

Official Transcript of Proceedings
NUCLEAR REGULATORY COMMISSION

Title: Crow Butte Resources, Inc.
Marsland Expansion Area

Docket Number: 40-8943-MLA-2

ASLBP Number: 13-926-01-MLA-BD01

Location: Crawford, Nebraska

Date: Tuesday, October 30, 2018

Work Order No.: NRC-3960

Pages 300-569

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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

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In the Matter of: : Docket No.

CROW BUTTE RESOURCES, INC. : 40-8943-MLA-2

(Marsland Expansion Area) : ASLBP No.

: 13-926-01-MLA-BD01

-----x

Tuesday, October 30, 2018

Crawford Community Center

1005 First Street

Crawford, Nebraska

BEFORE:

G. PAUL BOLLWERK, Chair

THOMAS J. HIRONS, Administrative Judge

RICHARD E. WARDELL, Administrative Judge

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1	CBE019	Appendix K-1
2	CBR020	Appendix K-2
3	CBR021	Basal Chadron Conceptual Flow
4	CBR022	Regional Pumping Test Plan
5	CBR023	Regional Pumping Test Plan
6		Revisions
7	CBR024	Theis, C.V. publication
8	CBR025	Cooper, H.H publication
9	CBR026	CBE-EMP-003
10	CBR027	Deep Disposal Well Location
11		Information
12	CBR028	Appendix D-1
13	CBR029	Excerpts from Kreuzmen &
14		DeRidder
15	CBR030	Appendix FF
16	CBR031	Appendix G-1
17	CBR032	Appendix G-2
18	CBR033	Rebuttal Testimony on
19		Contention 2
20	CBR034	Rebuttal Affidavit of
21		Robert Lewis
22	CBR035	Rebuttal Affidavit of
23		Walter Nelson
24		
25		

1	<u>Exhibit</u>		<u>Mark Rec'd</u>
2	CBR036	Rebuttal Affidavit of	
3		Doug Pavlick	
4	CBR037	Rebuttal Affidavit of	
5		James Striver	
6	CBR038	Appendix S	
7	CBR039	Appendix Z	
8			
9	<u>NRC</u>	331 331
10	NRC001	Back Testimony	
11	NRC002	Back Qualifications	
12	NRC003	Lancaster Qualifications	
13	NRC004	Striz Qualifications	
14	NRC005	Trefethen Qualifications	
15	NRC006	Final Environmental Assessment	
16	NRC007	FONSI	
17	NRC008	SER	
18	NRC009	NRC Materials License SUA-1534	
19		Amendment 3	
20	NRC010	NUREG-1569	
21	NRC011	NUREG-1748	
22	NRC012	Swinehart Excerpt	
23	NRC013	Diffendal Excerpt	
24	NRC014	Back, Lancaster, Striz Rebuttal	
25		Testimony	

1	NRC015	Excerpts from Todd		
2	NRC016	Excerpts from Driscoll		
3	NRC017	ASTM Standards		
4				
5	<u>Intervenor</u>	334	334
6	OST001	Dr. Kreamer CV		
7	OST002	Wireman CV		
8	OST003	Dr. Kreamer Opinion		
9	OST004	Wireman Revised Opinion		
10	OST005	Dr. Kreamer Supplemental		
11		Testimony		
12	OST006	CBR, Inc. Aquifer Pump Test #1		
13	OST007	CBR, Inc. Aquifer Pump Test #2		
14	OST008	CBR, Inc. Aquifer Pump Test #3		
15	OST010	Dr. LaGarry Opinion		
16	OST013	Dr. LaGarry CV		
17	OST014-R	Dr. Kreamer Opinion		
18	OST015-R	Wireman Rebuttal		
19	OST016-R	LaGarry Rebuttal		
20	OST017	Maher & Shuster Poster		
21	OST018	Maher publication		
22	OST019	Lewis & Haeni publication		
23	OST020	Hallum & others publication		
24				
25				

P R O C E E D I N G S

8:00 a.m.

CHAIR BOLLWERK: Good morning. Let me begin by introducing ourselves. To my right is Dr. Richard Wardwell. Judge Wardwell is a civil engineer specializing in hydrogeological and waste disposal matters, and a full-time member of the Atomic Safety and Licensing Board Panel. To my left is Dr. Thomas Hirons. Judge Hirons is a nuclear engineer and a part-time Panel member.

My name is Paul Bollwerk, I'm an attorney and a full-time Panel member, and the Chairman of this Atomic Safety and Licensing Board.

Each of us is an independent administrative judge appointed by the five-member Nuclear Regulatory Commission as members of the Atomic Safety and Licensing Board Panel.

Members of the Panel are designated by the Agency's Chief Administrative Judge acting at the behest of the Commission to serve on three judge licensing boards such as this one that preside over hearings in which the Atomic Energy Act permits a hearing to be held relative to the construction or operation of nuclear power plants, the use of nuclear materials, and/or the storage of nuclear waste.

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1 The Panel's administrative judges do not
2 work for or with the NRC staff relative to the staff's
3 own technical review of such licensing and enforcement
4 matters. Rather, we're charged with deciding in the
5 first instance what issues will be litigated in the
6 hearing and, for those issues we find litigable,
7 making a determination regarding their substantive
8 validity in terms of granting, conditioning, or
9 denying the requested license, or sustaining or
10 modifying the proposed enforcement action.

11 Our decisions on hearing matters generally
12 are subject to review, first by the Commission, the
13 Agency Supreme Court, and then by the federal courts,
14 including in appropriate instances, the United States
15 Supreme Court.

16 This licensing board is here today to
17 conduct an evidentiary hearing regarding the
18 application submitted by Crow Butte Resources, Inc.,
19 in May 2012 requesting an amendment to its 10 CFR Part
20 40, that's Code of Federal Regulations Part 40, source
21 materials license that authorizes the operation of its
22 existing in situ uranium recovery, or ISR, facility
23 near Crawford, NB.

24 Specifically, Crow Butte Resources asked
25 that the Nuclear Regulatory Commission, or NRC,

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1 authorize the operation of a satellite in situ
2 recovery facility, the Marsland Expansion Area, or MEA
3 site, which is located in Dawes County, NB, some 11
4 miles to the southeast of Crow Butte Resources'
5 Crawford Central Processing Facility.

6 In November of 2012, the Commission issued
7 a notice in Volume 77 of the Federal Register at page
8 71,454 outlining the process for becoming a party in
9 a hearing contesting the Crow Butte Resources
10 application.

11 In January 2013, the Oglala Sioux Tribe
12 and a group consisting of three individuals and two
13 organizations, collectively referred to as the
14 Consolidated Petitioners, each filed intervention
15 petitions challenging various aspects of the Crow
16 Butte Resources application and the accompanying
17 Environmental Report, or ER.

18 In a May 2013 decision, LBP-13-6, reported
19 in Volume 77 of the Nuclear Regulatory Commission
20 Issuances at page 253, the Board found that while the
21 individuals and organizations affiliated with the
22 Consolidated Petitioners had failed to establish their
23 standing or legal interest in this proceeding, the
24 Tribe did have standing, and it proffered two
25 admissible Atomic Energy Act-related safety or

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1 National Environmental Policy Act, or NEPA-related
2 environmental contentions or issue statements. A
3 decision the Commission subsequently affirmed in CLI-
4 14-2, recorded in Volume 79 of NRC Issuances at page
5 11.

6 One of those admitted issues, Contention
7 1, raised NEPA and National Historic Preservation Act-
8 related cultural resource concerns. Thereafter, with
9 the June 2014 issuance of a portion of the NRC staff's
10 draft Environmental Assessment concerning cultural
11 resource matters for the Marsland facility, in October
12 2014 the Licensing Board granted an NRC staff
13 dispositive motion seeking resolution of Contention 2
14 in its favor.

15 Entitled "Failure to include adequate
16 hydrogeological information to demonstrate ability to
17 contain fluid migration," the other admitted Tribe
18 issue statement, Contention 2, as originally framed,
19 challenged the adequacy of hydrogeological information
20 in the Crow Butte Resources application on both Atomic
21 Energy Act safety-related and NEPA-related
22 environmental grounds.

23 With the issuance of the remaining
24 portions of the NRC staff's draft Environmental
25 Assessment in December 2017, and the staff's final

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1 Environmental Assessment in April 2018, the focus of
2 the environmental portions of Contention 2 shifted
3 from Crow Butte Resources Environmental Report to the
4 staff's Environmental Assessment, as reflected in
5 Board rulings in March and July of 2018.

6 As a consequence, over the next several
7 days, the concerns under consideration relative to
8 Contention 2 will be, first, whether the descriptions
9 of the affected environment are insufficient to
10 establish the potential effects of the proposed in
11 situ recovery operation on the adjacent surface water
12 and groundwater resources.

13 Second, whether a description of the
14 affective porosity, hydraulic conductivity, and
15 hydraulic gradient of site hydrology -- hydrogeology,
16 excuse me, is absent along with other information
17 relative to the control and prevention of exclusions.

18 Third, whether an acceptable conceptual
19 model of site hydrology adequately supported by the
20 data presented in the site characterization has been
21 adequately developed to demonstrate with scientific
22 confidence that the area hydrogeology -- including
23 horizontal and vertical hydraulic conductivity -- will
24 result in the confinement of extraction fluids and
25 expected operational and restoration performance.

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1 And fourth, whether the staff's
2 Environmental Assessment contains unsubstantiated
3 assumptions as to the location of the aquifers in the
4 ore-bearing zones.

5 With us today as parties to the hearing
6 are Applicant, Crow Butte Resources, the NRC staff,
7 and the Oglala Sioux Tribe. Let's have the parties
8 identify themselves for the record, starting with Crow
9 Butte Resources, then moving to the staff, then
10 finally the Oglala Sioux Tribe.

11 MR. SMITH: Good morning, Your Honor, this
12 is Tyson Smith, Counsel for Crow Butte Resources. At
13 the table in front of me I have, starting at your
14 right, Mr. Bob Lewis, Mr. Jim Striver, Mr. Doug
15 Pavlick, and Mr. Walt Nelson.

16 CHAIR BOLLWERK: Thank you. NRC staff.

17 MS. SIMON: Good morning, Your Honor, this
18 is Marsha Simon for the staff. Next to me at counsel
19 table are Emily Monteith and Rob Carpenter. And in
20 front of me at the witness table, again starting on
21 your right, are Mr. David Back, Mr. Tom Lancaster, Dr.
22 Elise Striz, and Ms. Jean Trefethen.

23 CHAIR BOLLWERK: Thank you, and for the
24 intervenor.

25 MR. BALLANCO: Good morning, Your Honor,

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1 this is Tom Ballanco representing the Oglala Sioux
2 Tribe. With me at counsel table is David Frankel.
3 Our witnesses are Mike Wireman, Dr. Hannan LaGarry,
4 and live on the video tape, Dr. David Kreamer.

5 CHAIR BOLLWERK: Thank you very much. As
6 outlined in the Board's October 3 issuance regarding
7 the administration of this evidentiary hearing,
8 because of the issues of the availability of tribal
9 witnesses, the concerns will be presented in an order
10 slightly different than what was presented above.

11 Specifically, Concern 2 will be dealt with
12 first, followed by Concern 1, then Concerns 3 and 4,
13 with the possibility that Board questions for Tribe
14 witness Dr. LaGarry regarding his testimony on
15 stratigraphy and containment pathways may come after
16 the Board has finished with Concern 1 or after it has
17 concluded with Concerns 3 and 4. We'll sort of play
18 that by ear depending on how things are going.

19 Further, as we indicated during the May 6
20 teleconference with the parties, and we contemplate
21 empaneling all three parties' witness panels at the
22 same time to allow for more robust interchange of
23 views in response to Board questions.

24 Also, while the Agency's 10 Code of
25 Federal Regulations Part 2, Subpart (1), simplified

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1 hearing procedures governing this proceeding
2 contemplate that all questions for the parties'
3 witnesses will be posed by the Board, from time to
4 time we will pause to allows that parties to propose,
5 and the Board to consider, additional questions for
6 the Board to put to the witnesses.

7 And I think our plan at this point is
8 generally when we're finished with a concern, at that
9 point we will be looking for any proposed questions
10 you all might have.

11 Finally, as part of our July 27 guidance
12 on the conduct of this evidentiary hearing, we
13 indicated that we would afford Counsel an opportunity
14 to make brief opening statements. In that regard, in
15 a moment we'll turn first to Counsel for the Oglala
16 Sioux Tribe for its opening statement, followed by the
17 opening statements of Crow Butte Counsel and of the
18 NRC staff Counsel.

19 Before we do so, however, I wanted to
20 mention another aspect of this proceeding. As the
21 Board has noted in various issuances, including its
22 February 8, 2013 initial prehearing conference
23 scheduling order and the July 27, 2018 notice
24 regarding this evidentiary hearing session, which was
25 published in the Federal Register, Volume 83, at page

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1 37,828, under Section 2.315(a) of Title 10 of the Code
2 of Federal Regulations, presiding officers are
3 authorized to entertain limited appearance statements
4 from members of the public who are not otherwise party
5 to the proceeding.

6 These statements, which are placed in the
7 official Agency docket of the proceeding, are intended
8 as an opportunity for members of the public to express
9 their views about and may help the Board and/or the
10 parties in their consideration of the issues in a
11 proceeding.

12 At this juncture, the Board has received
13 several written limited appearance statements and
14 conducted a transcribed session in Chadron, Ohio this
15 past Sunday afternoon at which approximately 20
16 members of the public were afforded the opportunity to
17 present their views and concerns to the Board orally.

18 If, however, there is anyone here who
19 would like to provide the Board with a written limited
20 appearance statement, there are forms available in the
21 back of the room that you can complete and place in
22 the box on the table before this evidentiary
23 proceeding adjourns. Or, if you prefer, you can
24 submit a statement by mail, facsimile transmission, or
25 email by following the instructions provided in the

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1 Federal Register notice published in Volume 83 at
2 pages 37,829-37,830.

3 As amended relative to the facsimile
4 transmission number to be used in the Federal Register
5 notice, which was published in Volume 83 at page
6 48,874, as well as the information flyer that's
7 available at that back of the room.

8 And I would mention there are information
9 flyers about this proceeding available at the back of
10 the room. Please feel free to take one if you like,
11 as well as small pamphlets that describe the Atomic
12 Safety and Licensing Board Panel and what our
13 authority and function is within the Agency.

14 In addition, I would observe that today we
15 will be utilizing some technology that will aid the
16 Board and parties in conducting a more efficient
17 proceeding. This may involve some interchange between
18 the Board and our Information Technology Technician,
19 Joseph Deucher, who is sitting over to my right.

20 In particular, we anticipate using display
21 technology as part of the evidentiary presentation,
22 which will enable Counsel and those in the audience to
23 observe the witnesses as they testify, as well as make
24 the documentary information we will be discussing with
25 the parties and witnesses more accessible and

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1 understandable.

2 And as a consequence of the witness
3 availability issues I mentioned previously, Oglala
4 Sioux Tribe witness Dr. David Kreamer will be
5 participating remotely from Las Vegas, Nevada via
6 GoToMeeting both today and on Thursday.

7 Finally, as we begin today's evidentiary
8 hearing, I would note that this is my cell phone,
9 which is in my pocket, and I have turned it off. I
10 would ask that all cell phones and similar electronic
11 devices in the hearing room be turned off or placed on
12 vibrate, and that any cell phone conversations be
13 conducted outside this room. That will be the rule
14 throughout this proceeding when it's in session.

15 Also, no food or beverages, other than
16 water, are to be consumed in this hearing room while
17 the hearing's in session, and I thank you for doing
18 that.

19 Let's now turn to Counsel for the Oglala
20 Sioux Tribe for the Intervenor's opening statement to
21 whatever degree they wish to add such a statement.

22 MR. BALLANCO: Good morning, Your Honor,
23 Counsel, experts, guests. I am Tom Ballanco, I am
24 honored to be representing the Oglala Sioux Tribe on
25 these important, this important contention.

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1 At the outset, I'd like to say that the
2 Oglala Sioux Tribe, and the Lakota People in general,
3 are defined by nothing else than by their culture and
4 their connection to a way of life that existed in this
5 very place for generations, hundreds of generations.

6 There is no doubt, both in this proceeding
7 and in every proceeding involving traditional Lakota
8 lands, that the Tribe has been very interested in
9 protecting its cultural resources and understanding
10 the process of the proceedings and the rulings of the
11 Board.

12 We do still object to dismissal of
13 Contention 1, the cultural resources contention. We
14 believe that it is the very definition of the trust
15 responsibility for an agency to ensure that the known
16 values of a tribal interest are protected through
17 these proceedings.

18 Leaving that aside, I do acknowledge and
19 want to thank this Board, NRC staff, and Counsel for
20 Crow Butte for indulging these stumbles that we have
21 made along the way. This is a new process, even
22 though we've been doing it for some time.

23 I do acknowledge the Board has made many
24 efforts to make our presentation possible, including
25 Dr. Kreamer here via video conference this morning.

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1 We do appreciate that, and we welcome you here and
2 appreciate you being here.

3 Turning to the contention at hand, the
4 Oglala Sioux Tribe believes that we do not have an
5 accurate characterization of the hydrogeology involved
6 in the Marsland Expansion Area. We believe that NEPA
7 requires a thorough understanding of what is going on
8 in the subsurface.

9 There is no doubt, I think, between those
10 of us sitting at a table here that were mining to
11 commence at the Marsland Expansion Area, as with every
12 other in situ leach mining operation in the world,
13 when it comes time to wrap up and restore, it will be
14 impossible to return the aquifer to baseline premining
15 levels. We understand that there will be ACLs.

16 Without trying to litigate or relitigate
17 the strata findings, we do acknowledge that that
18 process begins here. The reason that ISL mines cannot
19 restore to premining conditions begins with the fact
20 that we don't have a clear picture of what those
21 premining conditions are and what the characteristics
22 of the mining environment are before mining begins.
23 And we'd like to see that become the manner in which
24 licenses are granted.

25 We believe the NRC practice of issuing a

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1 license prior to completing the NEPA process goes
2 against the spirit of NEPA, and in fact, is contrary
3 to federal law on the issue. We'll present experts
4 that will demonstrate that the picture presented in
5 the EA and the various reports from Crow Butte is
6 incomplete and has not been subjected to the hard look
7 standard.

8 We welcome your questions, and again, we
9 thank you for engaging us on this subject. Thank you.

10 CHAIR BOLLWERK: Thank you, sir. And
11 perhaps if, maybe Dr. LaGarry, the microphone that's
12 in the middle, if you could just point that -- not
13 yours but the one next to it. Could you bring that
14 down a little bit? Unfortunately, it was kind of in
15 the way there.

16 The microphones are fairly directional by
17 the way, so if you have them in front of you, you're
18 going to do just fine. All right, then Counsel for
19 Crow Butte, please. I think we have a clear shot of
20 you, so --

21 MR. SMITH: All right, good morning. On
22 behalf of Crow Butte, I'd like to thank the judges,
23 the parties, and members of the public for coming to
24 Crawford this morning for these hearings. We welcome
25 the opportunity to address the issues raised in the

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1 one admitted contention and to answer questions from
2 the judges.

3 As you know, Crow Butte submitted its
4 application for the Marsland Expansion Area several
5 years ago. That application included the results of
6 intensive, in-depth site investigations and analysis
7 of the proposed Marsland Expansion Area satellite
8 facility. Since then, the NRC has conducted its own
9 independent assessment of the application and
10 performed the required analyses under the National
11 Environmental Policy Act.

12 The NRC staff's Safety Evaluation Report
13 documents the technical and safety aspects of the NRC
14 staff's review and includes an assessment of Crow
15 Butte's compliance with the applicable requirements of
16 10 CFR Part 40.

17 The Safety Evaluation Report concludes
18 that the application complies with the standards and
19 requirements of the Atomic Energy Act and the
20 Commission's regulations, and that measures are in
21 place to protect the public and minimize danger to
22 life or property.

23 The NRC staff also completed a
24 comprehensive Environmental Review, culminating in
25 issuance of a final Environmental Assessment. Based

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1 on its review of the proposed action, the NRC
2 determined that the Marsland Expansion Area Satellite
3 Facility will not significantly affect the
4 environment.

