the heads in the
2 Brule formation.

3 My first question is how many wells were
4 used to derive these maps, similar to the question I
5 had when we were talking about the potentiometric
6 contours in the basal Chadron.

7 MR. BEINS: I believe that, again, this is
8 one of those maps that we generated from the limited
9 amount of data that was present. In the early days of
10 the project, as we were beginning to do the licensing
11 for the project, the data would be shown -- or the
12 wells that are shown with elevation, attached to them
13 are the wells that were sampled.

14 JUDGE WARDWELL: Is there a reason -- it
15 is interesting that this is the same time frame, '82
16 to '83, if read that correctly, '82 to '83 that we had
17 the other ones for the basal Chadron that showed, I
18 think, a total of six wells all kind of in one line,
19 almost, which, to me, kind of dictates the flow of
20 direction because that is the line the wells were
21 oriented in.

22 Here, I don't know for sure, but I see a
23 lot of elevation numbers scattered around and,
24 certainly, a contour map, which the other one wasn't
25 a contour map. It was just a list of elevations.

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1 Why wasn't a similar contour map drawn for
2 that pre-mining condition? It seems to me that is
3 really the important one.

4 MR. BEINS: I'm not sure why that was.

5 JUDGE WARDWELL: And so this shows that
6 the regional water level in the Brule, pre-mining, was
7 towards the northwest. Is that correct?

8 MR. BEINS: Correct. It was flowing up
9 towards the northwest towards the White River.

10 JUDGE WARDWELL: And you don't have a
11 table of these wells with the elevations on them, do
12 you, that show the number of wells that were located?
13 I was wondering about the 12 wells that are shown on
14 Table 2.7-5 on page 2-184 of your license renewal
15 application. I was wondering if those were the only
16 wells used or the wells used at all in deriving these
17 maps, of which this is only the first of them.

18 MR. BEINS: I would have to look into that
19 further.

20 JUDGE WARDWELL: Why don't you look into
21 that and get back to us at the next break?

22 Yes, and also to follow up on that, look
23 to see if they were used for the subsequent years of
24 the other maps that are shown after this one.

25 MR. BEINS: Yes, sir.

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1 JUDGE WARDWELL: That is from pages 2-173
2 to 179 of your license application.

3 And staff, do you agree that the flow in
4 the Brule is towards the northwest?

5 MR. BACK: Yes, absolutely.

6 JUDGE WARDWELL: And the same thing, Mr.
7 Wireman, would you agree that that is -- you have no
8 reason to dispute that?

9 MR. WIREMAN: Well, in my reading of the
10 license application, and I noted this in my notes and
11 I think in my testimony, there were four or five
12 different directions of flow given and they range from
13 northwest to north to northeast and east north. So,
14 one of the points I have made is it is all confusing
15 to me.

16 If the flow is changing, spatially or
17 temporally, that needs to be explained. Why is that
18 happening? This map shows pretty consistent northwest
19 flow from the very southeast end all the way to the
20 northwest. So, I was confused about the different
21 descriptions of flow directions.

22 JUDGE WARDWELL: And you believe these
23 different descriptions were given for the flow in the
24 Brule formation or was it in the basal Chadron, or are
25 you unsure?

1 MR. WIREMAN: It was in the Brule.

2 JUDGE WARDWELL: Okay, thank you. And do
3 you have a reference for those other directions that
4 you were referring to?

5 MR. WIREMAN: I believe I do.

6 JUDGE WARDWELL: You can get back to us,
7 if you want to have some time. No problem.

8 MR. WIREMAN: I do have a page number.

9 JUDGE WARDWELL: Sure, no problem. We are
10 just getting to the limit of things that I can
11 remember that we have to get back to.

12 CHAIR GIBSON: Maybe we could shoot for
13 getting that done. We will take one more break later
14 this afternoon. Maybe you could have that -- make
15 sure and have that to us when we come back from that
16 break.

17 MR. WIREMAN: Absolutely.

18 JUDGE WARDWELL: Okay, and --

19 MR. WIREMAN: I have that now, if you
20 would like it.

21 JUDGE WARDWELL: I'm sorry?

22 MR. WIREMAN: I do have that. I found it.

23 JUDGE WARDWELL: Okay, great. I putzed
24 along long enough to give you the time to get it, huh?

25 MR. WIREMAN: I found it, yes.

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1 JUDGE WARDWELL: Age is wonderful, isn't
2 it?

3 MR. WIREMAN: Well, I'm there.

4 JUDGE WARDWELL: I'm with you.

5 MR. WIREMAN: This is my notes, north,
6 northwest for the -- Brule is east-northeast on page
7 2153. The SER, page 22, says groundwater flow in the
8 Brule is the northwest. And then there is a couple
9 others that I would have to find but I don't see them
10 in my notes.

11 JUDGE WARDWELL: Okay, well get us your
12 full list at the break. No problem with that.

13 MR. WIREMAN: I will.

14 JUDGE HAJEK: Is this in your testimony?

15 MR. WIREMAN: It is mentioned in my
16 testimony that there were three or four different flow
17 directions given. I don't know that I put the
18 reference --

19 JUDGE HAJEK: I'm sorry. What you are
20 reading from, is that the testimony?

21 MR. WIREMAN: No. No, it's not. It is my
22 notes. But I will find it.

23 JUDGE WARDWELL: In regards to that Brule
24 formation, I think on your testimony, Exhibit 070 page
25 2, you state that the hydraulic properties in

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1 groundwater flow in the Brule aquifer is not
2 adequately characterized. There is no water table
3 potentiometric map for this aquifer. The direction of
4 flow is apparently not known with certainty as it is
5 reported to flow in numerous directions in various
6 reports and technical documents.

7 Do not the maps presented in Crow Butte's
8 license application on pages 175 -- 2-173 through
9 2-179, and those are Figures 2.7-3A to E, of which
10 this is the A version of it, provide those
11 potentiometric contours that you are seeking?

12 MR. WIREMAN: They provide some of them.
13 I would like to see some maps of much smaller areas
14 that try and deal with these different flow directions
15 that are described in the application because the
16 concern I have is that there is some kind of a -- the
17 water table, the upper Brule, is more of a water table
18 than a confined aquifer, and that that water table
19 surface is being changed for some reason. It is being
20 modified, due to pumping, due to whatever.

21 So, by drawing these water table maps for
22 smaller areas in more detail, that would help explain
23 those differences a little better. That was the point
24 of my comment.

25 JUDGE WARDWELL: And could you say again

1 your concern in regards to this water table? Are you
2 concerned that the Brule or the basal Chadron is not
3 confined or -- I couldn't hear that.

4 MR. WIREMAN: I'm not prepared to say that
5 but I think it is important to explain why the
6 direction of groundwater flow differs. That was my
7 point. And I can't say why it changes. I don't know.

8 But it appears to differ, depending,
9 locally, where you are and that could be due to a
10 variety of things. It could be due to domestic well
11 pumping. It could be due to the fact that it is near
12 a stream and it is discharging. I mean there is a
13 variety of things but it should be explained.

14 JUDGE WARDWELL: Thank you.

15 Crow Butte Exhibit 045, which I believe is
16 your reply, I think, either that or your original
17 testimony, page 31 answer 55, and I quote: The upper
18 confining units do not contain recoverable quantities
19 of water and, therefore, there is no water to monitor.
20 If a well was installed in the upper confining layer,
21 the only water it would likely register would be water
22 used during installation and development.

23 My question to you is just because it is
24 low hydraulic conductivity, why does that preclude the
25 presence of water to monitor? Which is what I

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1 interpreted your statement.

2 MR. BEINS: That particular formation does
3 not produce enough water to really be measurable,
4 using our methods.

5 JUDGE WARDWELL: But if there is, if it is
6 saturated, I believe you stated it was -- well, you
7 stated it was, would not eventually water equilibrate
8 into a well?

9 MR. BEINS: To define it as being truly
10 saturated, perhaps is an overstatement on my part. It
11 is damp. Certainly over a long period of time you may
12 be able to get enough water into the well to be able
13 to see some sort of a response there but it would be
14 a very difficult thing to measure and take a long
15 time.

16 JUDGE WARDWELL: So, wouldn't it be better
17 phrased that the recovery would be so slow that it
18 would not be responsive to different aquifer tests,
19 that would be a better way to say than just saying no
20 water?

21 MR. BEINS: Yes, sir.

22 JUDGE WARDWELL: Because that gets back to
23 my concern with this dry statement. When you have got
24 an aquifer below and an aquifer above, I have a little
25 hard time understanding why the stuff in the middle

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1 ain't wet -- ain't saturated. And if you can explain
2 that to me, fine. But if not, then it says it is
3 there and saturated and yes, it may be so tight that
4 water can't flow and that makes sense.

5 MR. BEINS: Certainly, it is a very low
6 permeability zone, yes.

7 JUDGE WARDWELL: And likewise, when you
8 are trying to quantify the retention capabilities of
9 this particular zone, especially in regards to its
10 confining properties, wouldn't you want to take some
11 extra steps to be able to define how much it is able
12 to separate out the communication between the basal
13 Chadron, Chamberlain pass and the materials above it?

14 MR. BEINS: Certainly. And that is what
15 we have done with our aquifer pumping tests. We have
16 had four tests on the site. All of the tests have
17 demonstrated --

18 JUDGE WARDWELL: We will get to those. We
19 have got probably a half of day on those -- no, we
20 don't, but we have got some time on those tests. So,
21 we will look at those tests.

22 Could you not also put in other devices
23 besides a standpipe well to measure the water pressure
24 at locations and not use something that requires a
25 volume of water to enter it in order to measure these

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1 types of things?

2 MR. BEINS: I believe that we did such a
3 test during one of our aquifer testing periods, where
4 we installed just a small diameter well and put a
5 piezometer downhole and monitor that for a time period
6 on the upper confinement that showed that there was
7 zero drawdown during those pumping tests.

8 JUDGE WARDWELL: Again, we will get into
9 that. But couldn't you also send an electronic device
10 down there, you don't even need the standpipe, so that
11 it is measuring the pressure directly? Could you not?

12 MR. BEINS: Yes.

13 JUDGE WARDWELL: And to the best of your
14 knowledge, that has not been done.

15 MR. BEINS: No, sir.

16 JUDGE WARDWELL: And in regards to that,
17 in addition to the pump tests, were there any other
18 hydraulic tests performed in the field, like I think
19 someone mentioned earlier a rising-head/falling-head
20 test. I guess there are some things like packer tests
21 and slug tests, and all kinds of different things
22 people play around with in the field, if they are
23 given enough budget, which I assume Crow Butte has
24 infinite budgets for your operation.

25 Are there any others besides the pump

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1 tests? And we will talk about the pump tests in
2 detail. I am just curious as to whether there were
3 any other types of tests that were performed on Brule
4 specifically, not only the Brule but the upper
5 confining unit, specifically.

6 MR. LEWIS: Your Honor, this is Lewis,
7 Crow Butte.

8 Testing of low permeability materials is
9 very difficult when they don't yield a sufficient
10 amount of water. You could introduce a fluid into the
11 formation through pressurized tests.

12 You asked me if there were other things
13 that could be done. You could introduce a fluid under
14 pressure and try to measure pressure fall, that type
15 of thing. Those tests can be of very long duration.
16 And typically, often the packer itself leaks more than
17 the formation and the data is very difficult to obtain
18 with those kinds of conditions. It is also a very
19 expensive way to go about testing.

20 But if the formation, itself, is not
21 yielding water sufficiently, it is very difficult,
22 other than core samples, which we mentioned there was
23 some core testing done, to really quantify the
24 permeability, other than through aquifer testing and
25 that type of regional analysis that might give you

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1 some additional information on the vertical
2 permeability of the formation.

3 JUDGE WARDWELL: So, I guess your answer
4 is no, you haven't.

5 MR. LEWIS: No, we have not.

6 JUDGE WARDWELL: Thank you.

7 JUDGE HAJEK: Excuse me, Judge Wardwell.

8 Dr. LaGarry, do you agree with what Mr.
9 Lewis just said, these tests are very difficult and
10 very expensive?

11 DR. LAGARRY: I'm a stratigrapher, not a
12 hydrogeologist, but I am sure one of my fine
13 colleagues could answer that.

14 MR. WIREMAN: He is correct. It is more
15 difficult to do hydraulic testing of low permeability
16 materials. That is true but there are methods out
17 there. There are standard methods that have been
18 developed by EPA and USGS and others that can be used
19 to do that. It takes longer but it is the same
20 principle. You are still looking at the rate of which
21 water either moves out into rock or comes out of rock
22 over time. And that is related, the slope of that is
23 related to the hydraulic conductivity.

24 JUDGE WARDWELL: So what types of tests
25 would these be? Could you give some examples in how

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1 would you be able to measure those changes in a very
2 low hydraulic conductivity material?

3 MR. WIREMAN: I'm sorry, I didn't
4 understand.

5 JUDGE WARDWELL: Sorry, I think I had my
6 fist in my mouth. My mother always said don't speak
7 with your fist in your mouth.

8 Could you give some examples of specific
9 tests that could be run on low hydraulic conductivity
10 materials that would require the equilibration of
11 water because of the length of time it would take to
12 yield any types of results?

13 MR. WIREMAN: Well, I would have to dig
14 around to find specific methods but you can do slug
15 testing. You can use air and inject air out into a
16 formation and then there is similar behavior with air
17 that gets rid a little bit of the long time for water
18 to either come into the hole or leave the hole. Slug
19 tests, which are kind of quick and dirty but they give
20 you a little information if you can measure it.

21 So, the real problem is the length of time
22 and that is the cost because you have got personnel
23 out there having to wait and you are paying them by
24 the hour but the methods are kind of the same.

25 JUDGE WARDWELL: But for instance, in your

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1 slug test example, I can envision the change in the
2 water level that might occur with that. But then
3 wouldn't it take quite a long time for that to get to
4 equilibrium, to the point that you may lose more from
5 evaporation than you would from the movement into the
6 formation, possibly?