5 As you'll hear from Crow Butte and NRC
6 staff witnesses, the issues raised in the admitted
7 contention have been the subject of extensive reviews.
8 In contrast, the intervenors make only broad
9 assertions regarding site hydrogeology and present
10 only vague claims that additional or alternative
11 analyses should be performed.

12 None of these alleged deficiencies calls
13 into question the adequacy of the application, the
14 Safety Evaluation Report, or the reasonableness of the
15 Environmental Assessment.

16 As these hearings will demonstrate, Crow
17 Butte has fully addressed those matters NRC
18 regulations require to be addressed, including those
19 raised in Contention 2. Contention 2 should be
20 resolved in favor of Crow Butte and the NRC staff. We
21 look forward to answering any questions you might
22 have. Thank you.

23 CHAIR BOLLWERK: Thank you, sir. The NRC
24 staff.

25 MS. SIMON: Thank you and good morning,

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1 Your Honors. The NRC staff appreciates this
2 opportunity to appear before the Board to present its
3 case on this contention. The reasons discussed in the
4 staff's testimony and exhibits, the staff's position
5 is that the Environmental Review for the Marsland
6 Expansion Area -- as documented in the final
7 Environmental Assessment -- complies with the
8 requirements of the National Environmental Policy Act
9 and NRC's environmental regulations.

10 Because the staff has already outlined its
11 position in detail in its initial and rebuttal
12 statements of position, I will limit these opening
13 remarks to touch on key points of the staff's
14 position. But before I do so, I would like to briefly
15 review some principles related to NEPA that inform the
16 Board's consideration of the environmental aspects of
17 this contention.

18 Under NEPA, the NRC is required to take a
19 hard look at potential environmental impacts of a
20 proposed action to inform its decision and to inform
21 the public. This hard-look standard is balanced,
22 however, by a rule of reason which requires agencies
23 to address only those impacts that are reasonably
24 foreseeable, not ones that are remote and speculative.

25 The staff is only required to provide a

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1 reasonably thorough discussion of significant aspects
2 of the environmental issues and need not address every
3 effect that could potentially result from the proposed
4 action. A NEPA document is not a research report.
5 NEPA does not call for certainty or precision, but
6 instead calls for an estimate of potential impacts.

7 In addition, the Commission has emphasized
8 that licensing boards do not sit to flyspeck the
9 staff's NEPA documents or add details or nuances. The
10 purpose of a hearing is not to parse or fine-tune the
11 staff's NEPA document, or to edit it to suit an
12 intervenor's preferred language or emphasis.

13 If the staff's Environmental Review
14 document on its face comes to grips with all important
15 considerations, that is sufficient. With these
16 principles in mind, I will briefly summarize key
17 aspects of the staff's position on the four asserted
18 deficits that comprise this contention.

19 First, the staff's EA and the MEA
20 application provide a thorough description of the
21 affected environment sufficient to establish potential
22 impacts to surface water and groundwater resources.
23 The staff describes in its testimony the information
24 needed with respect to geologic setting, surface water
25 hydrology, and groundwater hydrology consistent with

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1 staff guidance in NUREG-1748 and NUREG-1569 and
2 identifies where in the EA that information is
3 provided.

4 The staff also notes that its discussions
5 in the EA are based on descriptions and supporting
6 information that are in the MEA application.

7 Second, although the intervenors assert
8 that certain information on hydraulic parameters of
9 aquifers was missing from the MEA application, the
10 staff explains in its testimony where each of those
11 parameters is discussed in the application, and that
12 the information provided was sufficient for the
13 staff's review.

14 Third, the MEA application and the EA
15 present an acceptable hydrological conceptual model
16 for the MEA that is adequately supported by extensive
17 site characterization data. The staff's testimony
18 describes the components of a hydrological conceptual
19 model and identifies where they are discussed in the
20 EA.

21 The staff also describes in its testimony
22 the comprehensive subsurface investigation conducted
23 by Crow Butte, as well as the reliability of the data
24 and the methods used to obtain them.

25 With regard to the applicant's ability to

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1 demonstrate confinement, the staff's testimony
2 reiterates and amplifies the bases for confinement
3 discussed in the EA and the multiple lines of evidence
4 supporting the conclusion that ISR production fluids
5 will be adequately confined.

6 Likewise, the staff's testimony reinforces
7 the discussion in the EA in which the staff thoroughly
8 considered various potential contamination pathways,
9 including horizontal excursions, vertical excursions,
10 leaks and spills, and preferential pathways such as
11 faults.

12 Finally, the EA and the MEA application
13 did not contain unsubstantiated assumptions regarding
14 isolation of aquifers. The intervenors did not
15 identify any such assumptions in either document, and
16 in its testimony, the staff explains how statements
17 related to isolation of aquifers are substantiated by
18 extensive and reliable supporting information and
19 data.

20 In summary, the staff's Environmental
21 Review of the MEA, as documented in the final
22 Environmental Assessment, complies with the
23 requirements of NEPA and the NRC's environmental
24 regulations. The staff has provided testimony in
25 supporting exhibits that meet its burden of proving,

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1 by a preponderance of the evidence, that the
2 intervenor's challenges to the final EA are without
3 merit.

4 It is also the staff's position that the
5 MEA application provided sufficient information for
6 the staff to make necessary safety findings under the
7 applicable regulations. For these reasons, this
8 contention should be decided in favor of the staff and
9 CBR. Thank you.

10 CHAIR BOLLWERK: Thank you, appreciate all
11 the counsels' opening statements clarifying your
12 positions. Thank you very much.

13 All right, at this point let's go ahead
14 and move on to the business at hand. The first thing
15 we need to do is to get those witnesses sworn in and
16 to admit the exhibits. What I'd like to do briefly is
17 we'll go, use the order of Crow Butte, the staff, and
18 the intervenor. And what we're going to do is swear
19 in the witnesses, and then we will put in the
20 evidentiary material.

21 We're going to do that by using the list
22 that we provided you all, which lists all the
23 exhibits, excuse me. And I'll simply identify them by
24 number, the list will put into the transcript, which
25 will have the other identifying information, the

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1 title, and that way we'll have a clear record as to
2 exactly what was admitted into evidence.

3 I should mention that I don't consider
4 this the final list of exhibits. There could be
5 things that happen during the next several days that
6 would require putting additional evidentiary material
7 in.

8 Also, when we issue the final exhibit
9 list, I'd anticipate that that will include the Adams
10 ML accession numbers in that list as well. And we'll
11 probably do that about the same time as we adopt any
12 transcript corrections and close the record. So
13 that's the way I'd like to proceed.

14 So the first exhibit we're going to deal
15 with is BRD001, which is the joint stipulation.

16 (Whereupon, the above-referred to
17 document was marked as Exhibit BRD001 for
18 identification.)

19 CHAIR BOLLWERK: And all these exhibits
20 have been subject to a motion, or I should say that
21 one was agreed to by the parties. The others have
22 been subject to a motion in limine, so I'm simply
23 going to indicate that that exhibit is identified for
24 the record and admitted.

25 (Whereupon, the above-referred to

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1 document was received into evidence as
2 Exhibit BRD001.)

3 CHAIR BOLLWERK: Let's move on then to
4 Crow Butte Resources. Did you want to introduce your
5 witnesses again? I recognize you already did that
6 once, but --

7 MR. SMITH: Certainly. For Crow Butte
8 Resources, we have on the judge's right we have first
9 up Bob Lewis, Jim Striver, Doug Pavlick, and Walt
10 Nelson.

11 CHAIR BOLLWERK: All right, thank you.
12 All right, gentlemen, I need all of you to raise your
13 right hand if you would, please. And I need an
14 affirmative response, an oral affirmative response to
15 the question I'm going to ask you.

16 Do you swear or affirm that the testimony
17 you give in this proceeding will be the truth, the
18 whole truth, and nothing but the truth?

19 Let's just start at that end and just
20 right down the line, yes or no.

21 (Witnesses sworn.)

22 CHAIR BOLLWERK: Thank you. All right,
23 let's deal then briefly with the Crow Butte exhibits.
24 And we're looking then at Crow Butte, we're looking at
25 CBR001-R, CBR002 through CBR004, CBR005-R, CBR006,

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1 CBR007, CBR008-R, and CBR009 through CBR039.

2 (Whereupon, the above-referred to
3 documents were marked as Exhibits CBR001-
4 R through CBR039 for identification.)

5 CHAIR BOLLWERK: All those exhibits are
6 identified for the record and admitted into evidence.

7 (Whereupon, the above-referred to
8 documents were received into evidence as
9 Exhibits CBR001-R through CBR039.)

10 CHAIR BOLLWERK: Thank you very much.
11 Let's then turn to the NRC staff. If you could
12 identify again your witnesses, please.

13 MS. SIMON: Certainly, Your Honor. Again,
14 from the judge's right we have David Back, Tom
15 Lancaster, Elise Striz, and Jean Trefethen.

16 CHAIR BOLLWERK: All right. Then if you
17 all could raise your right hand, please. And again,
18 I'm going to need an affirmative oral response from
19 each of you to the question I'm going to ask. Do you
20 swear or affirm the testimony you will give in this
21 proceeding will be the truth, the whole truth, and
22 nothing but the truth? Let's start on this end.

23 (Witnesses sworn.)

24 CHAIR BOLLWERK: All right, thank you very
25 much. Let's deal briefly then with the staff's

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1 exhibits, which are actually a little bit easier
2 because it's NRC001-NRC017.

3 (Whereupon, the above-referred to
4 documents was marked as Exhibits NRC001-
5 NRC017 for identification.)

6 CHAIR BOLLWERK: Those exhibits are
7 identified for the record and admitted into evidence.

8 (Whereupon, the above-referred to
9 documents were received into evidence as
10 Exhibits NRC001-NRC017.)

11 CHAIR BOLLWERK: Let's then turn to the
12 intervenors. If you could please one more time for
13 the record identify your witnesses, please.

14 MR. BALLANCO: Good morning, Your Honor.
15 On the Board's right we have Dr. Hannan LaGarry, Mike
16 Wireman, and on camera, Dr. David Kreamer.

17 CHAIR BOLLWERK: All right. Before I
18 swear you in, I just want to talk with, for a second,
19 with Dr. LaGarry. And as you all, as Counsel are
20 aware, I'm sorry, not with Dr. LaGarry, excuse me.
21 With Dr. Kreamer, I apologize.

22 Dr. Kreamer, Counsel are here aware that
23 last night we got a late-night email saying that you
24 were having some travel difficulties. Now, there was
25 already a plan because of some conflicts that you had

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1 to bring you in by video conference, by GoToMeeting,
2 actually on Thursday. We're now doing that today as
3 well. And we're glad to have you here with us, sir.

4 But one thing I do need to let you know
5 beforehand is we're going to be very interested, sir,
6 in making sure you're there in that room alone, or if
7 anyone comes into the room, that you tell us about
8 that. And I'm hoping that when we swear you in you're
9 going to, obviously going to do that, all right.

10 And the folks here are basically using the
11 evidentiary record. So again, this is not open time
12 to go searching on the Internet for answers. My
13 assumption is you're going to testify on the basis of
14 what you've already told us, as well as the
15 evidentiary record. And you understand that as well?

16 DR. KREAMER: That is correct. And I want
17 to thank Your Honors for allowing your time. My
18 flight was delayed about five or six hours. I was
19 supposed to come in about 4:00 in the morning, and I
20 would have been late for this hearing. I was delayed
21 in the flight.

22 CHAIR BOLLWERK: All right. Let me just
23 check with our IT person, Joe. Are we all right in
24 terms of anything he needs to do to make the audio
25 work better?

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1 (Off-the-record comments.)

2 CHAIR BOLLWERK: All right, I don't know
3 how your microphone is set up, but Dr. Kreamer, but
4 maybe you could move it a little closer?

5 DR. KREAMER: Okay, is this better?

6 CHAIR BOLLWERK: Better? All right.
7 Hopefully that's not going to be a problem with him
8 dropping in and out, but we'll proceed on. All right,
9 then. As I did before, I would appreciate all three
10 of you gentlemen, if you could raise your right hand,
11 please.

12 And I'm going to need an oral affirmative
13 response to the question I'm going to ask you. And
14 we'll go ahead, when I ask for those responses, we'll
15 start with Dr. Kreamer, and then we'll move to the
16 gentlemen here in the room.

17 Do you swear or affirm that the testimony
18 you give in this proceeding will be the truth, the
19 whole truth, and nothing but the truth? Dr. Kreamer?

20 DR. KREAMER: Yes.

21 CHAIR BOLLWERK: And gentlemen?

22 (Witnesses sworn.)

23 CHAIR BOLLWERK: All right, let's deal
24 then briefly with the exhibits for the Oglala Sioux
25 Tribe. And we're going to start with OST001-OST003,

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1 then OST004-R, then OST005-OST008. OST010, OST013,
2 OST014-R, OST015-R, OST016-R, and then OST017 though
3 OST020.

4 (Whereupon, the above-referred to
5 documents was marked as Exhibits OST001-
6 OST020 for identification.)

7 CHAIR BOLLWERK: And those evidentiary
8 materials are identified for the record and admitted
9 into evidence.

10 (Whereupon, the above-referred to
11 documents were received into evidence as
12 Exhibits OST001-OST020.)

13 CHAIR BOLLWERK: And at this point, I
14 think, unless Counsel have anything further, we'll go
15 ahead and proceed with the testimony of the witnesses.
16 All right, then, why don't we go ahead. I came within
17 one minute of 8:30, so --

18 JUDGE WARDWELL: Very good, thank you
19 kindly. Welcome, everyone. I'm glad you're here to
20 go through some fairly technical discussions we're
21 liable to have over the next few days. A couple
22 comments I wanted to make before we get started is
23 that time is of the essence. We've got a lot to
24 cover. We have read all the prefiled testimony and
25 the rebuttal testimony associated with it, so we're

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1 well aware of that.

2 The questions we have are ones that just
3 came up in regards to reading that information. As
4 the questions are asked, I would encourage you all to
5 be very succinct in your answer. We generally do not
6 need a very long discussion of any particular
7 question, but just ask the question that's there.

8 Oftentimes, and I can speak from my own
9 personal experience as an expert witness, we tend to
10 answer the question we want to answer and not the one
11 that's been asked. And I would encourage you not to
12 do that. If I do interrupt you, it's because it would
13 seem to me that you're not addressing what's of
14 interest for the Board.

15 And so I'll try to clarify that. It's
16 probably, oftentimes it's going to be my fault that I
17 haven't clarified exactly what I'm after. But don't
18 feel I'm being rude; I'm going to stop you just for
19 the sake of the time commitments we have here and to
20 get us back onto addressing those particular items
21 that the Board feels it needs some additional
22 information on.

23 CHAIR BOLLWERK: Can I do one procedural
24 thing before you begin? It struck me --

25 JUDGE WARDWELL: Do I have a choice?

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1 CHAIR BOLLWERK: Well, probably not,
2 actually.

3 JUDGE WARDWELL: Go ahead.

4 CHAIR BOLLWERK: But let me just read into
5 the, we haven't really read into the record the
6 contention we're doing, actually the language of the
7 contention. Let me do that very briefly.

8 The contention we're going to be dealing
9 with is OST, Oglala Sioux Tribe, Contention 2, Failure
10 to include adequate hydrogeological information to
11 demonstrate ability to contain fluid migration.

12 And the language of the contention reads:
13 The application and final Environmental Assessment
14 failed to provide sufficient information regarding the
15 geological setting of the area to meet the
16 requirements of 10 Code of Federal Regulations Part
17 40, Appendix A, Criteria 4(e) and 5G(2), the National
18 Environmental Policy Act, and NUREG-1569, Section 2.6.

19 The application and final Environmental
20 Assessment similarly fail to provide sufficient
21 information to establish potential effects of the
22 project on the adjacent surface and groundwater
23 resources, as required by NUREG-1569, Section 2.7, and
24 the National Environmental Policy Act.

25 And Concern 2, which we're going to deal

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1 with first, challenges exclusively as a safety
2 concern, the absence of the applicant's technical
3 report, in accord with NUREG-1569, Section 2.7, of a
4 description of the effective porosity, hydraulic
5 conductivity, and hydraulic gradient of site
6 hydrogeology, along with other information relative to
7 the control and prevention of exclusions, such as
8 transmissivity and storativity. Excuse me, did I
9 pronounce that correctly? That's it.

10 JUDGE WARDWELL: Thank you. If it is a
11 yes/no question, answer it as a yes/no question.
12 We'll give you a chance to elaborate, more than
13 likely, on it, but please stick with that. I'm not
14 trying to bring up a series of questions that are then
15 designed to trap you. I'll probably say beforehand
16 where I'm going with a series of questions just so you
17 know where it's going. So that's at least my goals of
18 doing this.

19 The one other thing you'll notice is that
20 several times I will refer to sections in the list of
21 questions that I have. I have organized this, as has
22 already been talked about, in regards to the various
23 concerns that we are talking about, the four concerns.

24 So the first level of organization is
25 those concerns, of which we're going to start off with

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1 Concern 2 today, and then the subheadings that I end
2 up addressing are really directly related to the
3 prefiled testimony of the Oglala Sioux Tribe.

4 That's why, that's the reference for them,
5 and I'll be saying those, if nothing more so that when
6 I read the transcript, I know where I'm at in regards
7 to the proceeding as it took place. And you might
8 also yourselves find it useful to have those as a
9 particular guideline.

10 But if you look at them, I think you'll
11 see that it addresses the organization of the major
12 witness or witnesses that are responding to a given
13 concern, and that's the suborganization for that.

14 So with that said, I think we'll start
15 right on in on Concern 2, and it's Dr. Kreamer's area
16 that he provided the bulk of the testimony from. So
17 we'll spend most of the time with him, probably the
18 rest of the day.

19 It does deal, as Concern 2 does say, it's
20 a description of the effective porosity, hydraulic
21 conductivity, hydraulic gradient of the site
22 hydrogeology is absent, along with other information
23 relative to the control and prevention of excursions.

24 And I think I'd like to just get a, make
25 sure that you and I are on the same page, Dr. Kreamer,

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1 and I'll kind of try to paraphrase what I see is the
2 heart of your testimony, and then we'll go in and
3 certainly address most of the detail associated with
4 it.

5 But as I look at it, I say, it seems to me
6 that while you have other criticisms of the
7 correctness and the thoroughness of the analysis
8 performed by the applicant, it seems to me, is it not
9 a fair assessment that the heart of your testimony is
10 that the strata at the MEA is heterogeneous and
11 isotropic, and these are as a result of fractures of
12 the upper confining unit. Is that a fair assessment
13 of the bulk of your testimony?

14 THE WITNESS: No.

15 JUDGE WARDWELL: Would you like to
16 elaborate a little on that, if you could do it quickly
17 without a long dissertation of?

18 THE WITNESS: Absolutely. I also want to
19 say there is an echo, a delayed echo of what I hear.
20 And so it's one of the --

21 JUDGE WARDWELL: Okay, I'm going to have
22 to interrupt now. We're going to have to square away
23 this audio before we can proceed much further. You're
24 in and out. And it doesn't seem to appear as
25 directional, but --

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1 THE WITNESS: If I take off my audio, does
2 that help?

3 JUDGE WARDWELL: I got to look to Joe for
4 this one.

5 (Off-the-record comments.)

6 JUDGE WARDWELL: You have no other
7 solutions with leaving the video in place, Joe, in
8 regard to correcting that?

9 (Off-mic comments.)

10 JUDGE WARDWELL: Okay, try to elaborate
11 now, Dr. Kreamer, see if that's any better.

12 THE WITNESS: Okay, there is a delay on my
13 end. If I speak slowly, it works out. If I speak
14 quickly, it all runs together and then you would get
15 this sort of effect.

16 JUDGE WARDWELL: And is that a video
17 thing, do you think, Joe, and that's why?

18 (Off-mic comments.)

19 CHAIR BOLLWERK: Can he speak slowly, you
20 want to try that? Let's try that for a while, and if
21 it doesn't, we'll go to straight audio.