7 MR. WIREMAN: I don't know about the
8 evaporation but certainly it would take time. But you
9 know you can now put transducers there and get every
10 30 seconds a water pressure reading with a transducer
11 and convert that to water level. And you don't need
12 -- you can get some information on the sort of early
13 portion of those curves, the early time of either
14 injecting or pumping and you can do some analysis of
15 that early portion. It is not as good, as long -- you
16 know we like conventional 72-hour pumping time to kind
17 of become convention over time. But the real concern
18 is the longer you do it the better. And so, it takes
19 time.

20 So, there is no real shortcut but with
21 transducers, which you don't need people out there to
22 measure the water level, it can do it for you, and so
23 you can sit in there and wait.

24 So, again, he is basically correct. It
25 does take longer. It is a little more expensive. But

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1 the data it gets is the same data and you can use that
2 data to derive estimates of these hydraulic
3 properties.

4 JUDGE WARDWELL: Okay, thank you.

5 DR. KREAMER: If I could just follow up.
6 Dr. Dave Kreamer.

7 JUDGE WARDWELL: No. No, I think I have
8 got enough information.

9 DR. KREAMER: Okay.

10 JUDGE WARDWELL: I don't think I need
11 more. If you need more, fine.

12 CBR, is there any reason why you didn't do
13 some of these other tests that Mr. Wireman was talking
14 about?

15 MR. BEINS: We felt that the pump testing
16 that we did was sufficient to demonstrate the
17 confinement, as well as looking at the different water
18 quality that is present and looking at the different
19 water levels that are present between the Brule and
20 the Chadron aquifer. Yes, those particular examples
21 in with the 20 years of operational experience, as we
22 have monitored the overlying aquifer and the
23 underlying aquifer -- or the production aquifer, we
24 feel that it demonstrates the confining properties are
25 present there.

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1 JUDGE WARDWELL: Staff, if I might turn to
2 you. In your review of this license application, what
3 comments did you have and how did you reach the
4 conclusions that you did in the EA that this zone was
5 adequately characterized when you reviewed this
6 particular section of the application?

7 MR. BACK: Yes, in agreement with what was
8 just said, the aquifer test within the unit would
9 provide the best data. For example, slug tests would
10 give you horizontal hydraulic conductivities, rather
11 than vertical hydraulic conductivities. If you were
12 to inject air, now you are dealing with air
13 permeabilities, which you would have to have relative
14 permeability curves to back out what the permeability
15 to water is.

16 So, I mean, there really, in terms of a
17 straightforward test, with putting, monitoring points
18 above the pump zone, it is, in my experience, the best
19 way to do this.

20 JUDGE WARDWELL: What about the suggestion
21 that Mr. Wireman made in regards to setting individual
22 instrument at a given point in the aquifer that
23 measures the pressure right there, that measures it at
24 points in time?

25 MR. BACK: Your Honor, that is what was

1 done in the basal Chadron is I believe they did use
2 transducers. But what was most important out of all
3 of this were the wells that were put above the basal
4 Chadron because that is actually measuring the
5 confinement. The aquifer properties coming out of the
6 basal Chadron, out of the pump test, are far less
7 important than what does the confining aspects of the
8 units look like.

9 JUDGE WARDWELL: I think that is what we
10 are talking about now. I'm not -- I didn't mean to
11 imply that was a basal Chadron. I was interested in
12 how did you resolve that the upper confining unit was
13 adequately characterized to demonstrate that it is
14 providing that retention capability, that confinement
15 that you attribute to it, in regards to conclusions
16 you have reached in your assessments.

17 MR. BACK: Your Honor, you we looked at
18 how the tests were designed. They put the monitoring
19 point immediately above the pumping well, which would
20 be the most likely place for effects to be felt
21 through the confining unit. We looked at the actual
22 pressure curves. There were no signs of leakage
23 during the actual aquifer test. Now, they did do some
24 consolidation tests that it looked like there might be
25 some leakage. So, that looked good. And then no

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1 boundary conditions were hit, meaning recharged
2 boundaries or no flow boundaries. So, that is how
3 these tests are done and interpreted.

4 JUDGE WARDWELL: What was this
5 consolidation test you were talking about?

6 MR. BACK: Well, in the license
7 application, they mentioned a consolidation test for
8 looking at permeability of the confining unit. And I
9 mean we would need more information than a single
10 test, as was alluded here. It is not a very good way
11 to get that data.

12 And so in that test, though, as part of
13 the test, they said well, it looks like there might be
14 some leakage in this laboratory test that might
15 indicate leakage but then it wasn't seen at a field
16 scale. And the field scale is what is most important
17 to us.

18 JUDGE WARDWELL: Thank you.

19 Mr. Kreamer, I will ask you. Do you have
20 any suggestions for field tests that might be more
21 appropriate that would assist Mr. Back?

22 DR. KREAMER: I'll lean forward so you can
23 -- it almost went down my throat.

24 I have slight disagreements with what Mr.
25 Back said. Slug tests don't only measure horizontal

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1 permeability. If you vary the screen size to a small
2 screen size, you can get more vertical. And so there
3 are ways that you can adjust a slug test over time to
4 get vertical permeability and horizontal permeability.

5 JUDGE WARDWELL: You don't mean that you
6 would install a flexible screen size that could be
7 varied, a variable screen size. You mean you would
8 have to predesign to put a set small screen size --

9 DR. KREAMER: Yes, if you put smaller
10 screen size. A large screen size will have more
11 horizontal flow into it. A small, it will be more
12 vertical. There will be more of a vertical component
13 with that adjustment.

14 I think what was said about the pumping
15 tests that were done is a valid statement, although I
16 disagree with his conclusion on the pumping tests. In
17 viewing the pumping tests --

18 JUDGE WARDWELL: Can I ask you to reserve
19 that?

20 DR. KREAMER: I shall.

21 JUDGE WARDWELL: I almost did with him,
22 too.

23 DR. KREAMER: I shall reserve it.

24 JUDGE WARDWELL: I want to now not spend
25 any more time on the pumping test because we are going

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1 to cover that in detail.

2 DR. KREAMER: I shall reserve that. But
3 the only modification I would make is the tests we
4 have been talking about can be modified by screen size
5 and other factors to make them give us more data.

6 The disadvantage of a slug test is it is
7 a small area. It is small in the region. It is not
8 a regional thing. It just tests what is around that
9 particular piezometer or well. And you have to do
10 more of them to get a regional sense.

11 JUDGE WARDWELL: And I believe I heard Mr.
12 Wireman say that, in fact I think I almost asked him
13 and Dr. LaGarry, too, I think, but anyhow, I seem to
14 hear that the pump tests are the way to go to get the
15 larger area stressed enough to define larger areas of
16 this behavior. Would you agree with that also, Mr.
17 Kreamer?

18 DR. KREAMER: I would agree with that.
19 They mention a compaction test where you get a
20 disturbed sample and then you try and recompact it to
21 the original properties and then you test that for
22 permeability. But, obviously, that has some
23 shortcomings because your recompaction has got to be
24 along the lines of reality. And we have not seen the
25 methodologies for that.

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1 JUDGE WARDWELL: Thank you.

2 Now looking at the upper most aquifer, the
3 alluvium, the Ogallala, the Arikaree, and the upper
4 Brule. NRC's testimony exhibit 001, page 41 answer
5 D-13 and also page 45, answers to F-4; Crow Butte in
6 your license application, the Exhibit 011 at 2-99
7 staff and Crow Butte testified that the Ogallala group
8 is not present on the CBR site and are only found
9 several miles south.

10 Dr. LaGarry, do you agree with that or do
11 you have any information to say that the Ogallala is
12 in fact beneath or in that strata that is in the
13 license application?

14 DR. LAGARRY: Within the license area, I
15 don't know. I have never been able to get access to
16 map. Although, the NRC statement that it is present
17 to the south is correct.

18 JUDGE WARDWELL: Okay, thank you. And the
19 NRC at page 55, F-4, Crow Butte license application
20 2-121 and 125 show that the Arikaree group is present
21 only in the far southeastern corner of the site. And
22 would you agree with that statement also or have any
23 reason not to believe it in regards to the license
24 area?

25 DR. LAGARRY: I don't have any reason to

1 not believe that.

2 JUDGE WARDWELL: Thank you.

3 NRC testimony page 41 D-13, you state that
4 the Arikaree and Ogallala aquifers are not present in
5 or near the license area and only found several miles
6 south along the Pine Ridge Escarpment for the Arikaree
7 and south of the Pine Ridge Escarpment for the
8 Ogallala.

9 I guess my question to you is is the
10 Arikaree along the southeast corner or is it several
11 miles to the south?

12 MR. BACK: Your Honor, I believe that was
13 an oversight. I believe it is in the southeast corner
14 of the site.

15 JUDGE WARDWELL: So, it does touch the
16 southeast corner.

17 MR. BACK: Yes, Your Honor.

18 JUDGE WARDWELL: Thank you. I needed that
19 clarification.

20 JUDGE HAJEK: Let me follow-up on that a
21 moment, please.

22 It touches the southeast corner of the
23 site but it is not within a mining area. Is that what
24 you are saying?

25 MR. LANCASTER: Your Honor, our

1 understanding is that it is --

2 JUDGE HAJEK: Identify yourself, please.

3 MR. LANCASTER: Tom Lancaster, NRC. Our
4 understanding is it is within the license boundary.

5 JUDGE HAJEK: I can't hear you. I'm
6 sorry.

7 JUDGE WARDWELL: I found these don't bite.
8 Really, I have hit my lip a couple of times and they
9 didn't bite back. I hit it.

10 MR. LANCASTER: Our understanding is it is
11 within the license boundary. We have got some
12 Arikaree -- I'm sorry. You can't hear me?

13 Okay, can you hear me now? Okay.

14 So, our understanding is in the southern
15 portion of the licensed area, the southeastern
16 portion, specifically, we have got Arikaree present.
17 It is outcropping and forms part of a hill, part of
18 the escarpment that is present there, the Pine Ridge
19 escarpment. This, from what I have seen and during
20 inspections out there, annual inspections of the
21 facility, we have got some perimeter monitoring wells
22 that go through a couple tens of feet of the Arikaree
23 but the actual injection and production wells in my
24 unit 11 down there do not -- are not in the area of
25 this outcrop of Arikaree.

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1 JUDGE HAJEK: So, I think what I need to
2 repeat it in a slightly different way. The injection
3 and production wells for mine unit 11, which is the
4 southernmost mine unit --

5 MR. LANCASTER: Correct.

6 JUDGE HAJEK: -- are north of the Arikaree
7 outcroppings that you have noticed in your actual
8 inspections of the site.

9 MR. LANCASTER: Correct.

10 JUDGE HAJEK: Is that correct?

11 MR. LANCASTER: Correct.

12 JUDGE HAJEK: Thank you.

13 MR. LANCASTER: Your Honor, just so it is
14 clear, the perimeter monitoring wells that aren't
15 production injection wells do go through 10 or 20 feet
16 of the Arikaree down in the southeast portion of mine
17 unit 11, just so that is very clear.

18 JUDGE HAJEK: Okay, but the monitoring
19 wells are never -- these are 300 feet away from an
20 injection well. Correct?

21 MR. LANCASTER: Correct, in accordance
22 with our license conditions here. Correct.

23 JUDGE HAJEK: Okay, thank you.

24 JUDGE WARDWELL: And the Arikaree overlies
25 the Brule and upper Chadron. Is that correct?

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1 MR. LANCASTER: That's correct.

2 JUDGE WARDWELL: But still, its presence
3 there, if in fact the faults and fractures are found
4 to be significant enough to cause some movement
5 vertically upward, could it not get in the Arikaree
6 and then flow northeast towards the Pine Ridge
7 Reservation?

8 MR. LANCASTER: Well, you have got the
9 Brule aquifer. That is the overlying aquifer.

10 JUDGE WARDWELL: Under the assumption,
11 just the assumption that that is fracture enough to
12 provide some transmissivity, could not this ultimately
13 be a pathway towards the Pine Ridge Reservation or
14 still it could not be, even if that Brule -- even if
15 the upper Chadron and the Brule did not provide the
16 confining that is indicated?

17 MR. LANCASTER: Well, I would think that
18 if you had a communication, you would first see it in
19 the Brule and you would see it in their excursion
20 monitoring well data.

21 JUDGE WARDWELL: Do you have monitoring
22 wells in the Brule and the upper Chadron?

23 MR. LANCASTER: That is correct. We have
24 wells in the -- or they -- Crow Butte has excursion
25 monitoring wells in the Brule and those. And those

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1 excursion monitoring wells are required by license
2 conditions as --

3 JUDGE WARDWELL: And so those monitoring
4 wells where you encountered the Arikaree do have wells
5 in the Brule and the upper -- let's just call it the
6 upper confining unit, period, between the basal
7 Chadron and the Arikaree.

8 MR. LANCASTER: Could you repeat that
9 again?

10 JUDGE WARDWELL: You are smart to ask
11 because I was confused to in what I asked.

12 MR. LANCASTER: Okay.

13 JUDGE WARDWELL: So, is it your testimony
14 that the monitoring well that encountered and
15 penetrated through the Arikaree, which I thought I
16 heard you say, that you have --

17 MR. LANCASTER: Correct.

18 JUDGE WARDWELL: Did you set a well and do
19 you have a monitoring well in the upper confining unit
20 at that location where the Arikaree overlies it?

21 MR. LANCASTER: Well, I didn't.

22 JUDGE WARDWELL: Again, in your review --

23 MR. LANCASTER: Right, right.

24 JUDGE WARDWELL: -- did you ascertain
25 whether or not Crow Butte had one there?

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1 MR. LANCASTER: Well, the monitoring wells
2 I was referring to, the perimeter monitoring wells,
3 they are screened into the basal Chadron. The
4 overlying aquifer within the Brule has monitoring
5 wells and, as per our license condition, one every
6 five acres. But they actually are much less than that
7 in their spacing.

8 But regardless, they have got, if we were
9 to see an excursion from the basal Chadron through
10 this confining unit that has been talked about here,
11 we would see it in the Brule monitoring -- we would
12 expect to see it in the Brule excursion monitoring
13 wells and that is what I am trying to say here, before
14 we see it in the overlying Arikaree.

15 DR. STRIZ: Your Honor, may I add
16 something?

17 JUDGE WARDWELL: Not just yet. If you
18 want to answer this question, that's fine but I want
19 to go with my train of thought.

20 DR. STRIZ: I can answer this question.
21 There are no monitoring wells in the upper confining
22 layer. They are in the Brule.

23 JUDGE WARDWELL: And is there a difference
24 -- I gather there is a difference between the
25 perimeter monitoring wells and excursion monitoring

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1 wells.

2 DR. STRIZ: No, they are all excursion
3 monitoring wells. There is two types. There is the
4 perimeter ring excursion monitoring wells, which are
5 located in the basal Chadron to detect excursions from
6 the production zone. Then there are excursion
7 monitoring wells in the overlying aquifer, which we
8 identify as the Brule and in the south, the Arikaree.
9 And they are all considered excursion monitoring
10 wells.

11 JUDGE WARDWELL: And you said there is one
12 in the Arikaree in that corner or what did you say
13 about the Arikaree?

14 DR. STRIZ: According to Tom's -- Mr.
15 Lancaster's testimony, yes, through ten to a couple
16 tens of feet in the south, it passes through. But I
17 am not sure that it is in the saturated portion of the
18 Arikaree.

19 JUDGE WARDWELL: So, it's not saturated
20 but it is --

21 DR. STRIZ: I am not sure that the
22 Arikaree is saturated there so it may not be sampling
23 the Arikaree but it is sampling the saturated portion
24 of the Brule in the southern location of the licensed
25 area.

1 JUDGE WARDWELL: Where the Arikaree is
2 located.

3 MR. LANCASTER: Yes, actually, these are
4 perimeter monitoring wells that go through the
5 Arikaree and they go down to the basal Chadron. They
6 are screened into the basal Chadron and that is what
7 goes through the Arikaree.

8 JUDGE WARDWELL: I understood you to say
9 that there was also one in the Brule where the
10 Arikaree overlies it. Do you know for sure?

11 DR. STRIZ: I apparently misspoke.

12 JUDGE WARDWELL: Okay, thank you.

13 DR. STRIZ: So, what he is stating --

14 JUDGE WARDWELL: So you will go with what
15 the --

16 DR. STRIZ: Yes, that they go through the
17 Arikaree perimeter walls.

18 MR. LANCASTER: I'm sorry.

19 JUDGE WARDWELL: No, I was just trying to
20 get your name. It is all squished in there. I don't
21 know names. Lancaster, there you go.

22 MR. LANCASTER: Sorry.

23 JUDGE WARDWELL: No problem. There you
24 go. You are an entity.

25 MR. LANCASTER: We've got so many people

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1 up here.

2 JUDGE WARDWELL: A real live person now,
3 at least us.

4 MR. LANCASTER: Yes. Yes, so this is a --
5 what I was trying to say is that the Brule in the area
6 of mine unit 11 has excursion monitoring wells, one at
7 least every five acres. Now, they are less facing
8 than that. But as far as the Arikaree down there that
9 is outcropping on a hill right at the edge of the
10 southeast licensed area, there is, from my
11 understanding, the outer-most perimeter monitoring
12 well ring, some of those wells, one or two, I can't
13 remember off the top, but from what I recall, they go
14 through 10 to 20 feet of Arikaree, probably --
15 possibly.

16 JUDGE WARDWELL: Thank you.

17 JUDGE HAJEK: I'm sorry. I would like to
18 close this out. A monitoring well is sunk down into
19 the Brule. And does it have withdrawal points along
20 the depth that where you can sample?

21 Dr. Striz, I think also said there was not
22 a well or not a monitoring well into the confinement
23 area. And so I am confused by, since I am not
24 familiar with these wells, can you describe how they
25 are designed and how the extraction points for

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1 monitoring purposes are handled for us?

2 MR. LANCASTER: These excursion wells, as
3 Dr. Striz was detailing a little bit, we have got
4 excursion monitoring wells in the Brule aquifer and
5 the basal Chadron aquifer, not in the confining units.
6 That is the overlying aquifer for vertical excursions
7 and, within the Brule, the wells go down and they are
8 screened within the water-bearing zone of the
9 overlying aquifer within it. And so then you have got
10 the basal Chadron, the perimeter monitoring wells that
11 are 300 feet away, like you were saying, that are
12 screened within the basal Chadron and those are the
13 two excursion wells that you have in these mine units,
14 two types. Per their application, they do have to be
15 constructed a certain way or they have committed to
16 constructing these wells in a certain way.

17 And so but the real point here is I was
18 trying to provide information about the Arikaree and
19 there are staff acknowledges the presence of some
20 perimeter monitoring wells that go down to the tap,
21 the basal Chadron water-bearing unit and we believe
22 they go through a couple tens of feet of the Arikaree
23 that sort of crosses the license boundary down there
24 at mine unit 11.

25 JUDGE HAJEK: Okay, I apologize for having

1 difficulty in understanding.

2 MR. LANCASTER: That's okay.

3 JUDGE HAJEK: So, when you were monitoring
4 for an excursion in one of these monitoring wells, you
5 are sampling water that is specifically in the
6 ore-bearing zone or near the ore-bearing zone. You
7 are outside the ore-bearing zone, I understand that.

8 But at the depth of the ore-bearing
9 aquifer, are you taking samples or is there a design
10 in this monitoring well that enables you to take
11 samples at more shallow depths?

12 MR. LANCASTER: No, each well will sample
13 from a specific aquifer, a specific water-bearing
14 zone.

15 JUDGE HAJEK: And then when you say it
16 goes through the Arikaree or a few tens of feet or so
17 into the Arikaree, what you really mean is from the
18 surface drilling all the way down in this well hole,
19 it happens to go through, physically all the way
20 through the Arikaree and it is isolated from the
21 Arikaree. Is that it?

22 MR. LANCASTER: That is correct. It is
23 isolated -- it is cased.

24 JUDGE HAJEK: It's cased. Okay.

25 MR. LANCASTER: And these cases are tested

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1 with mechanical integrity testing in accordance with
2 our license.

3 JUDGE HAJEK: But you know it is
4 physically actually going through the Arikaree for
5 some other reason?

6 MR. LANCASTER: For some other reason --
7 I'm not sure I understand your question there.

8 JUDGE HAJEK: Well, you said it goes
9 through the Arikaree.

10 MR. LANCASTER: Yes, I was just
11 mentioning. I think it was brought up that do we have
12 production and injection wells in that area and we
13 just have -- all we see in these injections is not
14 that. We have maybe one or two monitoring wells
15 associated with perimeter monitoring well ring.

16 JUDGE HAJEK: That only go down into the
17 Arikaree only. Is that what you are saying?

18 MR. LANCASTER: They go through the
19 Arikaree.

20 JUDGE HAJEK: They go through.

21 MR. LANCASTER: And they monitor the basal
22 Chadron. That is the perimeter monitoring well
23 network, 300 feet away from the production injection
24 wells and 400-foot spacing, you know something along
25 those lines. Right?

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1 JUDGE HAJEK: Okay. And when you said
2 there is outcropping, the Arikaree outcropping, does
3 that mean that if I would go down to the site I would
4 see water in a stream coming from the Arikaree?

5 MR. LANCASTER: I mean that Arikaree can
6 be seen at -- not seen but it goes to the ground
7 surface. And I don't know if specifically you could
8 say there is a rock outcrop or a sediment outcrop but
9 it comes to the -- it is from -- it is at the ground
10 surface in that area.

11 MR. BEINS: Your Honor, could I offer some
12 clarifying information, perhaps?

13 JUDGE HAJEK: Sure. Is that okay with
14 you?

15 JUDGE WARDWELL: It's yours.

16 JUDGE HAJEK: Yes.

17 MR. BEINS: Yes, what Mr. Lancaster has
18 said is correct. The southeast corner of the permit
19 area does have outcroppings of the Arikaree formation.
20 Okay? The Arikaree formation makes up the cliffs and
21 the buttes that you see as you are driving back toward
22 Chadron tonight. Those particular buttes are a part
23 of the Arikaree formation. In this particular area,
24 the Brule aquifer is more than 200 feet below the base
25 of the Arikaree formation here.

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1 The Arikaree, at the mine site does not
2 have water coming out of the sides of the cliffs or
3 things like that in measurable amounts, necessarily.
4 The wells that Mr. Lancaster talked about are the
5 monitoring wells. They are cased through a small
6 portion of the Arikaree formation but they are wells
7 for the deeper Chadron aquifer, not for the Arikaree
8 aquifer.

9 JUDGE HAJEK: So, they go through the
10 formation.

11 MR. BEINS: The casing goes through the
12 formation but we are not sampling it.

13 JUDGE HAJEK: It goes through the
14 formation but it doesn't necessarily go through a body
15 of water.

16 MR. BEINS: The Arikaree formation there
17 is dry. There is no water --

18 JUDGE HAJEK: There is no water in it
19 there, okay.

20 MR. BEINS: -- to be had.

21 JUDGE HAJEK: Thank you.

22 MR. BEINS: Yes, it is at the surface.

23 JUDGE WARDWELL: Let's move on to the
24 White River structure. And starting off with Mr.
25 Wireman, in your testimony, exhibit INT-070 page 1,

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1 you state that in regards to the White River feature,
2 the work needs to generate empirical data based on
3 drilling or geophysical techniques.

4 Crow Butte, in their license renewal
5 application on page 2-135, state that the White River
6 feature is oriented northeast to southwest, generally
7 along the White River drainage and based on recent
8 closed-space drilling, the feature could be
9 interpreted as a fold because a Chadron confining
10 layer is continuous and not offset across it.
11 Specifically, review of -- quote, review of more than
12 130 geophysical logs, three-dimensional geologic
13 modeling indicates that the fault associated with a
14 structural feature does not truncate or offset members
15 of the White River group along a discrete fault
16 surface. Rather, members of the White River group are
17 broadly folded and are continuous across the
18 structural feature.

19 The NRC, in its EA Exhibit 010, sections
20 3.4.2, page 27 and 3.5.2.3.3, pages 38 to 39 state
21 that the staff evaluated the description of the White
22 River structural feature and agree with CBR's
23 conclusion that the White River structural feature
24 does not include an offset of the geologic contact
25 between the Pierre Shale and the basal Chadron

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1 Chamberlain Pass formation, nor members of the Chadron
2 and Brule formations -- nor members of the Chadron or
3 the Brule formations. As a result, the feature does
4 not affect hydraulic confinement of the basal Chadron
5 sandstone aquifer.

6 Finally, NRC EA at Exhibit 101 at 27 and
7 38 through 39, and on pages 37 through 38 answers to
8 D-9 and D-10 and page 44 answers to D-17, staff
9 reached this conclusion of a fold based on the
10 following seven items. So, I am going to repeat those
11 to you and then just get your reaction to whether or
12 not you agree or disagree with whether or not this
13 White River structural feature is more likely a fold
14 or a fault. And I will allow you or Dr. LaGarry or
15 whoever wants to you on your team respond to this line
16 of questioning.

17 MR. WIREMAN: Thank you.

18 JUDGE WARDWELL: This position of staff,
19 they have seven items I want to read to you.

20 MR. WIREMAN: First of all, I stand
21 corrected on the drill holes. That was a misstatement
22 on my part.

23 JUDGE WARDWELL: On what?

24 MR. WIREMAN: I said I stand corrected on
25 the statement I made about no drill holes. There are

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1 drill holes.

2 JUDGE WARDWELL: Okay.

3 MR. WIREMAN: I was just wrong and I
4 hadn't discovered that yet.

5 Secondly, and I will let Dr. LaGarry
6 address this as well. I have uncertainty as to
7 whether or not this is a fold or a fault and that is
8 mainly based on sort of not a real complete
9 description of what they found with the drilling. I
10 didn't see a real complete description using the data
11 from the drill holes to convince me that that was
12 clear.

13 Now, there may be data and information
14 from those drill holes that I am not aware of. So, I
15 will say that.

16 And then the final thing is a fold can be
17 permeable. I mean folds, just because it is a fold,
18 doesn't necessarily mean that there is no water
19 movement through it.

20 So, with that, I will let Dr. LaGarry
21 address the fold.

22 DR. LAGARRY: Okay, two things. The first
23 thing is that as I presented in my most recent
24 testimony that there is a widespread area of what are
25 called lineaments, representing faults and joints

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1 visible from outer space and low-flying aircraft. And
2 these are generally oriented in a northwest,
3 southeast, and southwest-northeast overlapping
4 pattern.

5 The White River follows on the stretch
6 that heads north towards the Pine Ridge Reservation
7 follows the southwest-northeast trend of this fracture
8 pattern.

9 Additionally, if you look at the river
10 drainages of this region from space, all of the
11 rivers, almost all the rivers, there may be
12 exceptions, almost all of the rivers and streams and
13 creeks follow this lineament fault pattern.

14 So, if you look at the White River from
15 space, it has its headwaters and the upper-most
16 stretch of the White River follows the
17 northwest-southeast lineament trend; and then
18 southwest of Crawford, it does an almost right-angle
19 turn and then joins the second southwest-northeast
20 lineament trend.

21 Would a monoclinal fault like the NRC and
22 Crow Butte maintains we would not see that. The White
23 River would not preferentially follow a fold.
24 However, it will prevent, preferentially follow and
25 preferentially erode a preexisting crack in the rock.

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1 JUDGE WARDWELL: What is the difference
2 between a lineament, a fault, a fracture, and a joint?

3 DR. LAGARRY: Okay, a lineament is any
4 unexplained straight-line feature. If you were to
5 look at aerial photography or satellite data and just
6 assume that everything on there was something in
7 nature, you might mistakenly include fence lines and
8 roads. But given modern satellite imaging tools like
9 Google Earth or things like that, you can zoom right
10 into ground level and check those out.