22 JUDGE WARDWELL: Okay.

23 THE WITNESS: I'll try to be as quick as
24 I can. You did embody half of what I said, that the
25 area is not homogenous entirely.

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1 CHAIR BOLLWERK: Let's just go to the
2 audio.

3 THE WITNESS: But one of my major
4 contentions --

5 CHAIR BOLLWERK: Dr. Kreamer, just wait
6 one second, we're going to switch our -- switch the
7 audio here.

8 THE WITNESS: Okay. I can also call up on
9 my telephone.

10 (Off-the-record comments.)

11 JUDGE WARDWELL: Okay, why don't you go
12 ahead and continue with your elaboration of your
13 answer, you know, to my first question.

14 THE WITNESS: Generally there's an
15 inadequacy in the number of tests. There was only one
16 pumping test. The cone of depression didn't cover the
17 entire site.

18 JUDGE WARDWELL: Okay, can I interrupt
19 you, Dr. Kreamer?

20 THE WITNESS: Yes, you may.

21 JUDGE WARDWELL: Well, I already have
22 anyhow, so. And that's what I meant by my
23 introductory phrase, while you have other criticisms
24 of the correctness and thoroughness of the analysis,
25 and we will get into details, we're going to go

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1 through all of the testimony, I just wanted to do a
2 broad brush painting of what my overview was.

3 And so the topics you're now talking about
4 I think are within that correctness and thoroughness
5 of the analysis that you do have criticisms for, and
6 trust me, we will get into them. But continue then
7 with anything else that you might want to say in
8 regards to the heart of your testimony.

9 THE WITNESS: No, the lack of (inaudible
10 due to audio interference) energy is a major point.

11 JUDGE WARDWELL: Is it your position that
12 the presence of those fractures within the upper
13 confining unit are primarily established by the
14 deviations of the type curve matching from the pumping
15 test results, or are there other reasons that you see
16 of justifying the presence of those fractures?

17 THE WITNESS: I think that's primary
18 evidence.

19 CHAIR BOLLWERK: Okay, let's go, we're
20 going to have to go to the cell phone then, Joe, if
21 that's the only other option.

22 THE WITNESS: I have a landline.

23 CHAIR BOLLWERK: Any way we can get audio
24 over the phone and do the video separately without the
25 audio?

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1 (Whereupon, the above-entitled matter went
2 off the record at 8:43 a.m. and resumed at 8:48 a.m.)

3 CHAIR BOLLWERK: Let's go back on the
4 record then. Thank you.

5 THE WITNESS: Your Honor, you have zeroed
6 in on one major argument, yes.

7 JUDGE WARDWELL: Thank you. I'll start
8 off on a broad-based, on the Tribe's Exhibit 003,
9 which is Kreamer's testimony at 3, you claim that the
10 statement in the exhibit Crow Butte 016, which is the
11 pumping test report at page 6, stating that results of
12 the previous testing indicate that, you probably use
13 the phrase Basal Chadron, but as we have stipulations
14 herein, we're going to -- the Board's going to call it
15 the Basal Chadron Chamberlain Pass Formation.

16 Or we'll just use the abbreviations, the
17 BC/CPF for designating that sandstone of the aquifer.
18 Is relatively homogenous and isotropic within the
19 current Class III UIC permit area. And you claim that
20 it mischaracterizes the results of the previous
21 testing.

22 And so I think my first question for you,
23 Dr. Kreamer, is: how does this description of the
24 Basal Chadron/Chamberlain Pass Formation at the
25 existing facility have any bearing on the MEA aquifer

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1 testing?

2 THE WITNESS: Well, in the previous
3 testing a similar divergent from the place -- can you
4 hear me adequately?

5 JUDGE WARDWELL: Again, the volume's okay.
6 It ends up to be some enunciation and running together
7 of the words. But that seemed to be almost
8 acceptable.

9 THE WITNESS: I'll speak a little bit more
10 slowly, hopefully that will help. In the previous
11 tests in the Crow Butte area, there was a divergence
12 from the Theis curve that was similar. At that time,
13 the NRC asked Crow Butte with similar circumstances to
14 do additional analyses, specifically leaky aquifer
15 testing they did not ask to do at Marsland.

16 JUDGE WARDWELL: Okay. Thank you. How is
17 homogeneity and isotropy of the Basal
18 Chadron/Chamberlain Pass Formation related to vertical
19 confinement? Does it have any relationship to it?

20 THE WITNESS: Yes, an interpretation of a
21 pumping test, an aquifer test. The homogeneity
22 assumption was crucial in interpretation of whether or
23 not you have an adequate aquifer test.

24 JUDGE WARDWELL: Yes, thank you for that,
25 but as a follow-up to that, I'm more interested in

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1 what nature, who doesn't know anything about pumping
2 tests, but just in the natural situation, the
3 homogeneity/isotropy of the Basal Chadron formation,
4 does that impact vertical confinement of any of the
5 mining solutions that are put in there by nature,
6 regardless of how anyone's going to try to analyze it
7 or model it?

8 I'm interested in how would -- how does
9 nature react, and how in regards to the homogeneity
10 and the isotropy of that unit, in regards to its
11 ability to be confined within that unit itself.

12 THE WITNESS: That's a good question, Your
13 Honor. When you see a sudden change in the thickness
14 of the Basal Chadron/Chamberlain Pass Formation, that
15 could indicate a fault or a fracture. When you see
16 lack of homogeneity, as indicated by the pumping test,
17 that could indicate additional fracturing or leakage.
18 And so all those factors lend themselves to an
19 interpretation of lack of confinement.

20 JUDGE WARDWELL: Would you agree that the
21 primary impact, though, from the homogeneity and
22 isotropy is really in regards to the effectiveness of
23 maintaining an inward gradient during operations and
24 restoration?

25 THE WITNESS: No, sir.

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1 JUDGE WARDWELL: And why not?

2 THE WITNESS: Even if there is an inward
3 gradient, if there is lack of confinement or leakage,
4 that could impact surface water resources and require
5 analysis of what that effect would be.

6 JUDGE WARDWELL: And what water resources
7 are you talking about?

8 THE WITNESS: Well, it would be anything
9 in the upper Brule, the overlying Brule Formation. It
10 would impact recharge rates to the Brule and any
11 surface water drainage that would occur during storm
12 events.

13 JUDGE WARDWELL: Again, let's back up a
14 bit and first say if inward gradients are maintained,
15 how would it get up through the upper confining unit
16 if there's inward gradients established?

17 THE WITNESS: I assume by inward
18 gradients, Your Honor, you mean gradients inward
19 toward the production aquifer. Let's just call in the
20 Basal Chadron for now, but I realize it's got a longer
21 term. The inward gradient, if there is leakage, would
22 draw water from above. It would diminish the Brule
23 aquifer which overlies it.

24 And that's in communication in several
25 places with the surface water resources, potential

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1 surface water resources, and with the aquifer itself,
2 the Brule aquifer.

3 JUDGE WARDWELL: In your review of the
4 pump test analysis, did you see any signs of major
5 fractures to the extent that that would actually be
6 significant enough to draw down the entire Brule
7 aquifer during the inward gradients that are
8 established during production of the mining units?

9 THE WITNESS: Well, you said the entire
10 Brule aquifer. The Brule aquifer has not been
11 characterized adequately at all. And so it would be
12 hypothetical for me to say that the entire Brule
13 aquifer would be drained. There is significant
14 leakage indicated by the single, solitary pumping
15 test. And the Nuclear Regulatory Commission, with
16 similar circumstances at Crow Butte, asked for leaky
17 aquifer analysis, did not ask for leaky aquifer
18 analysis in this case.

19 JUDGE WARDWELL: Okay. Thank you. NRC
20 Exhibit 006, which is their Environmental Assessment,
21 in Section 3.2.2.1 at 3-10 states that the Basal
22 Chadron sandstone aquifer has not undergone
23 significant chemical, physical, or biological change
24 since its initial deposition as a stream deposit, and
25 that the sands are relatively uncemented with calcite

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1 and silica cement present only in minor amounts.

2 And they're citing Gjelstein and Collins,
3 which I know I didn't pronounce right. But it's 1988,
4 and you'll probably get a drift if you look up that
5 particular cite.

6 And so I guess I'll turn to Crow Butte.
7 And I was going to say this also in my introduction
8 that I forgot to mention, but I will generally just
9 call on the party in regards to any question and let
10 you decide who you wish to answer it.

11 And so Crow Butte, do you agree with this
12 representation, and if not, what evidence do you have
13 to provide the Board that refutes this position of
14 what the NRC stated in their EA? This is for Crow
15 Butte, one of you. Sorry?

16 MR. PAVLICK: We agree.

17 JUDGE WARDWELL: Okay, thank you. Dr.
18 Kreamer, do you agree with that representation, and if
19 not, what evidence have you provided the Board that
20 refutes this position?

21 THE WITNESS: The statement only has to do
22 with the nature of the geology, it doesn't address
23 secondary porosities or fractures. As far as the
24 parent material, yes, I don't believe the authors of
25 that particular documentation took a trip throughout

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1 the entire aquifer. And the only evidence really that
2 addresses that is the pumping test that shows leakage.

3 JUDGE WARDWELL: Thank you. Dr. Kreamer,
4 do you agree that draw-down response was detected even
5 8,800 feet from the pumping well when pumping at a
6 relatively low weight for a short timeframe compared
7 to what would occur during operations and restoration?

8 THE WITNESS: I believe the pumping test
9 had a restricted radius of influence. And the radius
10 of influence did not cover the entire site.

11 JUDGE WARDWELL: Yeah, but my question was
12 do you agree that it was 8,800 feet from the pump
13 well, and with the pump well being at a relatively low
14 rate for a short time, compared to what would happen
15 at operations and restoration?

16 THE WITNESS: I believe that's correct,
17 yes.

18 JUDGE WARDWELL: Thank you. NRC's Exhibit
19 006, again at 3.2.2.1 at 3-10, I should say, NRC
20 states that because of the properties of, and let's,
21 we will continue, I guess, with the way we're going,
22 you just call it the Basal Chadron, and recognize that
23 when we write our decision, we will be calling it the
24 Basal Chadron/Chamberlain Pass Formation.

25 And, but for the sake of brevity here

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1 we'll just use BC or Basal Chadron if everyone is in
2 agreement with that. Speak now or forever hold your
3 peace for that, but --

4 Anyhow, I'll start that over again. At
5 that same section number that I just described, NRC
6 states that because of the properties of the Basal
7 Chadron sandstone aquifer are relatively unchanged
8 since their deposition with a stream environment, they
9 would retain their primary porosity, i.e., fractures
10 have not formed and would not develop, and thus the
11 groundwater flow and the lixiviant movement is much
12 more predictable.

13 And so I guess I'll turn to NRC now and
14 say: what evidence do you have to support this
15 position that the Basal Chadron would retain this
16 primary porosity and not develop fractures?

17 MR. BACK: Yes, Your Honor. The main
18 evidence we have is looking at recent stream deposits.
19 I mean, that's what these authors are saying, is that
20 the sand as it was placed down at the time it was
21 deposited is reasonably unchanged. And so if you go
22 to alluvial or sand deposits today, you will not find
23 fractures in those deposits, uncemented, as this is
24 saying. So I mean, it basically is very fine in your
25 hand.

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1 JUDGE WARDWELL: But in that, you did not
2 have any actual field data that you could turn to in
3 regards to the MEA site. Is that correct?

4 MR. BACK: No, Your Honor. We look at
5 the, we also look at the logs that geophysics --
6 geophysical data. I mean, there's a lot of data to
7 talk about the lithology of the Basal Chadron, so --

8 CHAIR BOLLWERK: We are now off the
9 record, please.

10 (Whereupon, the above-entitled matter went
11 off the record at 9:03 a.m. and resumed at 10:59 a.m.)

12 CHAIR BOLLWERK: It is now about
13 11:00 a.m. local time, and we went off the record
14 about 9:15 somewhat abruptly. And I want to sort of
15 clarify what happened and make a brief statement about
16 the situation.

17 There was an event, a situation, however
18 you want to describe it. Some individuals were not
19 pleased with how the Board -- the Board hearing, and
20 that has been addressed I think. I appreciate
21 Mr. Ballanco's help, as well as the help from some of
22 the Tribal Council members who spoke with the
23 individual, the individuals that were involved; also,
24 the help from the Dawes County Sheriff's Department
25 and from Chris Lamb and NRC security, who I think have

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1 addressed the situation.

2 One thing I would like to say is that I
3 understand that one of the concerns that was raised
4 was about the cultural resources issue. We -- as I
5 mentioned in the beginning of the proceeding, we did
6 dismiss that some time ago, and Mr. Ballanco raised --
7 raised that issue. In his statement, he noted that
8 they intend -- I believe intend to appeal that at the
9 appropriate time.

10 The one thing I would say is that that is
11 -- that is the process, and the -- if the Board is
12 wrong or incorrect in that -- in our position, and
13 there is an appeal taken, then the Commission, or it
14 could be a federal court, will correct our legal error
15 if that is the case. That's the way the process
16 works.

17 I have been doing this long enough that
18 that's what happens sometimes. If we are found by an
19 appellate body to be incorrect, then that would be the
20 process in this case.

21 The one thing that is important, however,
22 is that appeal will not lie until this issue that is
23 now before us is decided, and that is the Hornbook law
24 within the Commission and, frankly, federal courts and
25 most everywhere else, as far as I know.

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1 So we need to get this -- this issue
2 adjudicated, so that then that appeal can be taken.
3 So just something just to bear in mind, so there's
4 sort of a seriatim process that is involved here.

5 But, again, there is a legal process. And
6 if we've made an error, then that will be rectified as
7 part of that legal process.

8 So, again, my thanks to those individuals
9 who were able to rectify the situation, so that we can
10 continue. And so I hope that we can move forward to
11 the conclusion of this proceeding after we've had a
12 chance to talk with the witnesses.

13 I would add that this is a very technical
14 issue, and I believe all of the witnesses we're going
15 to hear from today, both from the tribe, from NRC
16 staff, and from Crow Butte, bring a lot of technical
17 expertise to this issue, and that's why we're
18 interested in hearing what they have to say.

19 There is a process going on here that is
20 going to involve some very technical but very
21 important information, and we need to hear what those
22 witnesses have to say, so our questions can be
23 answered.

24 So with that, I think we can -- we can
25 begin to move forward. Judge Wardwell, do you -- I

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1 think you still had some questions.

2 JUDGE WARDWELL: Yes, I -- I do have a
3 few. Where we left off, I was about ready to ask or
4 point out that NRC's Exhibit 006, which is their
5 environmental assessment, at Section 4.3.2.1 at 4-15,
6 states that in 2011 CBR performed an aquifer pumping
7 test at the MEA that involved pumping groundwater from
8 the Basil Charon aquifer for 100 hours at about 27
9 gallons per minute.

10 This test resulted in a consumptive use of
11 about 162,000 gallons of water, and CBR would also
12 perform additional aquifer pumping tests to provide
13 coverage in the southern portion of the MEA and to
14 identify hydraulic boundaries.

15 I guess my question for NRC is, I wasn't
16 quite clear on where the 162,000 gallons of water use
17 came from pumping at 27 gallons per minute for 100
18 hours. Could someone elaborate on that a bit?

19 MR. BACK: Your Honor, that number came
20 from the technical report. So we -- that number came
21 from the technical report, so we didn't go back and
22 question them on, you know, where the additional water
23 was coming from.

24 JUDGE WARDWELL: And would someone from
25 Crow Butte be able to clarify that then? Okay. And

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1 why don't we do this? Just for -- for sake of moving
2 along, if there is an issue that you think you need a
3 little more time, can -- can I ask the attorneys for
4 each party to document that we are going to get back
5 to that later on, so that we can move along with the
6 questioning and you can look up these other issues
7 that may require some more review than we want to take
8 while everyone pauses and wait for you to do that.
9 And then get back to us when you have the answer.

10 And this is probably an excellent example
11 for it. If you feel you need to do some calculations
12 or look at a given document, fine, let's do that
13 later. If, in this case, Mr. Smith could document
14 that we're going to get back to this question later,
15 the answer to this later, that's fine, and then we can
16 move on with the questioning.

17 MR. PAVLICK: Yes, Judge Wardwell.

18 JUDGE WARDWELL: So are you ready to
19 answer now, or would you rather wait and answer later?

20 MR. PAVLICK: We'd like to wait and check
21 that number.

22 JUDGE WARDWELL: You say you'd like to
23 wait?

24 MR. PAVLICK: Like to wait and check the
25 number.

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1 JUDGE WARDWELL: I think -- yeah.

2 MR. PAVLICK: Like to wait and check the
3 number.

4 JUDGE WARDWELL: Okay. So we'll get back
5 to that later. And then I'll just -- I am going to
6 trust that each attorney for each party keeps track of
7 these, and we'll try to do the same here. But I know
8 I won't be able to, so you'll have to refresh my
9 memory on -- on that later.

10 Staying with Crow Butte, what do you
11 consider to be the primary goals of the pump tests?
12 And if you could, introduce yourself because, again,
13 I don't -- I don't pick out one. I want whoever
14 answers it, until -- at least until the court reporter
15 gets used to you, to say who is doing the response.

16 CHAIR BOLLWERK: In that regard, let me
17 mention one other thing. It would be useful to the
18 court reporter if you would sit in the same order.
19 When you get up or have lunch, or whatever, don't
20 shift around, so he can -- you'll be in the same
21 place. That would be very helpful to him. Thank you.

22 MR. LEWIS: Your Honor, this is Bob Lewis,
23 Crow Butte. I believe the -- to answer the question,
24 the purpose of the pump test was to characterize the
25 hydraulic properties and characteristics of the first

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1 four mine units that were going to be developed by --
2 by Crow Butte.

3 JUDGE WARDWELL: And is that all you --
4 all you wish? Do you not also do -- do the pump test
5 to indicate the conductivity of the aquifer itself in
6 regards to how it is responding to a pump test?

7 MR. LEWIS: Yes. More detailed purposes
8 would include identifying any boundaries to the
9 system, any leakage characteristics, the degree of
10 confinement, the radius of influence, as well as all
11 of the hydraulic parameters of conductivity, storage,
12 that would go along with the pump test.

13 JUDGE WARDWELL: And what parameters do
14 you get out of a pump test? Do you get all types of
15 soil parameters or what parameters do you end up
16 getting out of a pump test?

17 MR. LEWIS: Primarily, the parameters that
18 would come directly from the pump test would be
19 transmissivity. The primary parameters would be
20 transmissivity, storage -- storativity --
21 transmissivity, storativity, radius of influence,
22 hydraulic conductivity.

23 JUDGE WARDWELL: Hang on just a second.
24 I am -- I think -- Dr. Kreamer is not hearing him or
25 --

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1 MR. LEWIS: Can you hear now, Dr. Kreamer?

2 DR. KREAMER: I can hear you very clearly,
3 but can you just speak directly into the microphone?
4 I cannot -- I cannot hear the responses, and the
5 questions are a little garbled. I can usually
6 understand the questions, but the responses, unless
7 they speak directly into the microphone, and even then
8 it's kind of difficult.

9 JUDGE WARDWELL: Okay. Why don't you try
10 to pull your microphone a little bit closer to you and
11 see if that helps out. Let's --

12 MR. LEWIS: Is this -- can you hear me
13 better?

14 JUDGE WARDWELL: Okay.

15 DR. KREAMER: That is better, yes.

16 MR. LEWIS: Okay.

17 JUDGE WARDWELL: What parameters directly
18 come from a pump test analysis?

19 MR. LEWIS: The parameters that come
20 directly from the pump test analysis would include
21 transmissivity and storativity. Those would be the
22 primary aquifer parameters that would come from the
23 pump test.

24 JUDGE WARDWELL: Dr. Kreamer, did you hear
25 that okay, and do you agree?

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1 DR. KREAMER: Yeah. It was a little
2 garbled, but I did get the -- I did get the gist, yes.

3 JUDGE WARDWELL: I heard Dr. Kreamer. Did
4 everyone else? Did it come through the system? I
5 guess we'll just move on.