11 A fault is a crack in the rock of --

12 JUDGE WARDWELL: So, can I interrupt to
13 ask questions on that?

14 DR. LAGARRY: Please.

15 JUDGE WARDWELL: So, a lineament is an
16 apparent linear feature, a straight feature --

17 DR. LAGARRY: Correct.

18 JUDGE WARDWELL: -- observable on the
19 earth's surface visually.

20 DR. LAGARRY: Correct.

21 JUDGE WARDWELL: Okay.

22 DR. LAGARRY: Correct. And then a fault
23 is one of these straight-line features in which the
24 rock has either moved vertically or horizontally. A
25 joint is a crack in the rock in which no movement has

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1 taken place, however, there is a crack there.

2 And what is typically done is that it is
3 prohibitively time-consuming and expensive to crawl
4 around in the landscape to find these things, although
5 it was done in Western Nebraska. It is much easier to
6 see them first from space and then go examine them
7 once you have found them. And a graduate student at
8 Chadron State College did a statistical study of
9 joints and faults viewed from space shuttle radar.

10 JUDGE WARDWELL: And who was this
11 individual?

12 DR. LAGARRY: Jennifer Balmat in a
13 master's thesis from Chadron State College. It is
14 cited in my last opinion, in which she field examined
15 -- she saw these in the satellite imagery and then for
16 her thesis, went out and field checked them.

17 And after eliminating roads and fence
18 lines, she found that the remaining lineaments
19 observable from space are, in fact, false.

20 JUDGE WARDWELL: And where was this? Was
21 this in the license area?

22 DR. LAGARRY: This was east of the license
23 area. However, other studies, notably Diffendal study
24 from the 1990s encompassed the license area.

25 JUDGE WARDWELL: And how far away was it?

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1 Was it Balmat did you say?

2 DR. LAGARRY: Balmat's thesis is from the
3 Chadron vicinity. Her thesis was from the Chadron
4 area, 20 miles east.

5 JUDGE WARDWELL: So 20 miles east here.
6 All right.

7 DR. LAGARRY: However, Diffendal's 1994,
8 I think, I would have to double-check, publication
9 covered the entire area of northwest Nebraska. The
10 area he studied had the license area in about the
11 exact center of his study area.

12 And Balmat's thesis, the point of it was
13 to reexamine Diffendal's data and confirm how much of
14 that was fault and joints.

15 JUDGE WARDWELL: Are all lineaments -- and
16 is a fracture the same thing as a joint?

17 DR. LAGARRY: Yes.

18 JUDGE WARDWELL: Okay. And are all
19 lineaments indicative of fractures or faults?

20 DR. LAGARRY: Some are a feature called
21 inverse topography, which Diffendal was able to
22 clarify and point out in his publication. Discounting
23 roads and fence lines, it seems that based on the data
24 that we have available, yes, in fact, the vast
25 majority of the lineaments are false.

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1 JUDGE WARDWELL: And with that, would you
2 agree that a claim that a lineament or a topographic
3 feature in a satellite imagery represents a subsurface
4 geological fault, fracture, or joint is speculative
5 until ground truthing is performed with some hard
6 field data?

7 DR. LAGARRY: I wouldn't use speculative.
8 It is more solid than that. I mean once you have
9 determined that within a given set of fractures, for
10 example, the northwest-southeast trending,
11 southwest-northeast trending overlapping set of
12 fractures, that takes it less from speculative and
13 moves it into a more certain than speculative.

14 You wouldn't necessarily want to assume
15 and if it really, really mattered, you would
16 definitely want to go check it.

17 JUDGE WARDWELL: Do you agree that some
18 type of subsurface exploration would be almost needed
19 to determine whether a fault or fracture is related to
20 a lineament, especially in regards to its potential
21 impact on any confinement?

22 DR. LAGARRY: I would look first for
23 surface expression of the fault or something like
24 lineament, where you can observe it at the surface.
25 But if such a thing wasn't present, the oil industry

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1 uses seismic techniques to do that.

2 JUDGE WARDWELL: And it is true that none
3 of these lineament studies or even necessarily the
4 field work of your graduate student 20 miles away from
5 here would give you any indication of the hydraulic
6 transmissivity of any given fault or fracture or
7 whatever the third one is?

8 DR. LAGARRY: That would require access to
9 the license area to do that.

10 JUDGE WARDWELL: Or any other area, for
11 that matter.

12 DR. LAGARRY: Or any other area.

13 JUDGE WARDWELL: You would have to do some
14 type of testing to define its transmissivity
15 characteristics.

16 DR. LAGARRY: You would have to map them
17 ---

18 JUDGE WARDWELL: The mere presence of a
19 fault or a joint isn't by definition preferential
20 pathway, necessarily.

21 DR. LAGARRY: It is a preferential pathway
22 but how much -- if there was water present and how
23 fast it moved, that would only confirmable by direct
24 observation.

25 JUDGE WARDWELL: Yes, well wouldn't faults

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1 also tend to have some materials, oftentimes, in that
2 interface between the two zones where the movement
3 occurred that tend to plug those types of things?

4 DR. LAGARRY: It depends on the grain size
5 of the fault. In the Chadron formation, what we have
6 been calling the upper confining unit, there are, in
7 fact, slickensides along the faults. You can observe
8 those at the land surface. They haven't healed. You
9 can see the slickensides.

10 However, in the overlying Brule in
11 Arikaree, there isn't enough clay to make
12 slickensides.

13 JUDGE WARDWELL: In our particular
14 endeavors here, isn't it the ultimate transmissivity
15 of the fractures that is really of importance here and
16 not just the mere presence of them?

17 DR. LAGARRY: It is. And these fractures
18 are the basis of the secondary porosity and make the
19 Brule an aquifer. So, if the Brule is acknowledged as
20 an aquifer, so are the presence of the secondary
21 porosity and the faults and joints.

22 JUDGE WARDWELL: Do you know if Diffendal
23 did any ground truthing of his work or was it all from
24 the photo -- ground topography?

25 DR. LAGARRY: He did the ground truthing

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1 of the inverse topography because that was his area of
2 expertise.

3 JUDGE WARDWELL: I'm sorry. Say that
4 again.

5 DR. LAGARRY: He ground truthed inverse
6 topography. Inverse topography is where you have a
7 less-easily erodible unit forming a ridge surrounded
8 by more easily erodible units. So, it is like a
9 series of isolated Buttes that make a line. He field
10 checked those but he did not field check the
11 lineaments.

12 JUDGE WARDWELL: Okay.

13 DR. LAGARRY: Balmat field checked
14 lineaments and Harmon Maher field checked lineaments.

15 JUDGE WARDWELL: Who was that last name?

16 DR. LAGARRY: Maher, M-A-H-E-R. I cite
17 him as well in my opinion.

18 JUDGE WARDWELL: Do you know if your
19 reference, I think you have referenced Figure 1 of
20 Diffendal in 1994 in one of probably in your lineament
21 study of 2015.

22 DR. LAGARRY: That is correct.

23 JUDGE WARDWELL: And do you know if that
24 is in fact, your INT Exhibit 055?

25 DR. LAGARRY: I would have to look and see

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1 about the number. It is one of the ones that I
2 provided.

3 JUDGE WARDWELL: Could you do that
4 beforehand, just to verify that that is what you
5 referring to with that exhibit, so we know we have got
6 that.

7 DR. LAGARRY: Super.

8 JUDGE WARDWELL: And the same thing with
9 Balmat of 2001, page 53. Is that INT-056? So, 55 and
10 56, if those are Diffendal and the Balmat ones that
11 you are referring to, that is what we would like to
12 know after the break.

13 DR. LAGARRY: Okay.

14 JUDGE WARDWELL: Great, thanks.

15 Back to this discussion of a fold versus
16 a fault. I would like to read off what NRC used to
17 reach a conclusion and get your reaction to that, if
18 I might, Dr. LaGarry, or you could pass it on to
19 anyone else, if you want to.

20 And so back to the discussion, it was
21 referencing the EA of the NRC, which, again, is the
22 document of concern here for most of the contentions.
23 Their conclusions in regards to whether the assessment
24 of the environment has been adequate is what we need
25 to decide.

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1 And in that EA on page 27 and 38 through
2 39, these items were listed, as were their testimony
3 on pages 37 to 38, answer D-9 and D-10, and on page
4 44, answer D-17. And there they say that their
5 conclusions in regards to a fold versus a fault relies
6 on one, first CBR's 3-D geological modeling, which we
7 will talk about separately and we will get into a
8 discussion of that. The second point was that the
9 vertical gradient and potentiometric groundwater
10 surfaces of the basal Chadron sandstone and the Brule
11 aquifer over the area of the structural feature, gives
12 them encouragement that it is a fold.

13 And third, an aquifer pumping test in the
14 area of the White River structural feature that
15 demonstrates the integrity of the overlying confining
16 unit, and there they are citing their exhibit New York
17 State 028 G-9 to G-11.

18 They then talk about distinct geochemical
19 variations among the aquifers citing the Exhibit 028
20 again at G-9. And then the staff's groundwater
21 modeling in their EA, indicative of a presence of a
22 fault that penetrates the Pierre Shale through the
23 Chadron or Brule formations is not probable. And if
24 one exists, it does not convey water from the basal
25 Chadron standstone aquifer to the Brule aquifer.

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1 And six, lack of hydrologic evidence that
2 the White River structural feature, whether
3 interpreted as a fault or a fold, influences the
4 groundwater flow in the basal Chadron aquifer.

5 And then lastly, that it is based on 130
6 geophysical logs lacking any discontinuity.

7 Now, that is a lot of information and if
8 you haven't read their testimony or studied it much
9 and you can't really comment on it, that is fine. I
10 just wondered if you would like to comment on any of
11 those particular topic areas.

12 DR. LAGARRY: All but the first one are
13 outside my expertise. So, I will defer to my
14 colleagues.

15 But I have mapped 81 to 24,000 quadrangles
16 when I was with the Nebraska Geological Survey,
17 including the ones that surround our Crawford and Crow
18 Butte resources and we found faults and fractures and
19 joints too numerous to map. So, ultimately, we
20 decided in our mapping that we would map those that
21 had five-foot displacement or greater.

22 The takeaway message from that is that
23 these rocks here are soft and extremely brittle,
24 extremely brittle. And so this idea that these rocks
25 are somehow smooth and folded and plastic and ductile

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1 enough to drape over a fold, when we have drilling
2 data 12,500 boreholes in the Nebraska Geological
3 Survey cited in Swinehart and others that showed
4 numerous faults going through the base of the Pine
5 Ridge, going from top to bottom and deep into the
6 Pierre Shale.

7 So, the expectation of geologists working
8 in this area that 1930s models of which they used clay
9 to model the behavior of the rocks, that the rocks
10 would bend plastically is considered outdated. That
11 the expectation now is that, and this isn't just me,
12 this is everyone that works in plains geology, that
13 the rocks break, they are brittle, the fractures go
14 into the surface into deeper rocks down below and
15 manifest on the surface as lineaments.

16 So, if in fact this is a fault or is a
17 fold, excuse me, if this White River structure is, in
18 fact, a fold, then it would be the only fold which we
19 would have observed in the region. That is not to say
20 that it isn't a fold. I don't have access to study
21 Crow Butte's proprietary subsurface data.

22 And with that, I will pass it on to my
23 hydrogeologist colleagues for the remainder.

24 MR. WIREMAN: I will address a couple of
25 your points. The difference in chemistry, for

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1 instance, in the water from the Brule aquifer and the
2 basal Chadron. Both of those, I agree that they are
3 distinct hydrostratigraphic units and that the upper
4 confining unit separates them and functions as an
5 aquitard. An aquitard does not mean that no water
6 moves up and down that. It just means less water
7 moves than if it was a more permeable unit.

8 I mean differences in chemistry does not
9 automatically mean there is no connection. It doesn't
10 mean that at all. Mixtures are -- almost all
11 groundwater -- the chemistry of almost all groundwater
12 represents a mixture of more than one source.

13 So, what you see in the Brule aquifer,
14 that chemistry, while distinct from the chemistry of
15 the basal Chadron could still be affected by flow up
16 from the Chadron that creates the chemistry of the
17 Brule and they don't necessarily have to be the same.

18 Secondly, Dr. LaGarry's point about the
19 faults is very well taken. The White River making
20 that turn, rivers, we know this all over the west,
21 follow major faults. There are many rivers in the
22 west that are like that.

23 Faults, in my experience, there has been
24 a paradigm in the geological world that is beginning
25 to change that faults are barriers to groundwater

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1 flow. You kind of grow up learning that and hearing
2 that. But experience is telling us differently and it
3 is related in one way -- there are a lot of factors
4 but one is the age. If you plotted the age of a fault
5 versus how open it is or isn't, you would find that
6 most of the younger faults are more open and more
7 transmissive than most of the older faults and that
8 makes some sense. There has been more time for it to
9 fill in. So, age of the fault is important.

10 And then finally, I will say this about
11 folds. If this is a fold, and I don't know if it is
12 or isn't, but folds don't mean no pathways. You know,
13 I know areas in Wyoming where anticlines, which are
14 folds, are highly transmissive and are areas of very
15 focused recharge, down to depths to 11,000 and 12,000
16 feet from the surface into an aquifer.

17 So, the deduction approach to making some
18 of these conclusions, I think needs to benefit from
19 some newer concepts and newer paradigms that are
20 developing over time, as we learn more about this.

21 So, I will say that, I guess.

22 DR. KREAMER: Dr. David Kreamer. I have
23 something that is really short and it relates to the
24 folds.

25 There are numerous photos from around the

1 world that show folds with intermediate layers and
2 some are consolidated, some are semi-consolidated but
3 you can actually see faulting in the fold. In other
4 words, if there are brittle places and brittle layers
5 in a fold, as you bend it with geologic forces, you
6 are going to get a fold but you are also going to get
7 a series of shorter faults within the fold. And so a
8 fold is not exclusive of having faults in it. That is
9 what I wanted to say.