6 Turning now to Crow Butte's Exhibit 001,
7 R1, answer 29, at page 27, and this is the initial
8 testimony. You stated that prior to testing
9 activities Crow Butte installed 14 monitoring wells in
10 the Basal Chadron of the -- the basal sandstone of the
11 Chadron Formation.

12 Nine wells were placed in the Brule
13 Formation, and -- and, let's see, oh, yeah, 14 wells
14 were in the Basal Chadron, as I said, and nine were in
15 the Brule Formation, for a total of 23 wells.

16 Then go on to say that Monitor 4 and BOW
17 4 were replaced with Monitor 4A and BOW 4A,
18 respectively, prior to the pump test activities.

19 And my question for Crow Butte is: wasn't
20 the pumped well CPW-1A also a replacement for CPW-1,
21 resulting in a total of three replacement wells?

22 MR. PAVLICK: Yes, sir.

23 JUDGE WARDWELL: And just introduce
24 yourself when you -- when you say --

25 MR. PAVLICK: Doug Pavlick for Crow Butte.

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1 Yes.

2 JUDGE WARDWELL: So now -- so with those
3 three replacement wells, that means the total number
4 of wells that you had in for the pump test was 20 at
5 the time of the pump test?

6 MR. PAVLICK: Doug Pavlick. Yes, that
7 sounds correct.

8 JUDGE WARDWELL: Okay. In the same
9 document, in the same Exhibit 001, answer 29 to
10 page 28, to provide baseline groundwater elevation
11 data for the pumping test. Static water levels were
12 collected from all 12 wells in the monitoring network
13 on November 12, 2010, from the Brule Formation and the
14 Basal Chadron sandstone.

15 And for Crow Butte, if you -- if you
16 looked at 12 wells, why weren't the other wells not
17 also measured for water levels? Because there is,
18 again, 20 wells available if I -- if I understood the
19 math correctly. Is there a reason why you only
20 sampled 12 of the wells for water level reads?

21 MR. LEWIS: This is Bob Lewis with Crow
22 Butte. I believe at least a partial answer to that
23 question is that in the work plan document for the
24 pump test, it was estimated what the radius of
25 influence of the test would be, and not all of the

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1 wells within that radius of influence were considered
2 formally monitored.

3 So I believe, in my recollection, if some
4 of the wells did not have static water levels
5 collected, it would have been the wells that were not
6 within the pre-estimated radius of influence of the
7 original test.

8 JUDGE WARDWELL: Okay. Thank you.

9 MR. LEWIS: For the production aquifer.

10 JUDGE WARDWELL: Okay. Thank you.

11 Continuing on with Crow Butte, if we
12 could, will not additional site-specific pumping tests
13 be performed for each additional mine unit in
14 accordance with License Condition 11.3.4, as citing
15 NRC Exhibit 009 at 19?

16 MR. PAVLICK: Doug Pavlick. Yes, Your
17 Honor.

18 JUDGE WARDWELL: Now, are the purpose of
19 these tests actually used to determine the updated
20 transmissivity and storage coefficient, or do you have
21 other uses for these pumping wells once you become
22 operational?

23 MR. LEWIS: The additional pumping tests
24 would provide more site-specific information on a more
25 local scale for each of the mine units, but they would

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1 provide -- generally provide the same estimates on a
2 local scale.

3 JUDGE WARDWELL: During your operations,
4 do you use results of the pumping tests to determine
5 what pumping rates you're actually using in each
6 individual well, both in regards to injection and also
7 in the production well? Or do you use actual water
8 level readings, or some other types of information to
9 control your operational procedures?

10 MR. PAVLICK: Doug Pavlick for Crow Butte.
11 Your Honor, we use a well field balancing scheme, so
12 the production wells will pump at a rate that balances
13 with the injection in the area, and also allows for
14 the maintenance of a hydraulic bleed on the system.

15 JUDGE WARDWELL: Thank you. Now moving on
16 to my --

17 DR. KREAMER: The end of that testimony
18 was -- was cut out on this end. I'm not sure if a
19 button was hit on the microphone or not.

20 CHAIR BOLLWERK: The mics are on all the
21 time. So if you hit the button, that turns it off.

22 DR. KREAMER: He has to speak directly
23 into the microphone or I can't hear him.

24 JUDGE WARDWELL: Could you repeat your
25 answer then, please.

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1 MR. PAVLICK: Doug Pavlick for Crow Butte?
2 The production well flows are used -- are set in
3 conjunction with the injection wells that surround it
4 to balance the well field and also to maintain a
5 hydraulic bleed on the entire mine unit.

6 JUDGE WARDWELL: Thank you.

7 Now moving into what I have labeled
8 Section 2.1, looking at Opinion 1 that came from
9 Dr. Kreamer's testimony discussing the
10 mischaracterization of the hydrogeologic environment.

11 And I am now looking at a statement made
12 in the Exhibit 003, which is this testimony at Section
13 2, Opinion 1 at 1, where it states that the Marsland
14 hydrologic test report number 8, written in 2011, is
15 deficient and mischaracterizes the hydrogeologic
16 environment at the MEA site.

17 It goes on to say that much of the
18 collateral -- collected pumping test data was
19 selectively ignored. The solitary pumping test
20 covered very little of the MEA site, leaving the
21 majority of the site hydrogeologically undefined, and
22 that the single pumping test was analyzed -- that was
23 analyzed was influenced by conditions outside of the
24 site boundary. And we're going to cover each one of
25 those subtopics separately.

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1 In regards to the first one, looking at
2 Crow Butte's Exhibit 006, which is their technical
3 report at Section 2.7.2.2 at 2-84, you state that
4 drawdown in the Brule aquifer observation wells was
5 indiscernible during the aquifer pumping test, which
6 indicates that adequate confinement exists between the
7 overlining Brule aquifer and the Basal Chadron
8 production zone.

9 NRC, in their Exhibit 006, environmental
10 assessment, under 4.3.2.1, at 4-6, 16, states that the
11 storage in the confined aquifer is derived from the
12 expansion of water and compression of the aquifer
13 mixture, and it is far smaller than the specific
14 yield.

15 And let me just start with Dr. Kreamer.
16 Do you agree with the staff's statement of how
17 confined water is released from storage in a confined
18 aquifer?

19 DR. KREAMER: Yes, sir. Yes, Your Honor.

20 JUDGE WARDWELL: And how does this play
21 out when we're dealing with an artesian well that is
22 constantly flowing and discharging water at the
23 surface. This is a hypothetical question. It's not
24 a specific question.

25 Does this mean that the aquifer is

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1 continually compressing and the water is continually
2 expanding? Or how does that water get released from
3 storage in a confined aquifer when we're looking at
4 flowing conditions at the surface water -- at the
5 surface?

6 DR. KREAMER: Is that a question for me,
7 Your Honor? Dave Kreamer.

8 JUDGE WARDWELL: Yes. Yes, sir. Yes,
9 sorry. Dr. Kreamer.

10 DR. KREAMER: Okay. Yes, that's -- there
11 are two ecnozones in a confined aquifer that release
12 water in storage. One is compression of the aquifer
13 materials, and the second is a slight expansion of the
14 water with reduced hydraulic head.

15 JUDGE WARDWELL: Okay. Thank you.

16 I'll go back to Crow Butte now. If the
17 release of water from a confined storage is true as
18 defined, doesn't it mean that it would be highly
19 unlikely that there would be any response in the
20 overlying aquifer Brule, unconfined aquifers from the
21 short-term pumping of a confined aquifer, especially
22 given the small amount of water that appears to be
23 released from a confined aquifer?

24 And there was one other point I wanted to
25 -- oh, and given the thickness of the overlying strata

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1 that is there between the Basal Chadron and the Brule
2 aquifer, which is the overlying aquifer.

3 DR. KREAMER: Absolutely not, Your Honor.

4 JUDGE WARDWELL: No, no. That's for Crow
5 Butte. I'm sorry.

6 DR. KREAMER: Okay.

7 MR. LEWIS: Generally, if there is -- if
8 there is not a significant amount of connection
9 between the surface and the pumped aquifer, the
10 shorter duration you would notice some drawdown. If
11 the -- if the confining layer were competent, you
12 would not.

13 So it really depends on the degree of the
14 hydraulic connection how long it would take to observe
15 drawdown in an overlying aquifer.

16 JUDGE WARDWELL: So was -- how do you know
17 if your aquifer test was conducted over a long enough
18 period to ensure that you would see any drawdown in
19 the Brule, or is it a fact that the lack of drawdown
20 in the Brule is -- is not a sign of anything dealing
21 with confinement?

22 MR. LEWIS: Well, perhaps an example, if
23 -- if the confining layer had the same properties as
24 the production aquifer, being only 400 feet away from
25 a pumped well, you would see a response in a matter of

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1 hours in the same way you would see them horizontally
2 in monitoring wells.

3 So we know that the confining layer,
4 obviously, is more competent and less permeable than
5 the material which makes up the production aquifer.
6 And then there is some amount of -- of professional
7 judgment in terms of how long the pump test would need
8 to go on for an expected drawdown through a particular
9 permeability of material.

10 I did not personally make those
11 calculations, but in my experience five-day pump test
12 is generally considered a longer duration pump test.
13 And if you have significant connections with the
14 surface, you would notice a drawdown under those
15 conditions.

16 JUDGE WARDWELL: And what leads you to
17 believe we have the significant connection to the
18 surface at the MEA site?

19 MR. LEWIS: I -- I hope I didn't infer
20 that. If there was a connection, you would have seen
21 drawdown over a five-day period. So the fact we did
22 not see drawdown in the overlying means there was not
23 a significant connection.

24 JUDGE WARDWELL: I see. Thank you. And,
25 Mr. Lewis, are you the author of -- of the pump test

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1 reports, or the -- yeah, the signatory of those.

2 MR. LEWIS: Yes, sir.

3 JUDGE WARDWELL: Thank you.

4 In your rebuttal testimony, for Crow
5 Butte, Exhibit 033, answer 12 at 5, says, "From the
6 pumping test results, CBR concluded that adequate
7 confinement exists. For example, no drawdown was
8 observed in the overlying Brule Formation observation
9 wells during the test period. This observation
10 supports the conclusion that adequate confinement
11 exists between the overlying Brule Formation and the
12 Basal Chadron production zone.

13 "In addition, drawdown data versus time
14 were plotted for each observation well. Based on the
15 character of the curves, it was determined that the
16 confined aquifer analytical methods were appropriate
17 for the analysis of the water level data." And you're
18 referencing the pump test report, which I believe is
19 your Exhibit CBR 016 at 11.

20 And my question for Crow Butte is: what
21 do you mean by "the character of the curves"? What
22 are you referring to with that?

23 MR. LEWIS: Your Honor, are you referring
24 to the shape of the drawdown curves?

25 JUDGE WARDWELL: I am referring to your

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1 statement in Exhibit 033 where you say that "In
2 addition, drawdown data versus time were plotted for
3 each observation well. Based on the character of the
4 curves, it was determined that the confined aquifer
5 analytical methods were appropriate for the analysis
6 of the water level data." That's -- I'm asking, what
7 do you mean by "the character of the curves"?

8 MR. LEWIS: The character of the curves
9 were -- did not have any special or unusual shapes or
10 conditions that would suggest a more sophisticated
11 approach would be necessary to analyze the data.

12 JUDGE WARDWELL: And what is the shape of
13 the curve now, and what would it look like if some --
14 if it was giving you a sign that something more
15 elaborate should be used to do -- to interpret the
16 curve?

17 MR. LEWIS: If -- if the system had
18 unusual characteristics, boundary conditions, that
19 would suggest a more sophisticated method might be
20 necessary, the curves would deviate from what I would
21 call a conventional curve, whether it be a Theis curve
22 or being a conventional confined curve, or some other
23 analytical curve that you can use to analyze the data.

24 JUDGE WARDWELL: Thank you. And we will
25 look at some of those curves in a few minutes.

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1 But I want to turn to Dr. Wireman to see
2 if -- Dr. Kreamer, sorry -- if he had any -- has any
3 comments in regards to the last few series of
4 questions that I have asked Crow Butte in regards to
5 how -- how relevant is the fact that no drawdown is
6 observed in the Brule aquifer well as a sign of
7 confinement? And what is his evidence for that, and
8 how does it relate to -- generally relate to the
9 character of the curves, keeping in mind, Dr. Kreamer,
10 that we are going to be looking at those curves
11 directly in a few minutes. But just as a general
12 comment.

13 DR. KREAMER: Very good. I understand.
14 When we were cut off before, we were talking about the
15 nature of the aquifer's open rule and the Basal
16 Chadron Chamberlain Pass Formation.

17 There were some statements made by NRC
18 that it was not indurated. We have agreed-upon
19 language that all parties agreed to saying that it was
20 a sandstone, not sand. We also agreed that it was
21 expected to be similar minerology to the CBR site,
22 which it was never characterized as sand in the Basal
23 Chadron.

24 The underlying assumption here, Your
25 Honor, is that to use analytical models you assume

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1 homogeneity and isotropic conditions. And we have
2 agreed that that is not the case in either the Brule
3 or in the underlying Basal Chadron Chamberlain Pass
4 Formation.

5 Specifically, we said that the production
6 zone has some localized channels, and a coarse grain
7 sandstone interbedded within silt and clay beds of
8 varying thickness. We have agreed as a group that the
9 depths range from 850 for the Chadron to 12,000 --
10 1,200 feet below ground surface, and that the
11 thickness for the analytical assumptions, you assume
12 that the thickness of the aquifer is consistent, and
13 we have agreed as a group that the aquifer thickness
14 is -- varies from 20 to 90 feet in thickness.

15 So, therefore, the transmissivities, which
16 are a product of the hydraulic conductivity and the
17 thickness have great, great error that wasn't
18 reported.

19 And, lastly, the technical report on the
20 hydrology said that a Cooper-Jacob semi-logarithmic
21 drawdown was -- was done. Those results were not
22 presented in the report. Jacob-Cooper is another
23 analytical technique, similar to -- to the Theis
24 method. It does also --

25 JUDGE WARDWELL: Yeah. We'll -- we'll

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1 get --

2 DR. KREAMER: -- more ably show there is
3 leakage.

4 JUDGE WARDWELL: Okay. Thank you, Dr.
5 Kreamer.

6 I'm going to move into Section 2.1.1,
7 which is still Opinion 1, but I want to spend some
8 time talking about Basis A of what Dr. Kreamer
9 presented in his testimony dealing with the initial
10 pump test attempt.

11 And Exhibit 003 at 2 states that the AQUI-
12 VER, Inc., Marsland hydrologic test report number 8,
13 which I believe is the one that we are talking about
14 -- have been talking about -- that is Exhibit CBR 016
15 at page 10, only reported one of two pumping tests
16 done on the MEA.

17 A second 19-hour test was not presented
18 and was characterized as failed. The second test
19 could supply -- and it's Dr. Kreamer's position that
20 the second test could supply additional insight as to
21 the hydrological conditions beneath the site. This
22 justification for the test failure was poorly
23 explained pump failure. If this occurred at the end
24 of the test, the information recorded is still valid,
25 according to Dr. Kreamer.

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1 In rebuttal, CBR Exhibit 033, answer 11 at
2 4, says, "Analysis of the failed pump test data would
3 not have been useful or insightful. The well CPW 1
4 test was terminated after only 10 hours, a small
5 fraction of the time necessary to measure significant
6 drawdown in more distant wells, and far short of the
7 4.3 days needed to reach all drawdown targets and
8 terminate the test.

9 "Failed test well CPW Number 1 was also
10 shown to be very inefficient, with an abnormally high
11 drawdown that prevented more detailed -- more ideal
12 pumping rates. Well CPW 1 was subsequently replaced
13 by well CPW 1A for the final test."

14 And I guess my question to Dr. Kreamer is,
15 do you agree that the inefficiencies, i.e. the poor
16 hydraulic connection between the pumping well and the
17 aquifer well, makes the use of the 19 hours of data
18 pretty limited?

19 DR. KREAMER: No, Your Honor. I do not.

20 JUDGE WARDWELL: And why not?

21 DR. KREAMER: Well, increased drawdown
22 could indicate, first of all, heterogeneities. The
23 whole premise of the pump test is that the aquifer is
24 homogeneous, isotropic, uniform thickness.

25 If I increase drawdown among the wells, on

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1 early time periods particularly, it could show that
2 you have a zone of low hydraulic conductivity.

3 JUDGE WARDWELL: Excuse me. Can I
4 interrupt?

5 DR. KREAMER: As indicated --

6 JUDGE WARDWELL: Dr. Kreamer, can I
7 interrupt you? We're going to get to that. I need to
8 be more focused on my -- rather than broad-brush
9 stuff, be focused on the question that I was trying to
10 get to in regards to let's talk about this failed pump
11 test. And why do you believe those 19 hours of data
12 may be useful? That's really the heart of my
13 question. I hope that clarifies it for you.

14 DR. KREAMER: I believe that whenever --
15 the single test that was done, it is bringing some
16 influence -- did not even cover the majority of the --
17 of the site that we're considering. So essentially we
18 did not hydraulically test more than half the site.
19 And so, therefore, under those conditions, I believe
20 that any information that is additional would give us
21 additional insight.

22 I can't vouch for how valid that
23 information would be, how useful it would be, it being
24 that it wasn't presented, but it being that there is
25 very, very limited information on just a small portion

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1 of a much larger site, I would say that any additional
2 information would be helpful for analysis.

3 JUDGE WARDWELL: Thank you.

4 Turning to NRC rebuttal at 014 Exhibit,
5 answer 16 at 17, staff says that CBR recognized that
6 "The pumping well in the first test was not
7 hydraulically connected to the aquifer, and,
8 therefore, that the data would not be suitable for a
9 meaningful quantitative analysis of the
10 transmissivity, storativity, and boundary conditions.

11 "For these reasons, we do not believe the
12 results of the first test would yield any materially
13 different useful information."

14 And so I guess I'll go to the staff, then,
15 and ask, would not the drawdown in the -- in the Brule
16 aquifer or even in the Basal Chadron aquifer during
17 this test be of some use?

18 MR. BACK: Your Honor, not when it's
19 repeated by a test, you know, tens of feet away that
20 is run for a much longer time period. So -- so that's
21 -- that's our answer.

22 JUDGE WARDWELL: And as far as you know,
23 you -- as far as you know, CBR hasn't analyzed that
24 data. And did you analyze -- did you look at the data
25 to see whether or not it would be useful to also

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1 augment the fact that only one other test is being
2 conducted in the MEA?

3 MR. BACK: No, Your Honor. And it's not
4 uncommon for an aquifer test to fail for one or more
5 reasons. I mean, these wells are 1,000 feet deep. So
6 trying to complete that and making sure you have a
7 good connection, a good sand pack, I mean, it's
8 difficult. So it wasn't a surprise that they had a
9 problem with the well.

10 JUDGE WARDWELL: No, that's not my
11 question. I'm sorry. I didn't make myself clear. I
12 was wondering whether you analyzed what limited data
13 there was to demonstrate that, in fact, it wouldn't be
14 useful. And do you know if Crow Butte has analyzed
15 that data and determined that it wasn't useful? And,
16 if not, why not?

17 MR. BACK: No, Your Honor, we did not
18 because we did not see a reason to, because the well
19 aquifer test was essentially repeated under much
20 better conditions.

21 JUDGE WARDWELL: Okay. Thank you.

22 And I guess I will verify that with Crow
23 Butte. Mr. Lewis, I gather, did you look at that data
24 and actually try to get some information out of it?
25 Or did you just say, "Well, I've got a better test

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1 here, so I'm not going to even look at that data"?

2 MR. LEWIS: We did look at the
3 information. We didn't ignore it or -- we didn't
4 present it, but we used it to refine our work plan
5 when we reinstalled a new well. We did gather some
6 information about the limited radius of influence from
7 that test, and refined our projected pumping rate for
8 the new test.

9 So we didn't ignore all of that
10 information. The pumped well was installed
11 immediately adjacent to the failed well. So we
12 consider that to be a redundant test.