10 JUDGE WARDWELL: Thank you.

11 DR. LAGARRY: Counsel handed me a little
12 note here that says INT-055 is, in fact Diffendal and
13 INT-056 is in fact Balmat.

14 JUDGE WARDWELL: Thank you, Dr. LaGarry.

15 One more question before we take a break
16 because then we will finish up this section.

17 INT Exhibit 011 is a 2007 letter from NDEQ
18 that that is the Nebraska Department of Environmental
19 Quality, I assume is what the initials stand for, to
20 Crow Butte providing technical comments on Crow
21 Butte's aquifer exemption petition for the NTEA, the
22 North Transit Expansion Area, aquifer exemption
23 request. It raises questions regarding CBR's
24 interpretation of the White River structural feature.

25 And I guess my question to whoever would

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1 like to field it, and I will start off with Dr.
2 LaGarry again, on April 7, 2011, did not DEQ approve
3 the aquifer exemption petition for the North Transit
4 Expansion Area, do you know?

5 MR. WIREMAN: They did.

6 JUDGE WARDWELL: Okay. So, I will stay
7 with Mr. Wireman, then.

8 With respect to the potential for the
9 White River structural feature to act as a conduit
10 between the aquifers, did not the DEQ conclude, as did
11 the NRC staff, that the basal Chadron formation at the
12 NTEA was hydraulically isolated from the other
13 aquifers, based on several lines of evidence,
14 including, again, CBR's three-dimensional geologic
15 modeling, drilling data from the NTEA site, and listed
16 assistance from independent experts and the flowing
17 artesian conditions observed in the North Transit
18 Expansion Area and the results of the 2006 pumping
19 test performed there.

20 Why are not those -- do you agree that
21 that is what NEQ used to reach their conclusion that
22 they agreed with CBR's interpretation of this feature?

23 DR. KREAMER: Dr. Dave Kreamer. Yes, that
24 is what they used but they did ignore certain other
25 information.

1 The aquifer tests that were run, there
2 were five previous to a sixth test. The sixth test,
3 pumping test, is the one they based their study on,
4 it's in the Northern Trend --

5 JUDGE WARDWELL: Okay, so it is important
6 that you said that sixth test here, yes, that is good
7 for why it is a challenge to what the NDEQ has. Let's
8 reserve all of that because I want to go through all
9 of those tests one by one --

10 MR. WIREMAN: Absolutely, fine.

11 JUDGE WARDWELL: -- and have plenty of
12 time to do it then with the other ones. So, it is
13 important that you did mention that test but we don't
14 have to go into the details of it.

15 MR. WIREMAN: May I address? Am I -- you
16 mentioned the aquifer exemption request and the
17 approval of that request. And within that document is
18 what you are talking about in terms of -- okay.

19 Let me just say this and it will be very
20 short. I am very familiar with the aquifer exemption
21 process under the UIC program and how it works. The
22 criteria for evaluating a request for an exemption
23 really had not very much to do with hydrogeology. I
24 mean those requests in the law, in the Safe Drinking
25 Water Act, there are two or three criteria that are

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1 listed that must be met in order to get an approved
2 exemption. And those criteria are is it being used
3 for drinking water; will it ever be used for drinking
4 water down the road; and then the third criteria is
5 hydrogeology. Is there a confining unit above and
6 below? And those three criteria have to be met but
7 the focus of all of those is on the use of the water.

8 So, in the evaluation of a request for an
9 exemption there normally is not a lot of very hard
10 core hydrogeology that goes into that. So, it is all
11 the same.

12 JUDGE WARDWELL: Thank you. Staff, a
13 couple issues. Let's start with the last one and we
14 will work our way backwards and then we will take a
15 break.

16 What about the NDEQ criteria focusing
17 mostly on drinking water aspects and not so much about
18 these hydrogeologic concerns in regards to whether it
19 is a fold or a fault?

20 MR. BACK: Well, Your Honor, I went
21 through in DQ's decision and it looked like they took
22 it very seriously. They had public hearings on it.
23 They declined it initially. They pulled together a
24 group of experts to look to see whether it was a fault
25 or a fold. It just seems to me like it was more than

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1 just a cursory review of three criteria.

2 JUDGE WARDWELL: And in regards to the
3 fold possibly being a pathway, does not some of their
4 arguments make sense that the brittle material will
5 still crack, even though you are folding it? There
6 still could be quite a bit of fall through that.

7 MR. BACK: I'm sorry to interrupt. Your
8 Honor, when we also look at this, we look at a feature
9 that is two miles away in a basal Chadron. That is
10 based on independent travel time calculations. That
11 is a 500-year travel time to get there. So, you know,
12 it is kind of outside the realm of what we would see
13 as a foreseeable expectation for things to move up
14 gradient, since we have an inward gradient to reach
15 that fold to begin with. And so that was something
16 that --

17 JUDGE WARDWELL: So, you don't dispute
18 that the fold still could be a transmissive zone,
19 similar to a fault?

20 MR. BACK: I don't -- the evidence doesn't
21 suggest that but I can't say for sure that it is not.
22 And the independent geologist said that a fold is
23 plausible, which is kind of looser than yes, it is
24 definitely a fold. So, there is uncertainty with it.

25 JUDGE WARDWELL: And the last one that I

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1 -- no, second. Sorry I got you two excited, the
2 second to the last one, the fact that different
3 chemical signatures could exist, even though there is
4 migration, why isn't that feasible? In fact, a change
5 in the whole conditions that existed in a given porous
6 media would be enough different to create different
7 species associated with the same impact that is
8 causing the problem?

9 MR. BACK: Your Honor, there is some truth
10 to that. I mean an aquitard, it does allow a certain
11 amount of flow. Now, whether it is enough to create
12 a problem with the leakage through it, that is really
13 the question. I don't think there is a dispute that
14 --

15 JUDGE WARDWELL: My question is -- sorry,
16 I didn't make myself clear. I am more concerned on
17 your reaction to their position that just because
18 there is a chemical difference in the species between
19 two different zones, that that is any proof that there
20 is not communication just because the chemical
21 signatures are different.

22 MR. BACK: Your Honor, you would have a
23 mixed water there. And it you wouldn't have clear
24 distinctions between the two. It would show a clear
25 mixing. And actually Spalding is one of the

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1 Intervenor's' exhibits talks about the different
2 stratification and mixing between the aquifers, where
3 it occurs. So, you would --

4 JUDGE WARDWELL: And so I lied again
5 because, in fact, that was the last question because
6 the other one was back to the brittleness associated
7 with the fold and I think we have covered that.

8 CHAIR GIBSON: All right, we will stand in
9 recess.

10 (Whereupon, the above-entitled matter went
11 off the record at 4:32 p.m. and resumed at 4:46 p.m.)

12 CHAIR GIBSON: Okay, Judge Wardwell.

13 JUDGE WARDWELL: The Intervenor's' petition
14 Exhibit 043 page 4, this starts talking about the
15 water resources -- oh, sorry -- that is a very polite
16 way to tell me to straighten up and fly right. I'll
17 do my best.

18 MR. SMITH: Judge Wardwell? This is Tyson
19 Smith for Crow Butte here, behind the screen.

20 Before we move on from the discussion of
21 the White River fold and feature, which it sounds like
22 you are leaving, there was one line of evidence that
23 wasn't discussed about tightly constrained age of the
24 fault. And I was wondering if we would have an
25 opportunity to remark on that briefly. I think it

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1 might provide some helpful clarification.

2 JUDGE WARDWELL: I think it will come up
3 again when we talk about the overall conclusions of
4 that. And I did not see that in the areas that I was
5 looking at specifically relating to the fault.

6 So, the answer is I am not interested in
7 hearing about it from here but I think you will see
8 that that will come up when we talk about overall
9 conclusions of your position.

10 MR. SMITH: Thank you.

11 MR. WIREMAN: Your Honor, I have some
12 information that was promised to bring back to you.

13 JUDGE WARDWELL: Yes, good.

14 MR. WIREMAN: Would you like that now?

15 JUDGE WARDWELL: Yes. Yes.

16 MR. WIREMAN: Okay. We were talking about
17 the different directions of groundwater flow in the
18 Brule aquifer.

19 JUDGE WARDWELL: Right.

20 MR. WIREMAN: And I have four different
21 things here.

22 JUDGE WARDWELL: Okay, yes, that is right.
23 That is correct.

24 MR. WIREMAN: In the license renewal
25 application, page 2-140, direction of flow in the

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1 Brule is indicated as north-northwest. In the license
2 renewal application, the direction is indicated as
3 east-northeast.

4 In the SER, page 22, it is indicated as
5 northwest. And in Souders, 2004, it says water table
6 configuration trends north-northeast.

7 So, I just wanted to point out those are
8 four different directions.

9 JUDGE WARDWELL: And what was that last
10 one?

11 MR. WIREMAN: Souders, S-O-U-D-E-RS.

12 DR. LAGARRY: Pronounced Souders.

13 MR. WIREMAN: Souders, I'm sorry, 2004.

14 JUDGE WARDWELL: And whose exhibit was
15 that or was it? Where did you get that from?

16 MR. WIREMAN: Just from my reading and my
17 notes, so I don't know if it is an exhibit or not.

18 JUDGE WARDWELL: Okay.

19 CHAIR GIBSON: Regardless of whether we
20 accept it, I would like for you to get us a copy of
21 that, if you could.

22 MR. WIREMAN: I will do my best.

23 CHAIR GIBSON: Souder?

24 MR. WIREMAN: Souders.

25 CHAIR GIBSON: Along with the -- what is

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1 the name of -- Terry. Right. We are going to get
2 Terry, could you also just get Souder as well and get
3 that to us? Okay, thank you.

4 JUDGE WARDWELL: NRC, would you like to
5 comment on those various directions, if you have
6 anything in regards to that?

7 DR. STRIZ: Yes, I would. Piezometric
8 surface, piezometric head surfaces, as you correctly
9 pointed out, noticing that the basal Chadron was based
10 on so few points, are dependent on the number of
11 points used to create the surfaces that are used to
12 determine the groundwater flow of direction.

13 The Brule aquifer is highly used around
14 the license area. There are many private wells around
15 the license area that draw from the Brule and they can
16 very much so impact the direction of the groundwater
17 flow.

18 So, it is possible that based on how many
19 points were used for each of these surfaces, you would
20 get differences and you would get different
21 interpretations of the direction of groundwater flow.

22 We, at the NRC, determined, based on what
23 the licensee provided to us that the direction was to
24 the northwest. And we had a lot of points in the last
25 application, as we indicated, that actually indicated

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1 that there were changes in some of the gradients
2 because of having more points to define the surface.

3 JUDGE WARDWELL: Thank you. Moving on,
4 the Intervenor's Exhibit 043 page 4, you state that
5 the water resources map, that is the Wyoming Fuels
6 Company 1982 shows the distribution of the potential
7 ore area in the Crow Butte project. It is Figure 2.

8 The wells marked on a map may be useful in
9 other contexts. However, what really caught my
10 attention, and I believe this is you talking, Dr.
11 LaGarry, was that the area marked as the potential ore
12 body is generally northwest to southeast trending
13 lineament, similar to the trend noted by Diffendal in
14 1994, which we now know is INT-055.

15 And my first question is that is the '82
16 water resources map that you referred to with this
17 statement on page 4 of 043 the Figure 2 of page 5 of
18 your INT Exhibit 043? I believe it is there. It is
19 on the --

20 DR. LAGARRY: That is the figure I
21 provided, yes.

22 JUDGE WARDWELL: Okay. And is there a
23 title on that?

24 DR. LAGARRY: It's at the bottom.

25 JUDGE WARDWELL: Okay, yes. And who

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1 entitled this figure, did the Wyoming Fuels or did
2 you?

3 DR. LAGARRY: Title which? You mean in
4 the very bottom right-hand corner of the map is the
5 Wyoming Fuels data, where they talk about what it is.
6 And then the caption that says Figure 2, that is me.

7 JUDGE WARDWELL: This is you where it says
8 Figure 2.

9 DR. LAGARRY: Yes.

10 JUDGE WARDWELL: You have given it this
11 name?

12 DR. LAGARRY: Yes.

13 JUDGE WARDWELL: Okay. What is the origin
14 of the two red lines we see on this figure?

15 DR. LAGARRY: The origin of those two red
16 lines are faults that inferred because of the kink in
17 the linear trend portrayed on the map. It is a series
18 of lines and the inner-most line looks like a sausage,
19 except it is like if you took a hotdog and pushed the
20 two ends together and it kinked in the middle. Right?

21 And so assuming that that is an accurate
22 representation of what is going on in the subsurface,
23 I would interpret that as fault offset, that there was
24 in fact horizontal movement along two faults that
25 offset that sausage-shaped trend.

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1 JUDGE WARDWELL: It must be the time of
2 day but you kind of lost of me on that explanation
3 when you got to the sausage.

4 DR. LAGARRY: Okay.

5 JUDGE WARDWELL: So, you can stay with
6 your sausage thing but I somehow glazed over when you
7 said that and then I lost it.

8 DR. LAGARRY: My metaphors are all food
9 metaphors.

10 JUDGE WARDWELL: I was trying to keep up.

11 DR. LAGARRY: Okay, it is a map --

12 JUDGE WARDWELL: Yes, I got that. It's a
13 map.

14 DR. LAGARRY: -- that shows full
15 potential. And you can see that it is generally
16 lozenge-shaped. The inner most line is sort of
17 sausage-shaped. And right where the lines are --

18 JUDGE WARDWELL: Are these the red lines?

19 DR. LAGARRY: Yes, the red lines. The red
20 lines I put there. Everything else is the original
21 figure.

22 JUDGE WARDWELL: Right.

23 DR. LAGARRY: So, the original Wyoming
24 Fuels Company just mapped where they thought the ore
25 was and it was a sausage-shaped trend.

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1 JUDGE WARDWELL: Going
2 northwest-southeast.

3 DR. LAGARRY: Going northwest and
4 southeast.

5 JUDGE WARDWELL: Okay, I'm with you.

6 DR. LAGARRY: And it has a kink in the
7 middle.

8 JUDGE WARDWELL: Got you. I see the kink
9 now, yes.

10 DR. LAGARRY: Right. And so how would one
11 explain that kink in the middle? Right? And so my
12 business is geological mapping stratigraphy and
13 structure. And the way I would interpret that kink in
14 the middle is that there were two faults that it was
15 originally a linear feature and then it was
16 subsequently faulted, producing a kink in the middle.

17 JUDGE WARDWELL: Got you.

18 DR. LAGARRY: That's it.

19 JUDGE WARDWELL: Okay, thank you.

20 CBR Exhibit 045, which is a reply, I
21 believe, page 2, answer 25 maintains that the faults
22 were not drawn by Wyoming Fuels Company and you concur
23 with that because you drew those --

24 DR. LAGARRY: I drew those.

25 JUDGE WARDWELL: -- your interpretation of

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1 this. And also maintains that nearly 11,000 drill
2 holes completed across a permit area aquifer tests and
3 other evidence do not support the presence of a fault
4 or faults in the permit area.

5 Besides this map, do you have any other
6 evidence indicating faults within the permit area?

7 DR. LAGARRY: I don't have access to the
8 permit area to make an independent investigation.
9 Were I to be granted access, I would happily do so.

10 JUDGE WARDWELL: Is it your position that
11 most of the fractures are aligned northeast-southwest
12 in the direction of Pine Ridge or more in the
13 northwest-southeast direction consistent with the
14 lineaments described by Diffendal in INT Exhibit 055,
15 page 145?

16 DR. LAGARRY: These lineaments are based
17 on the fracturing properties of sedimentary rocks and
18 what is called the stress strain ellipsoid that
19 structural geologists use to predict faults and
20 fractures occurring over geological domes like the
21 black hills.

22 So, the two directions,
23 northwest-southeast and southwest-northeast are like
24 bookends. They occur together.

25 JUDGE WARDWELL: Thank you.

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1 CBR 0455, pages 15 through 16 answer 29 in
2 response to your lineament study 043 pages 3 through
3 4 state that LaGarry's reference to the poster
4 presentation by Maher and Shuster, and that is INT
5 Exhibit 060, and I believe -- is this the same Maher
6 you referred to earlier today?

7 DR. LAGARRY: It is.

8 JUDGE WARDWELL: Great.

9 DR. LAGARRY: Yes, sir.

10 JUDGE WARDWELL: Super. Supporting the
11 lineaments identified by Diffendal, CBR countered
12 that, quote, the poster addresses faulting at four
13 locations. However, all locations are outside the
14 Crow Butte perimeter area. Crow Butte has not
15 observed faulting or joints at the Crow Butte site and
16 upward migration requires hydraulic conditions that
17 are not present at the site. Crow Butte has
18 demonstrated that faulting outside of permit area does
19 not affect Crow Butte's ability to control mining
20 fluid at the site.

21 And again, I assume that you do not have
22 any information in regards to whether or not those
23 four fault locations extend into the CBR site for the
24 same reasons you have described before about having
25 any abilities to evaluate the site.

1 DR. LAGARRY: My referencing Maher and his
2 colleagues' paper was to provide information on how
3 ubiquitous these features are in the region.

4 Neither Maher, nor myself, nor Diffendal,
5 nor Balmat, none of us had access to the permit area.
6 So, subsequently, we have to work in the vicinity and
7 infer and generalize to the larger region. However,
8 Maher's poster was one of the most detailed and
9 thorough of those that exist. And in it, he also
10 demonstrates the variability that these things can
11 manifest in.

12 So, it was an attempt to demonstrate the
13 ubiquity of these features.

14 JUDGE WARDWELL: Thank you.

15 I think that pretty much wraps up my
16 questions on lineaments, faults, and fractures, thank
17 goodness. And we can move on to finish up some things
18 on a secondary porosity. And I think I will start
19 with Exhibit 069 of the Intervenors', page 3 of
20 Kreamer's testimony, where you state that the
21 assumption that the sand or sandstone in the
22 Chamberlain Pass has no secondary porosity is
23 inconsistent with a reported directional anisotropy or
24 isotropy.

25 DR. KREAMER: Sure. Just like homogeneity

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1 and heterogeneity has to do with differences between
2 two points, isotropy and anisotropy has to do with
3 difference of a property at one point but in different
4 directions. So, if we are talking about hydraulic
5 conductivity, there are many places where the
6 horizontal hydraulic conductivity will be different
7 than the vertical and there are many geologic reasons
8 this can happen. If they are the same in all
9 directions, the media is said to be isotropic, that is
10 at one point. But at that one point, if in different
11 directions you have different hydraulic conductivities
12 vertically, horizontally, et cetera, that is called
13 anisotropy.

14 JUDGE WARDWELL: And what data do you have
15 to support the report what you testify is a reported
16 directional anisotropy. Where was this reported
17 directional anisotropy that you are referring to?

18 DR. KREAMER: Well, there are a couple of
19 lines of evidence to that. The first is that CBR, in
20 the restoration, is going to a numerical model. And
21 in that numerical model, they state that they will
22 account for heterogeneities and differences in what
23 they call the basal Chadron. And so the line of
24 evidence that was first apparent is that as they are
25 doing their numerical modeling, they are no longer, as

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1 they were in the '80s, saying that the aquifer is
2 homogeneous and isotropic, which is the basis for some
3 of their equations, and now they going to a MODFLOW
4 model, which actually specifies different hydraulic
5 conductivities in different directions.

6 JUDGE WARDWELL: Okay. And I guess you
7 are really saying that this directional anisotropy is
8 caused or related with or some type of indication that
9 there is these fractures that are secondary porosity
10 within the geologic strata.

11 DR. KREAMER: Not necessarily for the --
12 well, it doesn't necessarily have to be associated
13 with secondary porosities but it often is. If you
14 have a fracturing pattern, it means that you have more
15 ability of water to flow in some directions than it
16 does other directions.

17 JUDGE WARDWELL: It is your experience
18 that most sedimentary deposits exhibit anisotropy,
19 regardless of any fractures, with the horizontal
20 conductivity often times being ten times or more the
21 vertical conductivity? Is that common with
22 sedimentary features that we have here?

23 DR. KREAMER: It depends on the sandstone.
24 There are clean sandstones. There are dirty
25 sandstones. There are sandstones that are

1 cross-bedded. I come from a part of the world in Zion
2 and Bryce and you drive up and you see sandstones that
3 were beach and were very interbedded. So, you have --

4 JUDGE WARDWELL: Let's talk about the
5 types of formations we have here that we are talking
6 about at our site, where in fact there seem to be a
7 fair amount of non-uniformity, if you will in the
8 grain-size distribution of either the consolidated or
9 unconsolidated strata.

10 DR. KREAMER: Great question, Your Honor.
11 The anisotropy you would probably find in this area is
12 because of the genesis of the sandstone. You had
13 layers, it is streambed deposits and it is in a
14 fluvial environment. And so as the sediments are laid
15 down, the stream can meander, it can go different
16 places. And so you would expect to not have this same
17 layering vertically. When you have a situation like
18 that, oftentimes, you will get anisotropy. You will
19 get greater horizontal hydraulic conductivity than you
20 will vertical.

21 So yes, the idea that in the remediation
22 process they have to spot-treat areas that are more
23 contaminated than other areas is an indication that it
24 is not a homogeneous isotropic system.

25 JUDGE WARDWELL: And as you said, it is

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1 your understanding that they didn't treat as a
2 horizontal homogeneous isotropic strata. Is that
3 correct?

4 DR. KREAMER: Crow Butte did both sides.
5 In the '80s, when they were trying to show that there
6 was no verticality and they were doing pumping tests.
7 The analysis used equations, an analytical model,
8 equations like the Tyce equation, the Jacob-Cooper
9 modification, they used equations that assumed that
10 the aquifer was homogeneous, isotropic, was the same
11 thickness, did not tilt, and that is what they used
12 for their analysis.

13 When it came to remediation, I guess they
14 were not getting the efficiency they wanted for
15 restoration and so they went to a numerical model. A
16 numerical model sets up cells and so you can be much
17 more complicated about the system and you can
18 incorporate, as they said they have, when they
19 reported in the model that they accounted for
20 differences in thicknesses of the aquifer and
21 differences in heterogeneities.

22 And so I guess Crow Butte Resources has
23 done both. A lot of their initial calculations saying
24 that there was no vertical hydraulic conductivity were
25 based on assumptions of homogeneous isotropic layers

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1 that were equally thick and were, more or less,
2 infinite horizontal extent as far as the pumping test
3 was concerned.

4 JUDGE WARDWELL: Thank you. On page 3 of
5 your testimony, you state that quote, aquifer test
6 analysis in the Chamberlain has reported permeability
7 variations of approximately three times, which is
8 inconsistent with the assumption of homogeneity in the
9 production zone.

10 I guess my question to you is, is not this
11 a relatively small variation in hydraulic
12 conductivity, given the possible ranges of
13 conductivity that exist? You know it is not unusual,
14 is it, for a conductivity to range by a half an order
15 of magnitude or more in a given geologic strata?

16 DR. KREAMER: More than that. Sometimes
17 many --

18 JUDGE WARDWELL: So, wouldn't three times
19 be a fairly small variation?

20 DR. KREAMER: It is if you are not
21 considering secondary porosities. In other words,
22 what you said is this is based on cores. And so they
23 are looking at just the material itself that is
24 unfractured and --

25 JUDGE WARDWELL: Well, in fact, my

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1 question relates a little broader than that. That
2 conductivity, by its nature, which varies by many
3 orders of magnitude between various materials and
4 varies by several orders of magnitude for the same
5 material, and varies by a half an order of magnitude
6 for the same material in a geologic strata, just by
7 the nature of its existence. You know you have got a
8 little bigger pore space here and a little bit smaller
9 there. Isn't it easy for that to vary by three times
10 just by its nature of that particular parameter that
11 we are dealing with?

12 DR. KREAMER: That is correct, yes. This
13 is a pretty clean sandstone and the variation in the
14 rock, itself, matrix is not large compared to other
15 sandstones.

16 JUDGE WARDWELL: Thank you.

17 Mr. Wireman, in your testimony at 070 page
18 1 through 2, you state that the aquifer test data were
19 not appropriately analyzed and no data analysis
20 methods were used that are appropriate for non-Darcy
21 flow and fracture rock settings. Do you remember
22 saying that?

23 MR. WIREMAN: Right.

24 JUDGE WARDWELL: It seems that your major
25 concern relates to the potential migration of mining

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1 impacts through secondary porosity, again, associated
2 with this fractured rock. And I think we have all
3 agreed that is the main issue that we are dealing here
4 with in regards to the second porosity aspects. I
5 think we said that before. Is that correct, Mr.
6 Wireman?

7 MR. WIREMAN: That is correct.

8 JUDGE WARDWELL: Okay, good. Again, I
9 think you have already answered you don't have any
10 specific information because of the lack of abilities
11 to determine whether or not there is fractured rock in
12 the license area.

13 But I guess the heart of my question is
14 why doesn't Darcy's flow apply to fractured rock in
15 some cases and, in fact, most cases?

16 MR. WIREMAN: Well, I'm not sure about
17 most cases. The conventional thinking on that is that
18 the larger the volume of rock you are looking at, the
19 more you can use Darcy flow. And smaller volumes of
20 rock, it is less useful.

21 There are formulas that you can derive
22 estimates of transmissivity in fractured rocks. It is
23 related to the cube of the width of the aperture of
24 the fractures and that is a standard method in most of
25 the textbooks.

1 So, that is what I was getting at here is
2 it would be useful, I think, to just run that. It is
3 not terribly difficult if you have some, and it gets
4 back to the discussion we had earlier about
5 identifying fractures in the outcrop and measuring the
6 aperture and all that. Collect that data, crank
7 through this, get a transmissivity, compare it to what
8 you get with the pump test.

9 JUDGE WARDWELL: And then the harder the
10 problem then becomes not so much the ease with which
11 a model can be run because it is fairly apparent there
12 is lots of models out there and anyone can run them,
13 it is the input parameters that you put into them.
14 Isn't that correct?

15 MR. WIREMAN: Absolutely true.

16 JUDGE WARDWELL: And it then gets back to
17 our previous discussion of what are you going to put
18 in there for an aperture distance, the use of
19 something at the surface we discussed in regards to
20 the variations between what it might look like in the
21 subsurface. I don't think we need to repeat that.
22 But the mere fact that if in fact you are not looking
23 at that type of flow but you have got a fairly large
24 area compared to the size of the apertures would tend
25 to create a situation that does somewhat represent

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1 flow through porous media, which is what Darcy was
2 derived for, wouldn't it?

3 MR. WIREMAN: The answer to that is yes,
4 on a larger scale. However, that does not accommodate
5 flow through a single highly-preferential flow path,
6 whether that flow path be a fault, whether it be an
7 intensely jointed fractured part of the rock, whether
8 it be an opening in a fold. That, you can't use Darcy
9 flow on that sort of two-dimensional type of flow,
10 which is what we are talking about oftentimes with
11 highly preferential flow through lineament.

12 JUDGE WARDWELL: Is this now a size issue
13 or a laminar flow issue? Size of the representative
14 element that you are trying to model, compared to the
15 size of the aperture or is it that you are concerned
16 about non-laminar flow occurring in these larger
17 apertures?

18 MR. WIREMAN: It gets a little complicated
19 but Darcy flow can actually occur within a
20 preferential flow path. So, within a two-dimensional
21 fault, open fault, you can have Darcy flow within that
22 fault. But one foot or five feet either side of that
23 fault, you have little or no flow but it is Darcy
24 flow. So, it is a scale thing to a large degree and
25 the more rock you want to analyze, the more you can

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1 use a Darcy equation.