13 And the failed well was anomalous -- we
14 couldn't control pumping rates properly. There was a
15 pump problem as well as a possible well problem.
16 Identifying exactly what was wrong, it was more than
17 one thing. So it was better to just redo this test
18 over than to try to make something out of information
19 that we couldn't fully explain.

20 JUDGE WARDWELL: If I remember correctly,
21 Mr. Lewis, I think staff and you had different
22 descriptions applied to whether -- what was the cause
23 of this pump test. And I gather your last statement
24 made in regards to sometimes there is often many
25 things that might have caused it is the -- is the

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1 answer to that question.

2 MR. LEWIS: That's my opinion, yes.

3 JUDGE WARDWELL: Thank you.

4 Moving on to 2.1.2, Opinion 1, Basis B was
5 data selectivity. And Dr. Kreamer, in his testimony,
6 Exhibit 003, Opinion 1B at 2, says, "The report only
7 analyzed select portions of the data from the single
8 pumping test. The report did not present analysis of
9 the complete data set. The data the report
10 selectively excluded could demonstrate, if analyzed,
11 the lack of confinement of the Basal Chadron aquifer
12 production zone."

13 And I think I will ask Dr. Kreamer right
14 now a very specific question, and that is, by the data
15 you are claiming is selectively excluding -- excluded,
16 are you referring to the deviations that show up on
17 the pump test data graphs?

18 DR. KREAMER: Yes. In the main -- yes.

19 JUDGE WARDWELL: Okay. Thank you.

20 NRC rebuttal Exhibit 014, answer 17 at
21 page 17, states that "Appendix C of the MEA pumping --
22 aquifer pumping test report presents drawdown and
23 recovery response curves showing all data points for
24 all of the observation wells used in the aquifer pump
25 test."

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1 It goes on in the same rebuttal exhibit,
2 answer 18 at 18 to 19, that "We disagree with Dr.
3 Kreamer. First, it is not clear what Dr. Kreamer is
4 referring to as excluded data." And that's what just
5 clarified with my question to him.

6 In that same rebuttal, they go on to say,
7 "As discussed in answer 17 above, all of the data for
8 the drawdown and recovery in the observation well was
9 presented in the aquifer pumping test report."

10 And so -- and Dr. -- Dr. Kreamer, how do
11 you believe that is excluded if all the data is
12 actually presented in the graphs? And do you agree
13 all the data was presented in the graphs?

14 DR. KREAMER: Well, it being that one --
15 one pumping test was excluded, as we discussed
16 earlier, not all of the data was presented. But from
17 that one pumping test, the data is there, but the
18 analysis of the leakage, which has been done in other
19 tests over in Crow Butte, was -- was not analyzed.

20 JUDGE WARDWELL: So may I -- may I --

21 DR. KREAMER: So it was -- and the other
22 thing that was excluded, they said they did a Cooper-
23 Jacob analysis, and that -- that, though, was not --
24 that was not included in the report.

25 JUDGE WARDWELL: Okay. We will get to the

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1 Cooper-Jacob analysis, so -- in a while. So you can
2 reserve any comments on that for a few more minutes.
3 We'll get to that, but I want to -- I want to stick
4 with just the regular Theis analysis for now and what
5 is -- what is there on the data, in the graphs, and
6 how that is selectively or not selectively used in
7 regards to interpreting this information.

8 And so may I paraphrase for you what I
9 hear you saying to make sure it's correct? What
10 you're saying, the selectivity associated with the
11 excluded data is the fact that those deviations, while
12 they're available for you to look at, are not being
13 incorporated into the matching of the type curves. Is
14 that at least partially what you are referring to?

15 DR. KREAMER: Yes.

16 JUDGE WARDWELL: Okay. Thank you.

17 And why don't we pull up Figures -- at
18 least one of the figures, C1 to C8 of CBR 016,
19 Appendix C, and they're at PDF pages 80 to 86.

20 And we're looking at the graph here for
21 the pumped well itself. And, Dr. Kreamer, in this
22 particular instance, would you describe what you
23 believe to be either excluded data or non-excluded
24 data?

25 Is he able to see this, Joe?

1 DR. KREAMER: I do not have that here.

2 JUDGE WARDWELL: Joe, is he able to see
3 this? Okay. Thank you.

4 Go ahead, Dr. Kreamer. I'm sorry, I
5 interrupted you.

6 DR. KREAMER: This is one of the analyses.
7 And the key part of this is the very long timeframes.
8 That would be the far right-hand side. What you can
9 see is there is a line that is slightly above the red
10 line. That is the difference between the expected
11 drawdown response and the actual response.

12 If this were drawn a little bit -- if the
13 red line were drawn a little bit further to the left,
14 that would be a greater gap in that line between the
15 drawn line on the right-hand side on the red line
16 below. The drawn line is very, very faint, but in
17 this particular one you can see that there is a gap.
18 What that means is that extra water came into the
19 system from somewhere that was not expected.

20 JUDGE WARDWELL: And you would -- you
21 would term that a late-time flattening of the curve?
22 Would that be a fair phrase to apply to what the
23 actual data looks like compared to the -- which are
24 the X -- little X's that merge together into a solid
25 red -- looks like a solid red -- broad red line

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1 compared to at least we can see a -- it looks like a
2 greenish solid line, which would be some type of what
3 you would -- what you would expect to see. Is --

4 DR. KREAMER: That would be correct, Your
5 Honor.

6 JUDGE WARDWELL: Okay.

7 DR. KREAMER: And it's a log-log plat. So
8 that little space would be a little bit exacerbated
9 because of the logarithmic scale.

10 JUDGE WARDWELL: Can we move on to Figure
11 -- let's go to -- it would be Figure C. Let's see.

12 CHAIR BOLLWERK: Just clarify, that was
13 C1, correct? So we're moving on now.

14 JUDGE WARDWELL: Yes, that was C1. Let's
15 go ahead to -- let's come back to C2. Let's come back
16 to -- keep going. Go up to C4. Yeah, go to C4.

17 Okay. This is -- this is -- this would be
18 -- let's see. No, keep going. C5. I'll tell you
19 what I want. Make it C -- monitoring, 7, which I
20 don't know which that -- yeah, two more to go. There
21 we go.

22 And let me stop -- that's good right
23 there. But before I ask you something about this, Dr.
24 Kreamer, I want to ask CBR, do you have any -- any
25 modifications to what Dr. Kreamer said in regards to

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1 the interpretation of the C1 graph, which I believe
2 was the pumped well?

3 MR. LEWIS: Bob Lewis, Crow Butte. I
4 would say that --

5 JUDGE WARDWELL: Let me rephrase my
6 question, if I might, before you get into a long -- do
7 you agree there is a flattening of the curve? There
8 is a flattening in the late time period of the actual
9 data compared to what the expected result would have
10 been?

11 MR. LEWIS: There is -- there is a slight
12 flattening of that curve. For the pumped well,
13 analyzing the data from a pumped well due to well
14 inefficiencies is not the best example. But, yes,
15 that -- that is a slight flattening.

16 JUDGE WARDWELL: Okay. And what is the
17 solid line called? Is that called a type curve or
18 something like that? Would you call it something
19 else, just so we can refer to it with an easier
20 nomenclature than just that curve we expect to have?

21 MR. LEWIS: Yes, sir. That's an ideal
22 confined aquifer curve.

23 JUDGE WARDWELL: I want a simpler term.
24 I don't want a more exotic term. You can just call it
25 a type curve?

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1 MR. LEWIS: It is a type curve. Yes, sir.

2 JUDGE WARDWELL: You have no objections to
3 that, do you, Dr. Kreamer, calling it a type curve?

4 DR. KREAMER: I do not.

5 JUDGE WARDWELL: Okay. Dr. Kreamer, how
6 would you interpret what is presented here in
7 monitoring 7, at graph C7? Dr. Kreamer?

8 DR. KREAMER: Who are you asking? Oh,
9 okay, I'm sorry. I thought you were asking about Crow
10 Butte.

11 What you can see here is you can see
12 variations that you don't expect, a wiggle in the
13 line. Again, on a Jacob-Cooper semi-logarithmic plot,
14 this would show variations on heterogeneities that
15 were similarly found in Crow Butte. They started off
16 with analytical procedures, and then for cleanup they
17 had to go to numerical, more calculated procedures
18 rather than analytical -- the simplest analytical
19 approach that is shown here.

20 JUDGE WARDWELL: My question was more --
21 certainly we see some wiggle, and I guess that's not
22 surprising, is it, when you're dealing with any
23 geotechnical groundwater issue to see that. But isn't
24 there something else in regards to the early time
25 period where it's not matching the curve as well as it

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1 has later on? Dr. Kreamer?

2 DR. KREAMER: Well, typically, these
3 things are matched in judgment of the people doing the
4 analysis. And certainly the early time periods could
5 have been matched, moving the entire curve, the red --
6 the red X's to the right, which would show the
7 flattening again.

8 But, again, this is an interpretational
9 thing. Sometimes the early data isn't as reliable,
10 depending on the distance of the monitoring well. I
11 think the key feature here, though, is it does show
12 heterogeneities, and an assumption of using this whole
13 approach is that the aquifer is homogeneous.

14 JUDGE WARDWELL: And where do you see the
15 heterogeneity in this curve?

16 DR. KREAMER: The wiggle, sir.

17 JUDGE WARDWELL: Thank you.

18 Crow Butte, would you like to respond to
19 Dr. Kreamer's interpretation of this graph?

20 MR. LEWIS: Bob Lewis, Crow Butte. My
21 interpretation of that graph is this is a very typical
22 response that you would find at a well located at this
23 distance from the pumped well. It actually fits the
24 type curve fairly well for analytical solutions and
25 natural systems. I don't consider that to be unusual.

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1 JUDGE WARDWELL: Bear with me for a
2 second.

3 I'll stay with you, Mr. Lewis. Of all of
4 these wells that you monitored, which would be -- and
5 all of these wells are -- the ones that we're looking
6 at in these curves, of course, are ones that were put
7 in the Basal Chadron, correct?

8 MR. LEWIS: Yes, sir.

9 JUDGE WARDWELL: And how many wells did we
10 have in the Brule aquifer that you didn't monitor
11 during the pump test? We know how many there were
12 total of the 20, but I don't think we know how many of
13 those you actually monitored during the test.

14 MR. STRIVER: Jim Striver, Crow Butte.
15 There were two Brule monitor wells.

16 JUDGE WARDWELL: There's two Brule monitor
17 wells that were monitored during this test.

18 MR. STRIVER: In addition to the one
19 adjacent to the pumping test, so there are three
20 total.

21 JUDGE WARDWELL: So we have three Brule
22 wells that were monitored during this pumping test; is
23 that correct?

24 MR. STRIVER: Your Honor, may we have a
25 minute to verify that?

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1 JUDGE WARDWELL: Okay. Why don't we --
2 why don't -- I don't want to give you more than half
3 a minute, though. If you need more than half a
4 minute, we'll come back to it later. I don't -- there
5 is no -- there is no problem with just getting back to
6 us later. It's more important to move along than it
7 is to spend time sitting here with dead air because
8 you'll just hear me talk because I'll get nervous if
9 we're not filling the air with noise.

10 MR. STRIVER: Jim Striver, Crow Butte.
11 There are three Brule monitor wells included in the
12 pump test.

13 JUDGE WARDWELL: Thank you. Of those
14 wells -- of the wells in the Basal Chadron, which do
15 you consider to be wells that show early time
16 deviations? Which do you consider to be late time
17 deviations? And which do you claim to be normal
18 responses?

19 MR. LEWIS: I would need some time to --

20 JUDGE WARDWELL: Okay.

21 MR. LEWIS: -- to answer that question.

22 JUDGE WARDWELL: Come back to us after
23 lunch with -- that's a second item for you to respond
24 to once we get back from lunch.

25 MR. LEWIS: Yes, sir. And can you repeat

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1 that question?

2 JUDGE WARDWELL: Yeah. I would like to
3 know, of those -- of Figure C1 to C8 in the pump test
4 report, which ones of those data plots do you consider
5 to be normal type curve plots? Which ones do you
6 believe there was some late time flattening of the
7 curve? And which do you believe were some early time
8 deviations from the -- from the expected -- the type
9 curve in those particular wells?

10 Dr. Kreamer, I've seen some testimony, and
11 I can't recall it right now, but that stated that you
12 considered all of the wells to be having deviations
13 from the type curve. Do you -- was that a fair
14 assessment of your opinion of these type curves?

15 DR. KREAMER: No. There were some that
16 were very, very pronounced, and others that it was
17 barely discernible. So, no, that's probably not as
18 accurate. I consider the aquifer to be heterogeneous,
19 and so you wouldn't expect all of the wells to show
20 the same thing.

21 There are some wells that are perhaps
22 closer to leakage -- leakage zones that show that
23 deviation that we said, and others that are -- that
24 are less so.

25 JUDGE WARDWELL: Thank you.

1 DR. KREAMER: Were you asking about the
2 Brule as well?

3 JUDGE WARDWELL: No. No, because I
4 believe they didn't -- that -- well, I'll ask it
5 again, just to make sure. Crow Butte, was there no
6 discernible drawdown in the Brule aquifer wells? Is
7 that your position?

8 MR. LEWIS: Bob Lewis, Crow Butte. No,
9 sir.

10 JUDGE WARDWELL: And, Dr. Kreamer, do you
11 have any evidence that supports that there was
12 drawdown in the Brule aquifer wells during the pump
13 test?

14 DR. KREAMER: The heterogeneous nature
15 that we have agreed upon, they were all groups of
16 agreed upon that it's siltstone with isolated beds of
17 sandstone, means that it's unlikely that with their
18 monitoring wells placement that you would find
19 anything.

20 So I am in agreement that there was no --
21 nothing indicated, but I also feel that the monitoring
22 system in the Brule was not adequate, didn't show it.
23 The underlying assumption is that it's homogeneous,
24 isotropic, and that it -- that a well that would --
25 was placed -- a monitoring well that was placed in the

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1 Brule, would actually have the ability to pick up
2 drawdown.

3 And these are stringers of sandstones that
4 are discontinuous, and so, therefore, the effect on
5 the Brule aquifer I don't think was adequately
6 characterized by three wells.

7 JUDGE WARDWELL: So your answer to my
8 question was no?

9 DR. KREAMER: My answer -- the answer is
10 no, I did not see evidence of drawdown from the data.

11 JUDGE WARDWELL: Thank you.

12 Crow Butte, in regards to recovery data --
13 and I believe these are on Figures C9 to C17 of the
14 same exhibit, CBR 016 -- what did the recovery data
15 show you? And do you want to start with any -- yeah,
16 let's start with this one. It's the first one.

17 Let me start off with a simple question,
18 just to make sure I am reading this correctly. The
19 area to the left indicates -- the furthest area to the
20 left indicates the time that the pump was shut off,
21 and then the red dots pick up with data points at
22 various time-ratio periods, but related to time; is
23 that correct? That the pump goes off at the left-hand
24 side and the right-hand side is your -- it's a longer
25 timeframe since the pump was turned off, or have I got

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1 that backwards. Crow Butte.

2 MR. LEWIS: I believe that's correct, Your
3 Honor.

4 JUDGE WARDWELL: How do you interpret that
5 graph?

6 MR. LEWIS: This graph is of the pumped
7 well. I would not personally put a lot of weight on
8 the pumped well analysis, although the recovery data
9 is better. But I would say this fits reasonably a
10 type curve for the confined aquifer.

11 JUDGE WARDWELL: But isn't -- there seems
12 to be quite a large deviation, both on the left-hand
13 side and on the right-hand side of the diagram; isn't
14 there?

15 MR. LEWIS: That's not unusual for
16 recovery data, Your Honor.

17 JUDGE WARDWELL: Okay. And why not? Why
18 is recovery data like that, or is it just there it is?
19 I have no problem with, well, it's just, there it is.

20 MR. LEWIS: I -- the physics of that, I --
21 I don't want to testify to right now. But I would
22 just say that that is a very common appearance of the
23 recovery curve.

24 JUDGE WARDWELL: Well, if it has anything
25 to do with quantum mechanics, I don't want to hear

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1 about those physics either, so we'll move on.

2 Let's switch to -- let's go to C10 and see
3 if the same -- what that looks like. And what's your
4 comments in regards to the recovery data here?

5 MR. LEWIS: I have the same comment, Your
6 Honor.

7 JUDGE WARDWELL: Dr. Kreamer, would you
8 like to comment on -- on both of these recovery
9 curves? Dr. Kreamer, I'm sorry, would you like to
10 comment on these -- these recovery curves?

11 DR. KREAMER: The deviations there show a
12 break in the recovery, meaning that there is added
13 water coming from somewhere. The other one, Graph C9,
14 showed that better.

15 A lot of times you can ignore early data
16 in some of these situations. There are some rules
17 that are put down for these sort of things, but even
18 if you violate those rules for some of the early data,
19 the percentage error is very small as Crow Butte
20 pointed out in Deridder. On page 63, it shows that
21 there is very little error in some of the early data.

22 What this shows is it shows a break in the
23 direction, what some people call a recharge boundary
24 with water coming in that is unexpected. And the
25 previous graph shows that much better.

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1 JUDGE WARDWELL: Previous graph being
2 which one now?

3 DR. KREAMER: C9.

4 JUDGE WARDWELL: C9? Go back to C9.

5 DR. KREAMER: C9, yes. There's two breaks
6 in that, and one of the breaks is in the late data, as
7 you pointed out, Judge.

8 JUDGE WARDWELL: Okay. Yeah. And both of
9 these are pumped wells, right? Is that correct? One
10 is the other old pumped well that you abandoned; is
11 that correct, Mr. Lewis, for CBR?

12 MR. LEWIS: Yes, sir.

13 JUDGE WARDWELL: Okay. Go ahead, Dr.
14 Kreamer. Sorry to interrupt you. Dr. Kreamer?

15 DR. KREAMER: I'm just saying that the
16 deviations from -- what they should follow is it
17 should follow one straight line, which may be a little
18 bit of -- of flange coming out in the early time
19 periods to the left.

20 But what you see is you see two distinct
21 breaks here, and that -- that means that the
22 assumption of homogeneity that is the lynchpin of this
23 one well analysis that didn't even cover the whole
24 site is based on. It's based on that you can use the
25 simplest method that's in hydrology and not do any

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1 others.

2 You don't have to do leakage analysis or
3 anything like that, and the data here clearly shows
4 that there is a potential for leakage in -- in the one
5 pump test they did, the solitary pump test they did
6 conduct.

7 JUDGE WARDWELL: Thank you.

8 May I ask, Mr. Lewis, how he ended up
9 analyzing the data -- the drawdown data? And we can
10 go back to any one of the graphs that you want to
11 happen to select, and you can describe it just to give
12 us a handle of how you happened to pick that up and
13 what did you focus your -- your analysis of that pump
14 test data on?

15 MR. LEWIS: Bob Lewis, Crow Butte. Your
16 Honor, in general, in looking at the -- the drawdown
17 data, basically we analyzed that data with the
18 assistance of the software package in this case. And
19 the --

20 JUDGE WARDWELL: What was the name of that
21 software package? Just if you know it.

22 MR. LEWIS: This was AquiferWin32.

23 JUDGE WARDWELL: I'm sorry?

24 MR. LEWIS: AquiferWin32.

25 JUDGE WARDWELL: Okay.

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1 MR. LEWIS: And, generally, it takes its
2 first cut at the data. It takes an automatic estimate
3 using its own internal algorithms. But normally with
4 professional judgment you may adjust the curve to fit
5 the data better or worse because it uses a least
6 squares type of analysis to do that, which does not
7 always take into account the conceptual models that
8 exist.

9 Second, we would correct for barometric
10 pressure, if necessary. We went through that process,
11 and that's described in the report. That would be
12 done before the data are analyzed, actually. So
13 that's the general process that we -- that I had went
14 through.

15 Conceptually, I want to clarify that the
16 conceptual model for this system is a confined
17 aquifer, and it has been demonstrated at the CBO that
18 that is the case. The leakage analysis that
19 Dr. Kreamer referred to was performed on one of the
20 tests out of the several that were performed, with the
21 conclusion that it was unnecessary because
22 transmissivity variations were the reason for the
23 deviations from the type curve.

24 More importantly, Crow Butte is -- the
25 Crow Butte operation is the biggest pump test that has

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1 been conducted for the Marsland facility. It is --
2 drawdown at the Marsland facility has been observed as
3 a result of pumping from Crow Butte at a distance of
4 nine miles.

5 We know that the radius of influence of
6 the Crow Butte facility at Marsland goes beyond 13
7 miles. So with that kind of a radius of influence,
8 where we see drawdown at Marsland due to pumping at
9 Crow Butte 13 miles away, you can make that
10 calculation that that -- any recharge rate or leakage
11 rate resulting is less than the pumping rate at Crow
12 Butte of 200 gallons a minute, 250 gallons a minute.

13 That's a very small amount of leakage or
14 recharge over a 13 square mile area radius of
15 influence. So I feel very comfortable in saying that
16 this is a confined aquifer system conceptually, so
17 that's where I would start my analysis before I jumped
18 into some other types of analysis for leakage, which
19 don't have a conceptual basis in my opinion.

20 JUDGE WARDWELL: Can we go more
21 specifically now to one of the graphs of -- let's take
22 -- scroll up, Joe, until we hit monitor -- mon or
23 monitoring well 7. There it is.

24 As I look at this graph, it is the green
25 solid line, the type curve that was used by you in

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1 deriving the transmissivity and storativity
2 coefficients for this well.

3 MR. LEWIS: Yes, Your Honor.

4 JUDGE WARDWELL: And so aren't you
5 basically selectively passing that line through some
6 points and, to use another phrase, ignoring or
7 bypassing -- maybe that's a better phrase than
8 ignoring -- some of the other ones at the earlier time
9 data here?

10 MR. LEWIS: I would agree, Your Honor,
11 that the earlier time data in general is not as
12 reliable as the middle and late time data.

13 JUDGE WARDWELL: First of all, please
14 answer my question.

15 MR. LEWIS: Yes, sir.

16 JUDGE WARDWELL: Then you can go on and
17 elaborate because I never get the answer to my
18 question. Does this -- have you not matched this
19 through some data points and bypassed some others at
20 an early timeframe?

21 MR. LEWIS: Yes.

22 JUDGE WARDWELL: See, I need that in the
23 record when I start writing things. I can't deal with
24 you going onwards to -- and then put in your words
25 that you said yes to this, but I don't hear the yes.

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1 So that's why -- it's not that I'm trying to ping you
2 or anything. It's just I need that for the record.

3 So now go on with your explanation, if you
4 wish.

5 MR. LEWIS: No. That's correct. I mean,
6 the early time data on this type curve are given less
7 weight than the later time information.

8 JUDGE WARDWELL: What is your
9 justification for that?

10 MR. LEWIS: In general, the early time
11 data is -- is skewed by storage effects and other
12 inertial effects that later and early time data are
13 not, or middle and late time data are not.

14 JUDGE WARDWELL: Dr. Kreamer, I believe
15 you were alluding to something very similar to that
16 with the early time data. Was that not correct, or
17 did I hear you wrong earlier, 10, 15 minutes ago?

18 DR. KREAMER: Yes. It depends on how
19 early the time data is. Sometimes the early time data
20 drawdown is affected by the well bore itself and water
21 filling the well bore. That is the near effects of
22 the initial pumping.

23 So typically some of the early data is
24 less reliable. I can't tell you that all of this
25 early data should be thrown out. As a matter of fact,

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1 I think some of the early data is -- is still usable.

2 JUDGE WARDWELL: And so you didn't do any
3 analysis to determine how much of that should or
4 should not be in regards to well bore storage? Dr.
5 Kreamer?

6 DR. KREAMER: No. I did notice this gap
7 in this monitoring well. No, I did not.

8 JUDGE WARDWELL: And, likewise, you
9 mentioned that the wiggles in the graph that has been
10 matched -- and I don't have access to the pointer, but
11 if Joe can bring the pointer up and I can guide him to
12 where I'm trying to point to you. There you go. Now
13 go right up from there. Yeah, right to your -- now a
14 little bit more to your -- now go down the graph, down
15 the red -- follow the red guys down. No, follow the
16 red guy -- up to the reds, follow them down.

17 Are those the wiggles? No, back up. Back
18 up, Joe. This is ridiculous. We get this -- keep
19 going up. There.

20 Are those the wiggles you're referring to,
21 or are there some other ones that you're referring to,
22 Dr. Kreamer? For your -- for your indications of
23 heterogeneity.

24 DR. KREAMER: The arrow is really delayed
25 here. Okay. I see the -- yeah, that wiggle right

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1 there at WU10² that is being pointed out now, that
2 flattening means that it hit extra water and then
3 suddenly went back to its original trajectory.

4 So the flattening right there is extra
5 water showing up somewhere.

6 JUDGE WARDWELL: Okay. And do you have
7 any evidence to show whether or not this heterogeneity
8 -- if this was representative of the entire Basal
9 Chadron, would have any effects on the ultimate
10 conclusions of either just the hydraulic parameters
11 but also any confinement associated with the aquifer?

12 DR. KREAMER: Yes, Your Honor. Would you
13 like me to elaborate?

14 JUDGE WARDWELL: No. I -- have you done
15 -- yeah. I'd like to know if you can point me to the
16 evidence you've submitted, or the analysis that you've
17 conducted, that demonstrates there is a difference in
18 the ultimate results of transmissivity and storage
19 coefficient.

20 DR. KREAMER: Well, first of all, you gave
21 Crow Butte a little bit of leeway in describing the
22 other site, Crow Butte, and they said that the leakage
23 analysis was no good and it was attributed to bad
24 reagents and transmissivity. That's a very important
25 term because what that means -- transmissivity is the

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1 thickness times the hydraulic conductivity.

2 The whole analysis that they relied upon
3 says that the thickness and the hydraulic conductivity
4 is constant. So what he just said is with -- it is
5 attributed to variations of --

6 JUDGE WARDWELL: I'm going to have to
7 interrupt you here.

8 DR. KREAMER: -- they violated the
9 assumptions of the analytical thing at Crow Butte.

10 Now, going back to this one here, again,
11 what's key here is the assumptions of using the
12 simplest model that students learn. First of all
13 here, the Theis analysis --

14 JUDGE WARDWELL: Excuse me. Can I
15 interrupt you, Dr. Kreamer? Dr. Kreamer?

16 DR. KREAMER: -- homogeneous --

17 JUDGE WARDWELL: Dr. Kreamer?

18 DR. KREAMER: And that wiggle there --
19 there are other things that show it more -- more
20 definitely, other graphs that show it more definitely.
21 But there are heterogeneities shown in this -- in this
22 set of graphs.

23 JUDGE WARDWELL: My question to you was:
24 what evidence or analysis have you performed that
25 demonstrates there would be a change in the resulting

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1 transmissivity from this particular plot had you
2 incorporated your interpretation of this?

3 And it's -- and I believe we get
4 transmissivity directly from this plot -- that's what
5 I heard earlier today -- such that we're not
6 multiplying hydraulic conductivity by any thickness.
7 It is a measurement that we get directly from this
8 plot, and so my question to you is: what analysis
9 have you performed that demonstrates that this
10 transmissivity value that has been selected would have
11 changed dramatically enough such that it would result
12 in a different conclusion relating to the hydraulic
13 properties of the Basal Chadron? Have you done any?

14 DR. KREAMER: That's a good question.
15 What the program does is what an experienced
16 professional would do. They eyeball the curve match,
17 and they would try and get the best curve match they
18 can. This is not a great curve match, and certainly
19 when you look at the transmissivity value in the
20 legend, which has three decimal points of accuracy,
21 that is something that we flunk students out all the
22 time for doing that sort of thing.

23 JUDGE WARDWELL: Have you done -- have you
24 done an analysis of your own that demonstrates that
25 this transmissivity value changes dramatically if in

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1 fact you were matching this curve? That's the
2 question I'm trying to get answered.

3 DR. KREAMER: There are several different
4 ways that I have gone through the curves. I have
5 matched them in different ways. And the error, which
6 is not really spoken about in the report, it can be
7 very large. It's not so much in this graph, but in
8 some of the graphs it is very large.

9 JUDGE WARDWELL: What graph here at the
10 MEA did you draw an analysis of?

11 DR. KREAMER: I drew -- I drew curve
12 matches in different places and came up with different
13 transmissivity. I did not --

14 JUDGE WARDWELL: Here for --

15 DR. KREAMER: -- some rise of those in the
16 handwritten document.

17 JUDGE WARDWELL: So you haven't submitted
18 that as part of the evidence here in this hearing.

19 DR. KREAMER: I have not, Your Honor.

20 JUDGE WARDWELL: Okay. In regards to the
21 flattening that occurs at later timeframes that we saw
22 in I believe it was monitoring well 2 -- let's see if
23 we can scroll up and see that. Not 2; make it 3.
24 Right there. That's good.

25 Dr. Kreamer, what is -- what is your

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1 interpretation of this flattening of the curve at the
2 late timeframe?

3 DR. KREAMER: Your Honor, there is at
4 least a 30-second delay. I'm still looking at 7 right
5 now. Okay. I now have 3 on the screen.

6 You can see that the curve matched
7 clearly. And if the early time were matched even more
8 accurately, there would be even more decided deviation
9 below on the left-hand side between the red line and
10 the type curve, which is the solid dark line there.

11 That indicates that there is a water
12 source, that there is a recharge boundary that occurs
13 after a certain amount of pumping. And so this well
14 clearly shows that there is some sort of water coming
15 from some other place.

16 JUDGE WARDWELL: Thank you.

17 Crow Butte, do you agree with Dr.
18 Kreamer's interpretation of this? And, if so, where
19 is that water coming from?

20 MR. LEWIS: Bob Lewis, Crow Butte. Your
21 Honor, I don't agree with the statement that that
22 represents leakage. I believe that that flattening of
23 the curve that you see on monitor 3, as explained in
24 the pump test report, is due to variations in
25 transmissivity, a thickening of the aquifer locally

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1 and to the west primarily of the pumped well. And,
2 again, that is explained in the pump test report
3 itself.

4 DR. KREAMER: Your Honor, may I -- may I
5 comment on that or --

6 JUDGE WARDWELL: Wait just a second,
7 Dr. Kreamer.

8 DR. KREAMER: Okay.

9 JUDGE WARDWELL: Okay. Yeah, go ahead.
10 You can respond now. That will work.

11 DR. KREAMER: The testimony just said is
12 change in transmissivity. That is a thickening of the
13 aquifer. The operating assumption for the Theis
14 analysis is that the aquifer does not thicken or get
15 less -- in other words, what was just said is that the
16 basic assumptions of using the Theis methodology have
17 been violated. That is essentially what was just
18 said.

19 JUDGE WARDWELL: But haven't they matched
20 up the vast majority of the data? And in that range,
21 is it not suitable to match for that and come up with
22 a coefficient associated with that which it matches
23 with in regards to the transmissivity and the storage
24 coefficient? Do you have any data that shows --

25 DR. KREAMER: Are you asking me, Your

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1 Honor?

2 JUDGE WARDWELL: Go ahead. Go ahead.

3 DR. KREAMER: Is this a question for Dr.
4 Kreamer?

5 JUDGE WARDWELL: Yes.

6 DR. KREAMER: Yeah. Being that just a
7 small percentage of the data matches the curve,
8 certainly you can use it to calculate transmissivity
9 to three decimal points. I think that it's very poor
10 practice, and it -- it is fairly meaningless in this
11 regard. Transmissivity means absolutely nothing.

12 JUDGE WARDWELL: And, Crow Butte, how
13 would you respond?

14 MR. LEWIS: Bob Lewis. Your Honor, one
15 comment with respect to the three decimal places of
16 accuracy. That's a software relic. What's reported
17 in the tables in this report are not reported to three
18 decimal digits. The tables and the results are what
19 matter.

20 Secondly, I think I responded previously;
21 I answered the question.

22 JUDGE WARDWELL: NRC, I've kind of left
23 you out of here for a while. And I know you're --
24 you're very jealous of not being able to respond in
25 some fashion. So I shall let you kibitz as you wish.

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1 MR. BACK: This is David Back. This
2 really takes us back to the -- to the relicensing
3 hearing where we went through essentially the same
4 curves, same -- same claims of leakage, but when we
5 started looking at 30 years of data, the pumping at
6 the main facility never impacted the overlying wells.

7 The staff believes there is heterogeneity
8 within the Basal Chadron sandstone. I mean,
9 depositionally, it is put down the sands with clay
10 lenses. So we understand that.

11 When we look at these curves, we see
12 several options. We see possibly a high
13 transmissivity zone that it was hit, possibly the --
14 there is a clay that overlies the Basal Chadron. And
15 when you pump, you can actually release water from
16 storage in that clay. That might be creating this
17 deviation from the -- from the Theis curve. So --

18 JUDGE WARDWELL: And which deviation? The
19 early or the late time?

20 MR. BACK: The late time. The flattening
21 of the curve. We saw that -- that was one of the
22 plausible explanations in the previous aquifer test.
23 So basically we are revisiting what -- what we did at
24 the relicensing.

25 JUDGE WARDWELL: Don't we have to revisit

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1 that?

2 MR. BACK: Absolutely. And that's fine.
3 It's just that these same curves that we looked at
4 there, there we had 30 years of data pumping and never
5 seeing an impact in the overlying aquifer. And
6 basically we had better confining conditions here than
7 we did there.

8 JUDGE WARDWELL: But, again, that's of no
9 interest here, is it? What's of importance here is
10 whether or not the analysis is done correctly and
11 whether the confinement exists. Whether there is --
12 whatever is happening up there is independent, is it
13 not, of -- of what our obligations are in regards to
14 showing that the MEA is performing as -- as you
15 interpret it to perform when you reach your conclusion
16 that in fact we are able to maintain control of a
17 lixiviant and that the confinement of that aquifer is
18 maintained during the pumping analysis; isn't that
19 correct?

20 MR. BACK: Absolutely that is correct. I
21 am really tying -- kind of tying off of Dr. Kreamer's
22 preliminary discussion, bringing in the aquifer test
23 from the -- from the relicensing. If you go to the
24 EA, you know, our --

25 JUDGE WARDWELL: Back up with your

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1 statement. What was that statement you just made?
2 You are trying to do what to --

3 MR. BACK: Dr. Kreamer brought in the
4 aquifer testing that was performed, saying that the
5 aquifer testing -- there is a leakage calculation that
6 was done on the main facility during that aspect
7 because we -- they saw the same kind of reactions.

8 The staff requested that additional
9 analysis be done on that leakage calculation, and what
10 I'm saying is, the end result was that that wasn't
11 leakage. We could demonstrate it wasn't leakage. We
12 can demonstrate it's not leakage here through multiple
13 lines of evidence, not just the aquifer test -- not
14 just these curves. So --

15 JUDGE WARDWELL: Again, do you agree that
16 because that was -- you -- the leakage analysis was
17 performed in the previous site, that still does not
18 relieve us from looking at the MEA site, correct, as
19 it stands on its own as a given proposed mine site?

20 MR. BACK: That is correct, and that is
21 why we had multiple lines of evidence that this is not
22 leakage at the MEA site.

23 JUDGE WARDWELL: Have you performed a
24 leakage analysis of the drawdown in the MEA in any of
25 the MEA -- in the data of any of the MEA wells?

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1 MR. BACK: Qualitatively, in the sense
2 that the distance drawdown results clearly show that
3 there is not leakage going to the Basal Chadron
4 sandstone.

5 JUDGE WARDWELL: Okay. We'll get to that
6 in a minute. But I want to fix the point one more
7 time that you do agree that the MEA needs to stand
8 alone and cannot count on either any performance
9 associated with what has taken place at the existing
10 facility.

11 MR. BACK: Yes.

12 JUDGE WARDWELL: Crow Butte, do you -- do
13 you agree to that statement, that we -- regardless of
14 whether there was homogeneity, in a perfect situation
15 up at the existing site, that doesn't allow us to
16 assume that it's perfect down at the MEA site? And,
17 likewise, if the MEA site is showing heterogeneity,
18 that doesn't necessarily mean that it's going to be up
19 at the other site.

20 They have -- we cannot count on that other
21 site to -- to make any conclusions. We have to rely
22 on the data and the information and the evidence that
23 is provided for the MEA site. Is that correct? Would
24 you agree to that?

25 MR. LEWIS: I agree with that, Your Honor.

1 JUDGE WARDWELL: I'm sorry?

2 MR. LEWIS: Yes.

3 JUDGE WARDWELL: You do agree with that.

4 Dr. Kreamer, do you agree that we have to
5 establish everything associated with the MEA site
6 based on the MEA data?

7 DR. KREAMER: The word you just said was
8 "everything." There are -- there are some analogies,
9 but, yes, I do believe the MEA has --

10 JUDGE WARDWELL: There is always going to
11 be analogies.

12 DR. KREAMER: The way you phrased it just
13 now was a little bit different, saying that we -- I
14 don't think we should exclude considering the other
15 site, but I think that the bottom line is the MEA site
16 has to stand on its own data.

17 JUDGE WARDWELL: So if the MEA does have
18 to stand on its own data, us reviewing the pump test
19 data from the existing site is a waste of our time;
20 isn't it? It's not part of the record.

21 DR. KREAMER: I'm sorry. Say again?

22 JUDGE WARDWELL: Is it -- if, in fact, we
23 have to rely -- you just stated that you agreed with
24 everyone that the MEA site has to stand on its own; is
25 that correct? That's what I just heard you say.

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1 DR. KREAMER: That's correct, yes.

2 JUDGE WARDWELL: Okay. Thank you. We'll
3 leave it at that.

4 I want to -- I want to fix one other issue
5 with this flattening of the curves later on. Well,
6 we'll get to that later.

7 Here we are. NRC, in your -- I guess it's
8 your rebuttal, Exhibit 014, answer 18 at 19 to 20,
9 another possible explanation is that the water -- this
10 is in regards to the flattening of the curves -- that
11 the water is being released from storage in the first
12 several hundred feet of the aquifer -- aquitard
13 immediately overlying the Basal Chadron Chamberlain
14 Pass Formation.

15 And this was your statement earlier, Mr.
16 Back, wasn't it, in regards to this coming out of that
17 zone.

18 MR. BACK: Yes, Your Honor.

19 JUDGE WARDWELL: If that was correct, why
20 didn't we see the flattening of that in all of the
21 wells?

22 MR. BACK: It's a plausible explanation
23 for why we're seeing this flattening. It might be
24 that the sands -- that the Basal Chadron -- that basal
25 sands going towards this well is more connected to the

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1 clay rather than one of the lower sandstones. So it's
2 -- again, it's just -- it's a potential explanation.

3 JUDGE WARDWELL: Do you believe the Basal
4 Chadron is a sandstone or a sand?

5 MR. BACK: I believe it's a sand, and we
6 can call it a sandstone, but the descriptions are more
7 like a sand.

8 JUDGE WARDWELL: But didn't you stipulate,
9 if my memory serves -- or serves me correct that it
10 was a sandstone when we had those stipulations? So
11 maybe I'm not remembering it correctly. I'd have to
12 look it up.

13 MR. BACK: Well, it's classified as a
14 sandstone, but it's not cemented. People call it a
15 sandstone, but it's porous, like a sand.

16 JUDGE WARDWELL: Sandstone is porous;
17 isn't it?

18 MR. BACK: But it's cemented, so it has a
19 lot -- it's a much -- a much different composition.

20 JUDGE WARDWELL: And what lets you believe
21 it is -- it behaves more sand-like?

22 MR. BACK: There is a description --
23 Josephine Collins, who you referred to earlier,
24 described it as having very little change from when it
25 was originally deposited, which they termed

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1 diagenesis. The TR describes it as interbedded -- an
2 interbedded material from a channel deposit, and then
3 the grain size analyses, they did two grain size
4 analyses, which suggests that it's -- it's not a
5 sandstone but more of a sand. It's a fine-medium
6 sand.

7 JUDGE WARDWELL: Crow Butte, any of the
8 witnesses here have experience being on the drill rig
9 while you were installing these wells and getting to
10 see the material come out and have -- have an opinion
11 in regards to the consolidation or cementation of the
12 Basal Chadron as to whether it is a sandstone or a
13 sand-like material?