2 However, if your concern is the potential
3 for movement of a contaminant through a highly
4 preferential flow path, having an estimate of Darcy
5 flow of some large massive rock is really not very
6 useful.

7 So, the way I always look at this, it is
8 really important to understand if there are
9 preferential flow paths, what are they? Are they
10 lineaments? Are they fractures? Are they
11 significantly more permeable zones in the rock? That
12 is the very first thing that is really, really
13 important.

14 Then, once you understand those and where
15 they are, then you start to focus on the hydrology of
16 those relatively small areas. And if it is truly a
17 two-dimensional fault or fracture, then you really
18 need to go back to some non-Darcy flow sometimes.

19 So, it gets quite complicated but I am
20 always --

21 JUDGE WARDWELL: Okay, clarify again,
22 exclusive of taking measurements at the surface, which
23 we have talked about, exclusive of that, do you have
24 any other suggestions of how you would characterize
25 those apertures that are 200 feet into the geologic

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1 strata?

2 MR. WIREMAN: Okay, have at it.

3 DR. KREAMER: Dr. Dave Kreamer. Yes,
4 there are several ways you can look at cores, if you
5 core the rock and look for fractures. And there is
6 typical fracture analysis that we did not see in
7 reviewing this.

8 Another way, I was a peer reviewer --

9 JUDGE WARDWELL: So, back to these cores.
10 How are you going to determine the aperture after you
11 get the cores out of the ground? I mean they are
12 going to be disturbed.

13 DR. KREAMER: Right. Well, then there is
14 another way. Another way is downhole TV logs. At
15 Yucca Mountain --

16 JUDGE WARDWELL: Downhole what now?

17 DR. KREAMER: Television logging, where
18 you send a camera down the borehole. These cameras
19 are very small. They can look sideways or down the
20 hole and you can actually measure the size of the
21 aperture. The angle of the aperture, the orientation.
22 You can look at two holes and see whether that
23 aperture or that fracture continues on further. I was
24 a peer reviewer for Yucca Mountain and I looked down
25 more holes and at more fractures than was healthy for

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1 me to do. But that is a common technique is a TV
2 logging or television logging of holes is another way.
3 Another way is geophysical logging in these holes and
4 some of that was done.

5 JUDGE WARDWELL: We will get into this
6 more in the next couple of days but you say this TV
7 logging is common but your reference that you use for
8 the use of this did not use any common techniques that
9 I am aware of in regards to trying to define the
10 conditions at Yucca mountain. At least when you look
11 at the dollars spent, none of it was very common.
12 They used, in my experience, really complex
13 techniques. Why I don't necessarily think that TV is
14 very complex, wouldn't you tend to agree that your
15 common garden variety geotechnical FERB would not
16 readily be using this on most projects?

17 MR. WIREMAN: Let me just answer that. I
18 think it is increasingly common to do this and it
19 doesn't require a big budget process. These TVs are
20 out there now. They are really easily sent down a
21 hole and watch. You can watch water flow in a
22 fracture with these. So, no, I don't think just the
23 logging of a hole is prohibitively expensive.

24 JUDGE WARDWELL: But given the time frame
25 when they were logging holes, was it common?

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1 MR. WIREMAN: That is a very valid point.
2 You know it is certainly cheaper today than it was 20
3 years ago, no question.

4 JUDGE WARDWELL: And certainly probably
5 more readily available than it was 20 years ago.

6 MR. WIREMAN: And the cameras were bigger
7 and they didn't go down smaller holes as they do
8 today. A lot of them didn't look sideways as they do
9 today but it is used very commonly in fractured rock
10 systems to see for like non-aqueous phase flow a lot
11 of times it will go opposite the groundwater direction
12 and you can actually see the non-aqueous phase come
13 out of the fracture.

14 JUDGE WARDWELL: And we, to your
15 knowledge, we don't have any of those issues dealing
16 with --

17 DR. KREAMER: No, no non-aqueous phase
18 flow regimes.

19 JUDGE WARDWELL: And we will talk more on
20 what this focused towards, and that is an EA and what
21 is needed for that later on.

22 The horizontal aquifer communication with
23 the license area with the Pine Ridge Reservation, I
24 have a couple of questions dealing with staff's
25 testimony on 001, page 41, answer D-13. Based on the

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1 absence of the Ogallala and Arikaree in the license
2 area, there is no hydraulic connection between the
3 basal Chadron sandstone aquifer and the Arikaree and
4 Ogallala aquifers.

5 Staff, in 01, page 32 to 33, D-4, in
6 regards to the extent of the basal Chadron, staff
7 states that there is at least a 25-mile barrier to
8 flow within the Chadron formation that separates the
9 basal Chadron sandstone aquifer in the license area
10 for any aquifers that supply drinking water at the
11 Pine Ridge Reservation.

12 And staff, you did state that the Arikaree
13 does exist on the southeast corner. We have been
14 through that. Some of these we may have already
15 covered and I get reading to find out we have covered
16 it. So, just bear with me.

17 Given that the area between the license
18 area and Pine Ridge is not within a license area, do
19 you have any information, Dr. LaGarry, or anyone else
20 on your staff, in regards to showing that there is
21 hydraulic communication between the basal Chadron and
22 the Pine Ridge Reservation? And let me start off by
23 saying does the basal Chadron underlie the Pine Ridge
24 Reservation to the northeast?

25 DR. LAGARRY: The basal Chadron does

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1 underlie the Pine Ridge Reservation to the northeast.

2 JUDGE WARDWELL: And where was that on
3 that map? We looked at the zero -- the isopach map of
4 the thickness of the basal Chadron and didn't that
5 zero line fall well short of the Pine Ridge
6 Reservation or was I misinterpreting that?

7 DR. LAGARRY: No. No, the interpretation
8 is correct. I mean the Chamberlain Pass formation is
9 not isolated to the syncline that Crow Butte mines.
10 There are multiple synclines and other features that
11 radiate from the Black Hills that contain Chamberlain
12 Pass formation.

13 JUDGE WARDWELL: Are those connected
14 hydraulically directly across from one to the other?
15 So, you are saying it is underneath the Pine Ridge
16 Reservation, another radiated line of the basal
17 Chadron does exist under the Pine Ridge.

18 DR. LAGARRY: Yes, it does. Swinehart and
19 others in 1985 show cross-sections of the Pine Ridge
20 escarpment through -- so, the Pine Ridge escarpment
21 starts at the Wyoming line, as it enters Nebraska, it
22 goes from Wyoming, it crosses the Wyoming-Nebraska
23 state line, comes through this area, and then angles
24 to the northeast, following the lineament trend that
25 Diffendal talks about.

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1 So, the Pine Ridge escarpment, as it is
2 manifested today, is very likely a product of faulting
3 and that stress strain ellipsoid and pattern from the
4 Black Hills.

5 So, although it is eroded off, if I was a
6 molecule of water and I was at the permit area and I
7 wanted to migrate northeast to the reservation, I
8 would butt up against the eastern limb of the
9 syncline, where the Chamberlain Pass formation is
10 eroded away. And then I would cross that structure
11 and I would get on the other side and then I could
12 find Chamberlain pass and I could continue my journey.

13 So, it is correct. That isopach map is
14 correct that it pinches out, assuming -- assuming that
15 the red clay -- okay, so the red clay that is the
16 lower unit of the confining layer, that is part of the
17 Chamberlain pass formation. That red clay, if that is
18 part of that figure that pinches to zero, then, in
19 fact, there is no direction connection via the
20 Chamberlain Pass formation.

21 However, if my opinions are correct and
22 that these faults allow transmissivity of fluids
23 connecting these little isolated pod to Chamberlain
24 Pass formation, then water could migrate through
25 Chamberlain Pass, through a fault, through Chamberlain

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1 Pass, through a fault, through Chamberlain Pass,
2 through a fault, through Chamberlain Pass to the
3 reservation.

4 However, that being said, the most likely
5 conduit for contamination to the Pine Ridge
6 Reservation is not through the Chamberlain Pass
7 formation. It is from where the Chamberlain Pass
8 formation meets the White River alluvium. The White
9 River alluvium diagonally transects the Pine Ridge
10 Reservation from southwest to northeast.

11 JUDGE WARDWELL: Thank you.

12 DR. LAGARRY: You're welcome.

13 JUDGE WARDWELL: Staff, when you were
14 preparing your EA, how did your conclusions differ
15 from those that were presented by Dr. LaGarry in
16 regards to the horizontal communication between the
17 basal Chadron and the Pine Ridge Reservation?

18 And I will start off with do you agree
19 that there is basal Chadron Chamberlain Pass material
20 beneath the Pine Ridge Reservation?

21 DR. STRIZ: No, we do not agree. We find
22 no pathway from the --

23 JUDGE WARDWELL: Could you speak up a
24 little bit or just pull that right toward you.

25 DR. STRIZ: Okay. We do not agree that

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1 the basal Chadron is present under the Pine Ridge
2 Reservation.

3 JUDGE WARDWELL: What is your evidence for
4 that?

5 DR. STRIZ: There are actually two studies
6 that were done by the USGS. The first one is NRC-025,
7 which was the Water Quality of Selected Springs and
8 Public-Supply Wells at the Pine Ridge Indian
9 Reservation and there is a table in there that
10 describes the Chadron and does not describe the basal
11 Chadron member as being present.

12 In addition, there was a groundwater
13 modeling study done on the Pine Ridge Reservation in
14 2014, just recently. Once again, when they described
15 the Chadron, they did not describe the basal Chadron
16 member.

17 JUDGE WARDWELL: Is that an exhibit here?

18 DR. STRIZ: Yes, for both. It is NRC-025
19 and NRC-026, the tables.

20 JUDGE WARDWELL: Thank you.

21 DR. STRIZ: They also did not include a
22 basal Chadron in the groundwater model. The only
23 aquifers they considered at the site were the Arikaree
24 and the Ogallala.

25 JUDGE WARDWELL: Dr. LaGarry, did you have

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1 a chance to look at that at any time and what is your
2 reaction to that statement?

3 DR. LAGARRY: I have personally mapped the
4 geology of the Pine Ridge Reservation this past July
5 in Pierre, South Dakota, at a presentation of the
6 National Science Foundation South Dakota and
7 Experimental Program for the Stimulation of
8 Competitive Research. My student, Sean Garnett,
9 presented a poster in which he describes the White
10 Clay Fault, in which the basal, what used to be called
11 the basal Chadron now we call the Chamberlain Pass
12 formation is exposed and is transmitting radioactive
13 geothermal waters through the land's surface.

14 So, the use of the latest, most recent
15 research has plagued this proceeding from its
16 beginning and I would say that those publications are,
17 in fact, that NRC sites are in fact out of date. In
18 fact, we are preparing work on that.

19 In my testimony, I provided the citation
20 for at least three abstracts detailing the presence of
21 the Chamberlain Pass formation on the Pine Ridge
22 Reservation.

23 JUDGE WARDWELL: I will give you one last
24 chance for the back and forth.

25 DR. STRIZ: In addition, the Arikaree is

1 not saturated at the license area. We just had Crow
2 Butte testify to that. So, there is no pathway in the
3 southern portion of the license area for water to get
4 in the Arikaree and to be transported 30 miles all the
5 way up to the Pine Ridge Reservation.

6 In addition, anything that enters Brule,
7 the groundwater flow direction of the Brule is very
8 distinctly toward the White River alluvium. So, any
9 particle entering the Brule would have to go
10 cross-flow all the way across to the Reservation.
11 There is no pathway.

12 And as he agreed, the basal Chadron
13 pinches out and then you have all the siltstones and
14 mudstones for 27 miles that a particle of water would
15 have to pass through.

16 JUDGE WARDWELL: But Dr. LaGarry, didn't
17 you say that the particle of water you are concerned
18 about is the one that goes to the White River
19 alluvium? Is that --

20 DR. LAGARRY: That's right. That is the
21 one that really worries me is the one that comes out
22 of the Chamberlain Pass formation, 12 to 15 miles
23 downriver from here and from there, it gets into the
24 White River alluvium and then its first stop is Pine
25 Ridge, the community of Pine Ridge.

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1 JUDGE WARDWELL: At that point, it will
2 enter the --

3 DR. LAGARRY: Pine Ridge Reservation.

4 JUDGE WARDWELL: And what aquifer source
5 at the Pine Ridge Reservation?

6 DR. LAGARRY: That would be the White
7 River alluvium, in which the Pine Ridge Municipal Well
8 Field is developed.

9 JUDGE WARDWELL: Okay. So, in fact, you
10 are not counting on the basal Chadron as the
11 transmitter of any impacts that underlies the Pine
12 Ridge Reservation. It is the alluvial.

13 DR. LAGARRY: No solely. The contaminated
14 water could not take that route without connecting
15 faults and fractures, without connecting secondary
16 porosity. However, secondary porosity does not need
17 to be invoked to transmit contaminants from the
18 Chamberlain Pass formation to the White River alluvium
19 to the Reservation.

20 JUDGE WARDWELL: It does not --

21 DR. LAGARRY: It does not.

22 JUDGE WARDWELL: -- because they are
23 connected where it outcrops in the river.

24 DR. LAGARRY: That is correct.

25 JUDGE WARDWELL: You don't believe it is

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1 there.

2 DR. STRIZ: No, the basal Chadron is at
3 depth that does not outcrop in the White River
4 alluvium. It outcrops 12 miles northwest. It is very
5 deep under it. There is no evidence of a fault that
6 is flowing that would connect from the basal Chadron
7 to the White River and all the five lines of evidence
8 that we provided about the confinement of the basal
9 Chadron. We see no pathway.

10 JUDGE WARDWELL: Thank you.

11 Let's move on to vertical aquifer.

12 CHAIR GIBSON: Let me just ask one
13 question. Did you say there was a 2014 study --

14 DR. STRIZ: Yes.

15 CHAIR GIBSON: -- on the Reservation. Is
16 that correct?

17 DR. STRIZ: Yes.

18 CHAIR GIBSON: And Dr. LaGarry, I am
19 curious. You were critical of these other studies
20 because they were out of date. Was the data out of
21 date that was used in this 2014 study? I am just
22 wondering if you guys are talking past each other or
23 if there is some way we can understand this. Because
24 that does not sound out of date to me.