14 MR. STRIVER: Jim Striver, Crow Butte.
15 Yes, I have seen samples, both cuttings and attempted
16 to make core samples from the Basal Chadron. I would
17 consider it semi-consolidated in places, sand in most
18 places. It's very hard to recover core from the Basal
19 Chadron. It comes apart just like a sand you would
20 see in a fluvial environmental today.

21 So it's closer to sand, but there are
22 places where it's semi-consolidated.

23 JUDGE WARDWELL: Dr. Kreamer, what is your
24 evidence that supports your statement earlier that it
25 was a sandstone, the Basal Chadron?

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1 DR. KREAMER: Well, I thought we were all
2 in agreement. In the statement, we all agreed that
3 it's a coarse grain sandstone interbedded with thin
4 silt and clay beds of varying thicknesses.

5 But I think that we have to keep our eye
6 on the donut, not on the hole here. I think can take
7 you out to many unconsolidated, non-indurated sands,
8 and show you fractures in them, decent sized cracks
9 due to overpumping.

10 So I think the implication here is if you
11 have a non-indurated loose sand with -- or clay, you
12 can't have displacement. That's demonstrably false
13 and can be shown to be false in many areas.

14 So the idea that sand that is semi-
15 consolidated or not consolidated cannot fracture or
16 these beds cannot be displaced, I think that -- that
17 weighs into this, too.

18 But I thought we were in agreement that it
19 was a coarse grain sandstone, and everybody agreed to
20 that. At the previous site, there was no mention of
21 sand. It was always sandstone for this particular
22 formation.

23 JUDGE WARDWELL: If it was sandstone --

24 DR. KREAMER: Also, at the other site,
25 there is major faults that have been seen in the

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1 sandstone, great displacement and things like that.

2 So this is a continuous unit that is
3 mineralogically -- that we have agreed is
4 mineralogically and geochemically that -- similar to
5 the other -- other place, the other place which
6 characterizes the sandstone, has a major fault right
7 on the boundary of it and has the ability to fracture.
8 Even if it wasn't sandstone, it would have the ability
9 to fracture.

10 JUDGE WARDWELL: And, again, clarify for
11 me, if you would, whether or not the Basal Chadron is
12 fracturable or has fractured. How does that relate to
13 its confinement properties? How does that have any
14 bearing on it?

15 DR. KREAMER: It's not --

16 JUDGE WARDWELL: Aren't we concerned more,
17 if you'd bear with me, on what the upper confining
18 unit is rather than the fracturability of the Basal
19 Chadron?

20 DR. KREAMER: Well, again, if there is a
21 fracture in the Basal Chadron, there is a possibility
22 that it extends upward through what is called the
23 confining unit. Confining units can be fractured.
24 They can be leaky. So the term "confining unit"
25 doesn't mean that it's absolutely confined.

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1 I find that Mr. Back's analysis that the
2 clay leaks in one place but doesn't leak in another
3 place to be less likely than isolated secondary
4 porosities that extend not only to the Basal Chadron
5 Chamberlain Pass Formation but also upwards through
6 what is called the confining layer to allow water from
7 upper layers -- upper layers to move downward.

8 JUDGE WARDWELL: Thank you.

9 Here is a stopping point. We could go now
10 -- we can stop now or go half an hour.

11 CHAIR BOLLWERK: All right. Judge
12 Wardwell advises that this is a good stopping place
13 for him, and so why don't we go ahead -- it's right at
14 12:30. If possible, I would really like, given the
15 situation this morning, if we could do a 45-minute
16 lunch, that would be much better than an hour. So, is
17 that possible?

18 MR. SMITH: Your Honor, I think that might
19 be difficult for us. You had indicated previously an
20 hour, and we don't have lunch onsite. We are going to
21 go back to the mine and then return. So we can -- we
22 can certainly do our best, but there is some travel
23 time involved.

24 CHAIR BOLLWERK: Well, we would appreciate
25 it if you could get back here as quick as you can.

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1 Once you're back, we're going to start. So enjoy your
2 lunch. Be as prompt as you can, but we will
3 definitely start by 1:30.

4 (Whereupon, the above-entitled matter went
5 off the record at 12:30 p.m. and resumed at 1:31 p.m.)

6 CHAIR BOLLWERK: All right. Let's go back
7 on the record, please. We completed our lunch break.
8 We are dealing with concern number two under
9 contention two. I neglected to ask you before, Dr.
10 Kreamer, and I take it there's no one in the room with
11 you other than yourself, right?

12 DR. KREAMER: No, no, and I have the door
13 locked, as well.

14 CHAIR BOLLWERK: Okay. Very good. Again,
15 if someone were to come in, that's fine. We just need
16 to know that that's happening.

17 DR. KREAMER: No, the door is locked and
18 no one will come in.

19 CHAIR BOLLWERK: Okay. Thank you very
20 much. Appreciate that. All right. So let me turn it
21 back to Judge Wardwell, who I think has a few more
22 questions.

23 JUDGE WARDWELL: Okay. I'm about to
24 proceed into 2.1.3, opinion one, basis C, the Cooper-
25 Jacob methodology. Dr. Kreamer's testimony, Exhibit

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1 003 of the OST at 2, opinion one, basis C, Cooper-
2 Jacob, says that these analyses that were supposedly
3 run by the Crow Butte did not appear in the report.
4 The Crow Butte rebuttal at that next exhibit, 033, at
5 A-13, that's answer 13 at six, says the results of the
6 Cooper-Jacob semi-logarithmic distance drawdown
7 analysis are shown in the pump test report at CBR016,
8 Figure 18, at page 50 and discussed in Session 7.6.1
9 in the test report. And that cites again the CBR
10 Exhibit 016 at 12 to 13.

11 And I ask CBR is that inclusive of all the
12 Cooper-Jacob data and analyses that went into the plot
13 represented in Figure 18, CBR016 at 50?

14 MR. LEWIS: Bob Lewis, Crow Butte. Yes,
15 your Honor.

16 JUDGE WARDWELL: And where is the, is
17 there early time data shown on that diagram, or is
18 that not the type of diagram that would show such a
19 thing?

20 MR. LEWIS: Bob Lewis, Crow Butte. This
21 data is a single moment in time, and it's taken toward
22 the end of the test.

23 JUDGE WARDWELL: That's what this plot
24 did. You could plot it out for different time frames,
25 right? But this is just a plot of that drawdown with

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1 distance at a given snapshot of time, and you say
2 that's near the end of the pumping test; is that
3 correct?

4 MR. LEWIS: That's correct.

5 JUDGE WARDWELL: Okay. NRC014, rebuttal,
6 answer 18, at pages 20 to 21 says that a Cooper-Jacob
7 time drawdown analysis is not necessary to identify a
8 recharge boundary. It would not provide -- went too
9 far. It would not -- well, let me start over again
10 because I lost the, I just zoomed too many places.
11 Anyhow, oh, would not provide any additional
12 information not already available from a Theis curve
13 analysis because the Cooper-Jacob time drawdown
14 analysis is an approximation to the Theis analysis.

15 Referencing the CBR025 at 90 to 91, it
16 goes on to say the Cooper-Jacob time drawdown method
17 was developed because it is easier to fit a straight
18 line through the data than to fit the data, to fit the
19 data than to the Theis type curve, not because the
20 Cooper-Jacob method provides any additional
21 information. Furthermore, use of the early time data
22 might show deviations from a Theis curve that mimic
23 recharge. However, for the reasons discussed in A-17
24 above, use of the early time data in the Theis or the
25 Cooper-Jacob time drawdown analysis is inappropriate.

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1 So I ask NRC are you basically claiming
2 that the Cooper-Jacob is a shortcut analysis, rather
3 than one that's a more detailed analysis to the Theis
4 curve fitting?

5 MR. BACK: Yes, your Honor. There are two
6 types of Cooper-Jacob analyses, but the one that
7 involves time is a shortcut to the Theis method.

8 JUDGE WARDWELL: Thank you. And Crow
9 Butte, do you agree with staff's statement that a
10 Cooper-Jacob time drawdown analysis is not necessarily
11 to identify a recharge boundary and will not provide
12 any additional information not already available from
13 a Theis curve analysis?

14 MR. LEWIS: It provides a different type
15 of information, your Honor. It can identify
16 boundaries more obviously on a straight line in some
17 cases.

18 JUDGE WARDWELL: And what was your purpose
19 for performing this analysis?

20 MR. LEWIS: Normally, both types of
21 analysis are performed using analytical method and to
22 see for consistency if the transmissivities were in
23 the same range as the Theis method, which it is.

24 JUDGE WARDWELL: Thank you. And, Dr.
25 Kreamer, do you disagree with the staff that the

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1 Cooper-Jacob is a shortcut, rather than a more
2 involved analysis of the pumping test data?

3 DR. KREAMER: Can I be heard? I'm trying
4 to go on the phone now to avoid some of the problems
5 we had earlier. Does this work?

6 CHAIR BOLLWERK: Yes, we can hear you, Dr.
7 Kreamer.

8 DR. KREAMER: Okay. I can be heard. All
9 right. Yes, the Cooper-Jacob is similar to the Theis
10 equation. It's just that when you see recharge
11 boundary, it's more obvious in the Cooper-Jacob
12 analysis. And so by showing the Cooper-Jacob, it's
13 got slightly different assumptions but, essentially,
14 it's the same sort of analysis the Theis analysis is.
15 Those two represent the very simplest type of analysis
16 that can be done on an aquifer.

17 JUDGE WARDWELL: And does not this satisfy
18 your concerns where you said the Cooper-Jacob analysis
19 wasn't presented in any of the testimony?

20 DR. KREAMER: My concern was that recharge
21 boundaries would be much more obvious. As you looked
22 at the little wiggles we were discussing before in the
23 Theis analysis, the diversions from a straight line
24 would be, in the Cooper-Jacob would be much more
25 obvious and those little wiggles would then have

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1 greater import when seen in a different format.

2 JUDGE WARDWELL: I was referring to what
3 I was reading in regards to your testimony where you
4 said these analysis did not appear in the report. Do
5 you now see where these are in the report? Does that
6 satisfy that concern they are not in the report?

7 DR. KREAMER: No, I do not. I guess the
8 figure that's up, I'm not sure were there a host of
9 figures for all the monitoring well data. If that was
10 presented, I did miss it. But I didn't see for a
11 monitoring well a different Cooper-Jacob analysis.

12 JUDGE WARDWELL: There wouldn't be one for
13 every monitoring well because aren't these data points
14 that we're looking at in Figure 15 really the
15 drawdowns from different monitoring wells? While
16 you're pausing I'll ask Crow Butte that because --

17 DR. KREAMER: What is presented here is
18 not, it's one form of a Jacob-Cooper but it's not the,
19 it's not the typical form.

20 JUDGE WARDWELL: Crow Butte, would you
21 like to respond? Is this a plot of different wells,
22 drawdown from different wells at different distances
23 away?

24 MR. LEWIS: That's correct, your Honor.

25 JUDGE WARDWELL: So each one of these

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1 points is a different well?

2 MR. LEWIS: Yes.

3 JUDGE WARDWELL: Okay. And, Dr. Kreamer,
4 you see where this is, Figure 18 of that pumping test;
5 correct?

6 DR. KREAMER: I do see that. A typical
7 Cooper-Jacob is not individual to different distances.
8 It's one well with drawdown at that particular well,
9 similar to a Theis.

10 JUDGE WARDWELL: Where in this diagram do
11 you see the additional recharge boundary shown better
12 than in a Theis?

13 DR. KREAMER: I'm sorry. You broke up on
14 my phone here. Could you repeat, please?

15 JUDGE WARDWELL: Yes. In Figure 18, the
16 Cooper-Jacob method, where do you see that the
17 recharge boundaries are illustrated better than were
18 illustrated at the Theis curve?

19 DR. KREAMER: Typically, the Cooper-Jacob
20 would be time versus drawdown and not distance versus
21 drawdown.

22 JUDGE WARDWELL: That didn't answer my
23 question.

24 DR. KREAMER: Okay. I didn't hear you.
25 Could you please clarify?

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1 JUDGE WARDWELL: Yes. Where in this
2 diagram does it show that recharge boundaries are
3 better highlighted than would be in the Theis plots?

4 DR. KREAMER: In this sort of a plot, this
5 is completely different from Theis. In a Theis, it's
6 time versus drawdown. In this one, it's distance
7 versus drawdown. A typical Cooper-Jacob would be time
8 versus drawdown or U, a U term.

9 JUDGE WARDWELL: So in this diagram, it
10 doesn't show recharge any better than the Theis or
11 maybe even less better?

12 DR. KREAMER: Oh, yes, this one is
13 inferior to even the Theis. A typical Jacob-Cooper
14 that would talk about one well and its drawdown with
15 time would then show the inflections from a straight
16 line that would indicate some sort of boundary,
17 whether it be a recharge boundary or a solid no-flow
18 boundary.

19 JUDGE WARDWELL: And what's your basis for
20 calling your version the typical Cooper-Jacob and this
21 not being, which implies that Figure 18 is not the
22 typical one?

23 DR. KREAMER: Oh, this has got very
24 restricted data. You don't see all the drawdown
25 information from each well. What the --

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1 JUDGE WARDWELL: Excuse me. Can I
2 interrupt? Can I interrupt? Can I interrupt?

3 DR. KREAMER: I'm sorry?

4 JUDGE WARDWELL: My question was what was
5 your basis for calling this an atypical Cooper-Jacob
6 and you using the phrase in a typical one it would
7 show it? What makes this atypical compared to what
8 the version of the Cooper-Jacob that you're thinking
9 of that has time involved with it?

10 DR. KREAMER: Yes. Here are drawdown
11 versus distance, and it only uses select information
12 from a certain well here.

13 JUDGE WARDWELL: Let me rephrase it --

14 DR. KREAMER: In other words, all the --

15 JUDGE WARDWELL: I'm not coming across to
16 you, so I'll make it simple. Would it be a better
17 term to say one form of the Cooper-Jacob is this and
18 another form is another one that you're thinking of,
19 rather than applying possibly a pejorative adjective
20 to the type of curve that we're looking at?

21 DR. KREAMER: You're breaking up a little
22 bit, but I caught the gist of what you said, your
23 Honor. I guess that would be a fair assessment but
24 with the caveat that this is an unusual form. I'm
25 writing a textbook on hydrology right now, and this is

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1 a form that's very rarely used. And it actually
2 obscures whether there are recharge boundaries just by
3 its very nature.

4 JUDGE WARDWELL: Thank you. Crow Butte,
5 would you agree with their assessment that this is an
6 unusual one that you've provided us and there are more
7 typical ones out there, another one that's more
8 typical?

9 MR. LEWIS: No, your Honor. Cooper and
10 Jacob, Cooper and Jacob had two different type curves.
11 One was a distance drawdown plot here, the other is
12 the leakage analysis he's referred to. This is not an
13 inferior, it's just a different way of showing the
14 information. And there's actually one use of this
15 information that isn't useful in the Theis method, and
16 that is this method can be used to calculate well
17 inefficiencies, which can often be useful for various
18 reasons.

19 So this isn't an inferior method. It
20 actually provides some additional information if you
21 decide to use it for that.

22 JUDGE WARDWELL: Thank you. NRC staff,
23 would you like to comment on this?

24 MS. STRIZ: I'd like to comment. Your
25 Honor, Cooper-Jacob distance time graphs are included

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1 in their analysis. All the recovery analysis is
2 Cooper-Jacob. I just wanted to correct the record.
3 So if you go look at the Theis recovery, all of those
4 have been fed by Cooper-Jacob method. It's all a
5 straight-line analysis.

6 In addition, you have to be clear that the
7 T over T prime axis, early time is on the right side,
8 late time is on the left side. So as you get to T
9 over T prime equal to one, that is the point where the
10 period of the drawdown, which is T , is equivalent to
11 the period of the recovery, which is T prime. So the
12 axis is reversed.

13 So just for the record, these are Cooper-
14 Jacob analysis of the Theis recovery curves.

15 JUDGE WARDWELL: Okay, Dr. Striz. Did you
16 want to add anything, Mr. Back?

17 MR. BACK: No.

18 JUDGE WARDWELL: Okay. Give me a second,
19 Dr. Kreamer, here. I just want to make sure -- so
20 any, besides your statements where you say it didn't
21 appear in the report, any other statements you made
22 were in reference to the time versus drawdown Cooper-
23 Jacob and not the Figure 18 type of Cooper-Jacob; is
24 that correct?

25 DR. KREAMER: That's correct. I'm going

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1 to try very carefully to speak without the headset.
2 And if I talk over you, I'll look very carefully at
3 your picture to try not to do that. Essentially, the
4 Jacob-Cooper that NRC just referred to was only for
5 the recovery data. And as you pointed out in the
6 recovery data, the inflections off that line that
7 indicate even in the recovery data that there's
8 recharge boundaries.

9 But the Jacob-Cooper time drawdown
10 analysis was not presented for the pumping test
11 itself, just the recovery test, and that's my concern.

12 JUDGE WARDWELL: Thank you, Dr. Kreamer.
13 And when I do try to stop you and I'm not being
14 successful, if you see a big red and blue tight face
15 of mine, that's my indication that I wish to stop you
16 and clarify some things.

17 DR. KREAMER: I want to apologize. I mean
18 no disrespect when I talk over you. Please, sorry
19 about the audio.

20 JUDGE WARDWELL: I didn't attribute it to
21 you. I attributed you to the delay in the times that
22 we had. It is technology. It is Twitter, if I might
23 paraphrase a football coach over the weekend or an
24 equivalent to the Twitter anyhow.

25 Moving on to 214, opinion one, basic D,

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1 analysis of monitoring wells two and eight. Dr.
2 Kreamer, in his testimony, mentioned that -- and,
3 again, that's Exhibit 003, item D, at page two -- that
4 the report did not include analysis of pumping test
5 data from water level changes at monitoring wells two
6 or eight in the analysis, although these wells were
7 reported to be in the radius of the influence of the
8 pumping test and those water level changes were used
9 to define the extended radius of the pumping well
10 influence.

11 NRC, in their rebuttal, 014, answer 16 at
12 16, staff states that, due to failure of the initial
13 attempts to perform a pumping test, CBR refined their
14 design of the test by proposing different wells,
15 specifically monitoring six and seven, be designated
16 as the furthest wells to formally estimate the radius
17 of influence. However, although CBR indicated that
18 two and eight were no longer part of the formal
19 network, these wells were still being monitored.

20 And so I guess I'll just ask Crow Butte,
21 since there was still drawdown in two and eight, why
22 weren't these considered part of the formal network?
23 You know, what do you need, what kind of wristband do
24 you need to get into being designated as formal
25 monitoring network stuff?

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1 MR. LEWIS: Bob Lewis, Crow Butte. Your
2 Honor, we developed a work plan that was approved by
3 Nebraska DEQ, and it was their definition of a half a
4 foot of drawdown would be within the formal monitoring
5 well network. And we made an estimate --

6 JUDGE WARDWELL: Who is they? You say
7 they, they --

8 MR. LEWIS: Nebraska DEQ.

9 JUDGE WARDWELL: Okay.

10 MR. LEWIS: And so we made an estimate of
11 what we thought would be the radius of influence prior
12 to the test and included those wells as part of the
13 formal well network.

14 JUDGE WARDWELL: And, in fact, I think we
15 looked at some graphs of them, didn't we? Dr.
16 Kreamer, does that pretty much address two and eight
17 issue in regards to, in fact, they are actually there
18 and the data is there, even though they're not part of
19 the network because there's not enough drawdown there?

20 DR. KREAMER: Yes, it would have been nice
21 to have that presented just to have more data, but I
22 understand the response and I understand where they're
23 coming from.

24 JUDGE WARDWELL: Thank you. Before I move
25 on to 215, opinion one, basis E, MEA coverage from a

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1 single pump test, that's what we're going to cover
2 next. I'm going to stop and pause now to see if we
3 have any catch-up on the old pieces of information we
4 needed. We should have done that, I should have
5 picked up on that --

6 MR. SMITH: Yes, your Honor, we have the
7 answer --

8 JUDGE WARDWELL: Usually, my chair always
9 keeps me in line for that, so I'm going to blame him
10 for not keeping me in line on getting that.