25 DR. LAGARRY: It depends on the source

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1 material that the 2014 researchers were using. I
2 wasn't directly involved with that study and they may
3 have relied on existing research from the 1930s, '40s,
4 and '50s.

5 The Chamberlain Pass formation wasn't
6 recognized as a thing until 1998. So, if their
7 reference material predated 1998, there would have
8 been no mention of it. They would have been subsumed
9 within the Chadron formation, parts of it. The
10 remainder, the red clays would have been subsumed
11 within the Pierre Shale.

12 And so I recognize that people are, more
13 or less, at the mercy of the reference material
14 provided. It is incumbent to dig as deep as possible
15 and consult as widely as possible.

16 So, it is entirely conceivable to me that
17 the 2014 study being cited was compiled by individuals
18 who weren't familiar with the Chamberlain pass
19 formation and the fact that a change in an
20 interpretation had been made. So, they might be able
21 to look right at it and see it.

22 CHAIR GIBSON: All right. Do you know the
23 source of the data for the 2014 study off the top of
24 your head? If you don't, we'll go on. I don't want
25 to drag this out.

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1 DR. STRIZ: Well, I have the entire
2 modeling report here and I can look into that. I
3 don't typically question USGS.

4 CHAIR GIBSON: Well, you know, I think we
5 would appreciate learning about that later but I don't
6 want to hold this up.

7 DR. STRIZ: Okay, thank you.

8 CHAIR GIBSON: Okay, thank you. Maybe you
9 could talk to us in the morning about that?

10 DR. STRIZ: Yes, I would be glad to.

11 CHAIR GIBSON: Thank you.

12 JUDGE WARDWELL: Last couple topic areas
13 before we adjourn here.

14 The vertical aquifer communication between
15 the basal Chadron Chamberlain Pass formation and the
16 upper Chadron lower Brule and upper Brule aquifer,
17 Crow Butte Exhibit 013, page 39 states that for the
18 North Trend Expansion Area, quote, all available data
19 indicated upward hydraulic gradient between the basal
20 Chadron Chamberlain Pass sandstone and the upper
21 middle Chadron with an average hydraulic head
22 difference of approximately 90 feet between the two
23 units.

24 Crow Butte's testimony on page 49, answer
25 92 says the vertical hydraulic gradient, and I am

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1 quoting, is strongly downward within the permit area.
2 Would you care to clarify which it is upward or
3 downward, Crow Butte?

4 MR. SPURLIN: Yes, this is Matt Spurlin.
5 The upward hydraulic gradients are observed at North
6 Trend.

7 JUDGE WARDWELL: Say that again.

8 MR. SPURLIN: The vertically upward
9 hydraulic gradients are present due to artesian
10 conditions at North Trend, not at the current license
11 area.

12 JUDGE WARDWELL: So the current license
13 area is, in fact, downward?

14 MR. SPURLIN: That is correct.

15 JUDGE WARDWELL: And it is upward in the
16 North Trend Expansion Area.

17 MR. SPURLIN: That is correct.

18 JUDGE WARDWELL: Okay, thank you. Your
19 testimony, Crow Butte -- well, no, it is the license
20 renewal application Tables 2.7-5 on page 2-194 and
21 2.7-6, page 2-195, what is the head difference shown
22 on these arcs and what does that result in gradients
23 and where is this for?

24 Let's start off with the 2005 one. That
25 says it is Brule water levels. Correct?

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1 MR. BEINS: This is water level data from
2 1982. Earlier, you had asked about what wells had
3 been sampled to create the one particular
4 potentiometric surface map. This, I imagine, was the
5 data that was used to generate that map and it shows
6 the flow to the northwest, towards the White River
7 from the current license area.

8 JUDGE WARDWELL: And what does CSA mean?
9 Is that stated on there somewhere?

10 MR. BEINS: Well, I believe CSA is
11 commercial site area or commercial study area.

12 JUDGE WARDWELL: And what is that,
13 compared to the license area?

14 MR. BEINS: It is the same as the license
15 area.

16 JUDGE WARDWELL: Okay.

17 And if we compare -- and then what is
18 Table 2.75 -- 6, I mean? That is the basal Chadron,
19 the water levels for relatively the same time period?

20 MR. BEINS: The same time period, similar
21 --

22 JUDGE WARDWELL: What are the difference
23 in those heads show and where is this located? Is
24 this in the license area or is in this in the North
25 Trend?

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1 MR. BEINS: These wells are located
2 regionally. It is going to cover the area of the
3 current site, as well as the North Trend area.

4 JUDGE WARDWELL: And is the difference in
5 these elevations indicative of the head difference
6 between the Brule and the basal Chadron?

7 MR. BEINS: I would assume they are, yes,
8 sir.

9 JUDGE WARDWELL: Well, don't assume. What
10 is it? Is it or isn't it? I mean these are water
11 level elevations. One is in the basal Chadron and the
12 other is in the Brule that lies above it.

13 MR. BEINS: Certainly.

14 JUDGE WARDWELL: And would not the
15 difference in that elevation indicate the head
16 difference between those two water-bearing bodies?

17 MR. BEINS: Yes, sir.

18 JUDGE WARDWELL: And that would be
19 indicative of the gradient, would it not?

20 MR. BEINS: Yes, sir.

21 JUDGE WARDWELL: With the highest
22 indicating which direction it is going to flow, the
23 highest would be the pushing one, if you would,
24 compared to the receiving one.

25 MR. BEINS: Yes.

1 JUDGE WARDWELL: And what does this show?

2 MR. BEINS: That is only going to occur
3 where we have well pairs, as my colleague here has
4 pointed out, where the wells in the Chadron formation
5 are in very close proximity to the Brules.

6 JUDGE WARDWELL: To a certain degree. So,
7 you don't think we can -- these aren't well pairs or
8 anything? You don't think they can just look at the
9 elevation differences? What is the elevation? What
10 is the average elevation of 2.76, 3.75 something,
11 looking around at it?

12 MR. BEINS: Which well would you like?

13 JUDGE WARDWELL: Just --

14 MR. BEINS: Just pick one?

15 JUDGE WARDWELL: Yes, it doesn't matter.
16 Just what is --

17 MR. BEINS: Looking at RC-4 --

18 JUDGE WARDWELL: I see a 3.75 in the last
19 number varies, basically.

20 MR. BEINS: Yes.

21 JUDGE WARDWELL: Let's go back up to the
22 other one and see what that says. Isn't these 3.9s
23 and 3.8s instead of 3.75s?

24 MR. BEINS: Yes, sir.

25 JUDGE WARDWELL: Isn't that larger?

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1 MR. BEINS: That is larger.

2 JUDGE WARDWELL: Doesn't that indicate
3 downward flow?

4 MR. BEINS: That is going to indicate
5 downward flow.

6 JUDGE WARDWELL: Thank you. So, that
7 supports your downward flow from the Brule down to the
8 basal Chadron, would it not?

9 MR. BEINS: Yes, sir.

10 JUDGE WARDWELL: That is all I was trying
11 to get.

12 MR. LEWIS: If I may just add to that,
13 this is a pre-mining condition or prior to significant
14 development. As development progresses, you have a
15 lowering of the depression of the potentiometric
16 surface in the basal Chadron, which exacerbates and
17 increases that downward gradient that you see from the
18 pre-mining and early development stages.

19 JUDGE WARDWELL: I don't believe that was
20 an answer to any question I asked, though, but thank
21 you for sharing.

22 And that, in fact, was going to be my next
23 question so really thank you for sharing.

24 (Laughter.)

25 JUDGE WARDWELL: It says is this

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1 difference shown on these tables caused by mining of
2 the original. You are incredible! I apologize for
3 being snippy with you.

4 We are almost there, gang. We are almost
5 there for the day.

6 Crow Butte's testimony page 16, answer 40.
7 If significant hydraulic communication was present,
8 the hydraulic heads of the two aquifers would expect
9 to be much closer in elevation.

10 You know what the question is going to be.
11 Well, how much closer would they have to be before you
12 would be satisfied that in fact there is significant
13 communication?

14 Well and this shows what, many tens of
15 feet?

16 MR. LEWIS: Yes.

17 JUDGE WARDWELL: A lot.

18 MR. LEWIS: Yes, and currently more on the
19 order of a hundred.

20 Basically, the question is relative. In
21 a laminar flow system that has a perfectly laminar
22 flow, if you had a system that was in full hydraulic
23 communication, the water levels would be equivalent
24 and there would be no difference in head between the
25 upper part of that aquifer and the lower part of the

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1 aquifer. As you introduce vertical flow gradients or
2 you have significant barriers to flow, such as
3 aquitards, the upper confining unit in this case you
4 introduce greater degree of separation of those water
5 levels as the isolation is more and more prevalent.
6 And I would just say in my experience, when you are
7 looking at head differences of as much as tens to
8 hundreds of feet over a thickness that we are looking
9 at, that that is a very solid basis for confinement.

10 JUDGE WARDWELL: Thank you.

11 I will turn to the Intervenors and ask if
12 anyone would like to comment on these hydraulic heads
13 or do you have any arguments with them, or the
14 gradients indicated here?

15 MR. WIREMAN: Mike Wireman. I will just
16 make one short comment. Currently, at the North Trend
17 Area, the gradient is upward. The direction of flow
18 is from the current license area towards the North
19 Trend Area, in that direction. So, you have a
20 potential, in a post-closure scenario, for
21 contaminated water to move northwestward along the
22 flow path and then it enters an area where there is an
23 upper gradient.

24 JUDGE WARDWELL: Thank you.

25 The last topic area I want to touch on

1 tonight is the abandoned boreholes, where CBR Exhibit
2 045, page 17, answer 32 discusses the 10,000 plus
3 explorations made at the site, as shown on CBR Exhibit
4 056, which is a map of drill holes at the permit area,
5 which I think, again, is that that same priority? It
6 doesn't matter. I don't need to call up any. I just
7 wondered if you remember. It doesn't matter.

8 CBR, have all of these holes been
9 adequately sealed in accordance with standard
10 practice?

11 MR. BEINS: All holes have been sealed and
12 abandoned according to standard practice.

13 JUDGE WARDWELL: Now, was this done when
14 they first drilled them or were there some open for a
15 while until the technology realized the significance
16 of open boreholes and what that allowed for
17 communication?

18 MR. BEINS: We are required by the
19 Nebraska Department of Environmental Quality to
20 abandon all of our drill holes in a timely manner.
21 The longest period of time that I am aware of that we
22 have left a drill hole open without any abandonment
23 fluid in it probably does not exceed more than four to
24 five days.

25 JUDGE WARDWELL: And can you testify that

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1 that same process was carried out in 1983?

2 MR. BEINS: I can, sir.

3 JUDGE WARDWELL: And what kind of fluids
4 are these usually used to abandon the holes, the whole
5 process, just describe it.

6 MR. BEINS: To abandon a drill hole,
7 currently, under our mineral exploration permit or our
8 Class 3 permit, if we are operating inside the license
9 area, the drill rig will mix a bentonite-based
10 abandonment fluid that has been approved by the DEQ.
11 In this particular instance, we use a CETCO product
12 known as Plug Gel and it is a high solids
13 bentonite-based drill hole abandonment powder. We mix
14 that in a jet hopper into the drill pit. And as we
15 are mixing that, we are circulating that material
16 through the entire borehole. We mix that material,
17 continuing to add additional bags of that particular
18 Plug Gel to the pit until the pit viscosity of the
19 fluid that is in the pit, when that viscosity reaches
20 a point that we are able to measure of 61 seconds,
21 using a Marsh funnel and cup, once it reaches that 61
22 seconds or a viscosity that is --

23 JUDGE WARDWELL: Too much detail.

24 MR. BEINS: Okay.

25 JUDGE WARDWELL: You plug it with

1 bentonite clay.

2 MR. BEINS: We plug it with bentonite.
3 And at that point, we put a cement cap at the surface
4 six feet down with a piece of rebar and a hole
5 identifying marker.

6 JUDGE WARDWELL: Do you know if that was
7 done in the 1980s also, that same basic process?

8 MR. BEINS: It was done in the 1980s, yes.

9 JUDGE WARDWELL: Is there any place this
10 has been documented in the license renewal
11 application? No is an answer.

12 MR. BEINS: I don't believe that it is,
13 no.

14 JUDGE WARDWELL: In your testimony on page
15 35, answer 69, and I quote, CBR has plugged all
16 exploration holes to prevent comingling of the Brule
17 and Chadron aquifers and to isolate mineralized zones.
18 Successful plugging was tested by conducting four
19 hydrologic tests prior to mining. Are you referring
20 to the pump tests when you talk about those four
21 tests?

22 MR. BEINS: That is correct.

23 JUDGE WARDWELL: We will get to that
24 tomorrow. Finished for the day.

25 One comment, I think. I think this would

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1 be a good time, also to receive questions that we
2 haven't asked on the topics we have covered today, if
3 you are agreeing. And if they could submit those
4 tomorrow morning.

5 CHAIR GIBSON: So, your homework tonight:
6 your homework, at least the lawyer's homework tonight
7 is to review your notes on what you have heard today
8 and to draft up any questions on the testimony that we
9 have heard today from these witnesses on Contentions
10 A, C, D and F, and 14 so far. And then please give
11 those to us in the morning. And if you could get them
12 to us by maybe 30 minutes before we go on at 9:00
13 tomorrow morning, maybe at 8:30, we can review them
14 and try to get those questions together so that we
15 won't waste a lot of time. Can you all do that for
16 us? Very well.

17 If there is nothing, we will stand in
18 recess until 9:00 tomorrow morning but you all get us
19 your homework at 8:30. Thank you.

20 (Whereupon, the above-entitled matter went
21 off the record at 5:45 p.m.)
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