11 CHAIR BOLLWERK: I was waiting for you.

12 MR. SMITH: I was ready, as well. I had
13 my microphone in front of me. We have the answer to
14 the two questions that you posited.

15 JUDGE WARDWELL: All right. Why don't we
16 --

17 MR. SMITH: Mr. Pavlick is going to
18 address the first one and Mr. Lewis the second one.

19 JUDGE WARDWELL: Great.

20 MR. PAVLICK: Doug Pavlick, Cameco. So
21 your first question was regarding the 167,000 gallons,
22 where did that come from. So that was the accumulated
23 volume of flow from the pumping well during the pump
24 test. It was captured in tanks and then transported
25 to the Crow Butte site for disposal.

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1 JUDGE WARDWELL: Well, wouldn't that
2 change your pumping rate then, that you're pumping
3 rate was different than what's reported there or the
4 length of time that you were running the test? If
5 that's the accumulated amount, something has got to be
6 in error here.

7 MR. PAVLICK: It's equal to the 4.29 days
8 that the test ran times the flow rate of the test of
9 27.08 gallons per minute.

10 JUDGE WARDWELL: Okay. Thank you. And
11 now the second one.

12 MR. LEWIS: Your Honor, I looked at each
13 of the monitoring wells type curves, and I had the
14 following summary. Seven of the eight monitoring
15 wells exhibited what I would call normal behavior.
16 Monitor well number three had a flattening of the
17 curve in late time. Monitoring well number two had
18 very small drawdowns at a great distance and had more
19 variability to the data in general. Monitor well
20 number eight was also at a great distance with small
21 drawdowns. It did display some early time deviations
22 but also had very small drawdowns with greater
23 variability.

24 JUDGE WARDWELL: And weren't we also going
25 to talk about how many have early time frames?

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1 MR. LEWIS: Thank you. There was an early
2 time deviation in the pump well, which it was
3 expected. I had some early time deviations in
4 monitoring well number two and number eight, and those
5 were the wells that were outside the formal monitoring
6 network.

7 JUDGE WARDWELL: Thank you. Dr. Kreamer,
8 if you want to, I won't ask you now whether or not you
9 disagree or agree with their assessments of their
10 characterization of those type curves. If you're
11 interested in responding to that, just remind me of it
12 when we meet again come Thursday and that will give
13 you time to look it over and get back to see whether
14 or not your comment are in regards to early and late
15 time influences of those particular plots of data from
16 the monitoring well of the pump test for various
17 monitoring wells.

18 DR. KREAMER: I have no response at this
19 time. I'll look at the data. Thanks.

20 JUDGE WARDWELL: Okay. So with that, the
21 pot is right and we got a clean slate, right? We're
22 all good. Moving on to, again, the coverage from a
23 single pump test, Exhibit OST004, is that you, Mr.
24 Wireman?

25 MR. WIREMAN: I'm sorry?

1 JUDGE WARDWELL: OST004? Is that your
2 testimony or --

3 MR. WIREMAN: Yes, yes.

4 JUDGE WARDWELL: Okay. So I thought, oh,
5 we had a different number here. Opinion three at four
6 talked about limited site coverage with only one test,
7 saying only one aquifer test has been conducted at the
8 MEA. The aquifer test was conducted in May of 2011
9 and the CBR reports that the radius of influence
10 estimated from the aquifer test was about 8,800 feet
11 or about 1.6 miles, and the MEA extends for more than
12 7.2 miles from the northwest corner to the southeast
13 corner. Therefore, much of the Basal Chadron has not
14 been tested to determine if there's a hydraulic
15 connection between the Basal Chadron aquifer and the
16 overlying Brule.

17 I'll start off with CBR. Do you agree
18 with the numbers, the values here for the radius of
19 influence and the 7.2 miles from the northwest corner
20 to the southeast corner?

21 MR. STRIVER: Jim Striver, Crow Butte.
22 Yes, we do.

23 JUDGE WARDWELL: Thank you. NRC rebuttal
24 014, answer 21 at 23, said, based on the ROI of 8,800
25 feet, the pumping test covered approximately three

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1 miles of the approximately 7.5 mile length of the MEA
2 site. And then CBR rebuttal, answer 15 at seven to
3 eight in regards to the claims that performing a
4 single pumping test covered only a relatively small
5 portion of the site is poor professional practice.
6 CBR rebutted that their approach is consistent with
7 industry practice and with NRC guidance, stating that
8 any of a number of commonly-used aquifer pumping tests
9 may be used, including a single-well drawdown recovery
10 test, drawdown versus time in a single observation
11 well, and drawdown versus distance pumping test using
12 multiple observation wells.

13 And I think I failed to read Dr. Kreamer's
14 response to this. I had Mr. Wireman's, but I believe,
15 Dr. Kreamer, you also had some criticism of the one
16 pumping test, and I just want to clarify for you that
17 when you were, and I'll do the same to you, Mr.
18 Wireman, when you were criticizing a single-well test
19 -- excuse me. When you were criticizing only one
20 pumping test, you weren't criticizing the analysis
21 they were running but just the mere fact that they ran
22 just one pump test out at the MEA site? Is not that
23 correct, Dr. Kreamer?

24 DR. KREAMER: We actually don't like the
25 analysis as well --

1 JUDGE WARDWELL: Please, answer the
2 question.

3 DR. KREAMER: -- we're talking about the
4 same -- I'm sorry.

5 JUDGE WARDWELL: Answer the question
6 simply. It was a pretty simple question. You're
7 going to have a chance to talk about the analysis. I
8 just want to make sure --

9 DR. KREAMER: The answer is --

10 JUDGE WARDWELL: -- they're talking about
11 --

12 DR. KREAMER: -- no, I don't agree. I do
13 not agree that it was, our only concern was the radius
14 of influence only covered a small portion --

15 JUDGE WARDWELL: Mr. Wireman --

16 DR. KREAMER: -- the analysis itself.

17 JUDGE WARDWELL: -- when you were
18 referring to the single pumping test, it was a fact
19 that there was only one pump test performed at the
20 site and that you felt more should be done to cover
21 the full range of the Basal Chadron in the MEA. Is
22 that correct or not?

23 MR. WIREMAN: With regard to opinion
24 three, that is correct.

25 JUDGE WARDWELL: Exactly. Thank you very

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1 much. That qualifies it nicely. And I turn to CBR in
2 saying when you were referencing in your rebuttal that
3 you had single well drawdown and recovery tests and
4 using the NRC guidance as justification for this,
5 aren't you really mixing a couple of things because
6 isn't a single-well analysis different than just
7 conducting one pumping test out there? It's a form of
8 analysis, rather than how many numbers of different
9 tests of those single-well analyses you're performing
10 out there; isn't that correct?

11 MR. LEWIS: Bob Lewis, Crow Butte. Your
12 Honor, I believe the single-well pump test is a
13 different methodology entirely, as you suggested, than
14 a single-well pump test. Those types of analysis can
15 be used for estimates of transmissivity and storage
16 coefficient within the guidance, so that is the only
17 reason that's in the rebuttal.

18 JUDGE WARDWELL: Okay. Thank you. Now,
19 in regards to Dr. Kreamer's and Mr. Wireman's issue
20 under this particular section of opinion one, basis E,
21 is that Crow Butte, in their rebuttal, Exhibit 033,
22 answer 15 at 78 said that the expectation is that
23 additional site-specific pumping tests are performed
24 as required as additional mine units are added.
25 License condition 11.3.4, NRC009 at 19, states that,

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1 as part of developing its well field packages for any
2 new mine unit at the MEA, the applicant shall perform
3 an aquifer pumping test for each new mine unit.

4 And I'll turn to CBR and ask you state in
5 this rebuttal that the expectation is that additional
6 pump tests will be performed. Isn't that really
7 required, rather than an expectation? It's a license
8 condition, isn't it?

9 MR. STRIVER: Jim Striver, Crow Butte.
10 Yes, that might be, the terminology may be incorrect.
11 That is a requirement that we would be conducting on
12 each new mine unit.

13 JUDGE WARDWELL: Okay. Thank you. With
14 that, Dr. Kreamer, and, again, you're going to have
15 time to comment on the methodology. If you look over
16 your testimony, you'll see, and I've said it as we
17 started here we're going to cover every topic. I'm
18 not concerned with your, at this point, with your
19 objections to the analysis. I'm concerned with your
20 concern about the fact there's only one test.

21 Comment on what is -- yes, I'll narrow it
22 for you. What is wrong with the fact that there are
23 going to conduct other pumping tests out there. They
24 have to form others as each mine unit developed. Does
25 that not satisfy your need for a better

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1 characterization of the Basal Chadron Chamberlain Pass
2 Formation?

3 DR. KREAMER: Your Honor, it's my
4 understanding that what we're doing here is not only
5 for the efficiency of mine operations but to see if
6 there's excursion and if there will be safety
7 enclosure. Under those conditions, looking just at
8 the mine site and not the potential for movement both
9 offsite and further on in the site I think is an
10 important consideration.

11 Also, the pumping test measure was an
12 aggregation of information and within the cone of
13 depression and part of the cone of depression was
14 outside the mining site. So the information that was
15 actually developed, part of it was related to water
16 that was drawn in from outside the mining boundaries.

17 And so I guess the short answer to that,
18 which maybe I should have answered to start with, is
19 I think that one single -- we don't call it a pumping
20 test, we call it aquifer test. One aquifer test was
21 insufficient because it didn't cover a large
22 percentage. The majority of the site was not even
23 evaluated.

24 JUDGE WARDWELL: Okay. Thank you. Mr.
25 Wireman, would you like to add anything to that?

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1 MR. WIREMAN: Yes, I'll add a couple of
2 things. Thank you. First of all, I don't believe
3 it's industry practice at all to only have one aquifer
4 test for an area this size. Secondly --

5 JUDGE WARDWELL: But they are going to
6 have more aquifer tests there.

7 MR. WIREMAN: But they won't go in the EA,
8 so people will not know what the results of those are
9 prior to mining. So it's kind of too late in my view
10 at that point. They will get hydraulic parameters
11 that they need for operation. That's true. It's
12 important to them. But with respect to characterizing
13 the groundwater flow in this area and evaluating the
14 risk of this mining operation with respect to
15 excursions or unwanted movement of contaminated water,
16 those don't do any good. So they need to be done up-
17 front.

18 JUDGE WARDWELL: Can I stop you right
19 there, though? Because that's a good point. I want
20 to get to them and then come back for the rest of
21 yours.

22 MR. WIREMAN: Fair enough.

23 JUDGE WARDWELL: I was going to get lost
24 if you started adding some others on top of it.

25 MR. WIREMAN: No problem.

1 JUDGE WARDWELL: Staff, how would you
2 respond to that? Why shouldn't the applicant be
3 responsible for characterizing most of the Basal
4 Chadron, rather than just having one test in one area
5 where you're starting the mine?

6 MR. BACK: Yes, your Honor, this is David
7 Back. There's a lot of characterization data, actual
8 borings and field measurements that are done
9 throughout the entire site. And so from that
10 standpoint, I mean, we still have a lot of data that
11 might not have been influenced by the aquifer test by
12 the zone of influence, but there's a lot of data that
13 supports that we're seeing very similar conditions
14 throughout the entire site. And you can see that in
15 the geophysical logs, you can see it in the borings,
16 you can see it in the water levels being relatively
17 consistent. There's just a general consistency
18 throughout the entire MEA.

19 JUDGE WARDWELL: Thank you, Mr. Back.
20 Continue on, Mr. Wireman.

21 MR. WIREMAN: With respect to looking at
22 borings and looking at some of the water levels, that
23 doesn't really tell you a lot about the overlying
24 Brule. The aquifer testing, if done correctly and if
25 the right types of data are collected and analyzed, is

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1 much, much better for telling you something about the
2 potential for either drawing water downward from the
3 Brule or the presence of pathways that would allow
4 water to go the other way.

5 So the aquifer testing is critical for
6 that reason. It gets at the potential for connection
7 and the potential for moving water from one formation
8 to the other. So for that reason and given the
9 heterogeneities even within the Basal Chadron, and
10 their testing indicates some significant hydraulic
11 conductivity differences amongst these wells, that in
12 itself, in my view, warrants doing aquifer tests.
13 They know there's differences, and so that warrants an
14 aquifer test in this area where they have very high
15 transmissivities versus low. So to me it just makes
16 sense.

17 JUDGE WARDWELL: I'll go back to staff
18 now. What would technically happen if you got three
19 or four pump tests down the road, mine units down the
20 road, and it was determined that the pump test
21 analysis demonstrated that you couldn't control
22 lixiviant in that particular area, that you had to,
23 you know, the pump test just showed there was too much
24 leakage there or not enough some other confinement or
25 the Basal Chadron was more impervious and you couldn't

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1 draw stuff out of it because it was so tight, yet
2 still could get off into the environment where it was
3 confined in other parts? What would happen then?

4 MR. LANCASTER: Yes, this is Tom
5 Lancaster. If it shows conditions different than what
6 the data shows us, under license condition 9-4, they
7 would be required to submit a license amendment with
8 a plan for safe operations in those conditions.

9 JUDGE WARDWELL: Thank you, Mr. Lancaster.
10 Moving on to 2.1.6, opinion one, basis F, offsite
11 influences. Dr. Kreamer, Exhibit 003 at two, stated
12 that the single solitary pumping test performed at the
13 MEA was impacted by hydrogeologic influences offsite
14 that were not part of the area to be evaluated.
15 Because of the elongated nature of the MEA, the cone
16 of depression's radius of influence for the solitary
17 pumping test extended significantly offsite well past
18 the boundaries of a narrow portion of the property.
19 The pumping test drew water from these offsite
20 locations.

21 And when we're talking about offsite or
22 the boundary of the property, Dr. Kreamer, were you
23 referring to the MEA or were you referring to some
24 cross-section or something that demonstrated the
25 limits of the Basal Chadron Chamberlain Pass

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1 Formation?

2 DR. KREAMER: Your Honor, when I referred
3 to offsite, I was talking about the radius of
4 influence. If you look at the radius of influence of
5 the pumping well, it extends, if you go at 8,000 feet
6 that we've talked about before, it goes far off the
7 sides of the site, which is an elongated site. So,
8 essentially, we're drawing water not just from the
9 site but from areas off the site. Therefore, the
10 drawdown data in the monitoring wells was really a
11 composite of onsite data and offsite data.

12 JUDGE WARDWELL: And by site, again, you
13 mean the boundary of the MEA; is that correct? Is
14 that what you're defining as the site?

15 DR. KREAMER: That is correct.

16 JUDGE WARDWELL: Okay. Thank you. CBR's
17 rebuttal, 033 exhibit, answer 16 at eight, says that
18 the aquifer test results are representative of average
19 aquifer conditions over the radius of influence of the
20 test, which includes the monitoring wells that were
21 evaluated as part of the test. The fact that the
22 radius of influence extends offsite to the east and
23 west of the MEA boundary is irrelevant to the outcome
24 of these testing results.

25 And I'll ask CBR the same question: what

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1 boundary of the property are you referring to? Is
2 that, again, the MEA black line area that is shown on
3 several of the figures in the application, in your
4 application?

5 MR. LEWIS: Bob Lewis, Crow Butte. Yes,
6 your Honor.

7 JUDGE WARDWELL: Okay. And isn't your
8 statement true that it's irrelevant or it certainly
9 would be false, wouldn't it, saying it's irrelevant
10 if, in fact, the radius of influence exceeded the
11 boundary of the Basal Chadron Chamberlain Pass
12 Formation? If you were pumping it so hard that you're
13 now pumping other materials that are beyond the limits
14 of the Basal Chadron, you're testing a different
15 material, aren't you? Strata.

16 MR. LEWIS: Well, your Honor, unless the
17 boundary of the site was circular, it would be
18 impossible for the radius of influence to match the
19 site boundary. I don't really see the relevance as
20 the transmissivity measured at various monitor well
21 locations show continuity across the site and are
22 consistent.

23 JUDGE WARDWELL: Is there any spot where
24 you believe the ROI does exceed the limits of the b
25 Chamberlain Pass Formation, or how far, how wide is

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1 the limits of the Basal Chadron, either side of, the
2 centerline, if you would, of that stepladdered outline
3 of your MEA?

4 MR. LEWIS: Your Honor, in some cases,
5 roughly, the radius of influence would extend three to
6 four-thousand feet offsite in some areas beyond the
7 site boundary.

8 JUDGE WARDWELL: How far does the -- what
9 I'm trying to get a grasp on is how far does the Basal
10 Chadron extend to either side of the MEA?

11 MR. LEWIS: It's continuous throughout
12 that area and beyond.

13 JUDGE WARDWELL: So there is no
14 interruption with part of the shale coming up or
15 anything else? It's Basal Chadron on either side of
16 it for --

17 MR. LEWIS: Your Honor, approximately
18 three miles to the northwest, the Basal Chadron does
19 not exist. It pinches out stratigraphically. So,
20 yes, there is a lateral boundary about three miles
21 east, I'm sorry, northeast of the MEA boundary.

22 JUDGE WARDWELL: You give me --

23 DR. KREAMER: Could I make a request?
24 When you don't speak directly into the microphone and
25 it's not only yourself but also Mr. Wireman, I cannot

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1 hear. It just goes off. Although you can hear it in
2 the room, it doesn't carry to the sound system.

3 MR. LEWIS: Very well. Let me rephrase.

4 JUDGE WARDWELL: Let me just say how I'd
5 like it rephrased. You said something about to the
6 northeast or the northwest. Fine. But I need to also
7 know east and west, the limit. Approximately, how far
8 does it before it pinches out, if it does at all?

9 MR. LEWIS: Right. The Basal Chadron
10 pinches out more than seven miles to the west and
11 pinches out approximately three miles to the east.

12 JUDGE WARDWELL: Okay. Thank you. And
13 that's from where? From the boundary or from the
14 center line of the MEA?

15 MR. LEWIS: From the boundary.

16 JUDGE WARDWELL: From the boundary?

17 MR. LEWIS: Yes.

18 JUDGE WARDWELL: And have you looked at
19 your radius of influence, that 8,000-foot one? Would
20 that, in fact, be butting up against, in the area that
21 you did it for, ME 1, would that radius of influence
22 extend to that strata beyond where the Basal Chadron
23 Chamberlain Pass Formation pinches out?

24 MR. LEWIS: I don't believe so, your
25 Honor, no.

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1 JUDGE WARDWELL: Dr. Lagarry, I was
2 debating whether -- don't take up too much time,
3 mainly because I'm going to get back to you. You're
4 here all the time, so I'm leaving you for the caboose,
5 if you will, of this train.

6 DR. LAGARRY: I look forward to it.

7 JUDGE WARDWELL: But I would like your
8 opinion while we're on that subject of what is your
9 knowledge base in regards to the extent of the Basal
10 Chadron east and west of the laddered outline of the
11 MEA?

12 DR. LAGARRY: There's three
13 interpretations, your Honor. The first one and --

14 JUDGE WARDWELL: I would like the one that
15 you would like to stand behind as a geologist as
16 closest to truth.

17 DR. LAGARRY: The Chamberlain Pass
18 Formation was deposited in a generally northwest -
19 southeast trending trough. Some say it's erosional,
20 some say it's structural. But the pinching out on
21 either side is about what CBR says it is.

22 JUDGE WARDWELL: Thank you very much.
23 Appreciate that. Sorry to let you think you were
24 really going to get into some meaty things here. That
25 will have to wait. I'm sorry.

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1 DR. LAGARRY: Every dog has his day, your
2 Honor.

3 JUDGE WARDWELL: But I appreciate the
4 input. NRC, in their rebuttal, 014, answer 20 at 23,
5 Dr. Kreamer's claim that water was drawn from offsite
6 misconstrues the actual groundwater flow dynamics
7 involved in pumping a confined aquifer, like the Basal
8 Chadron. The changes to the potential metric surface,
9 i.e. drawdowns, observed in the furthest monitoring
10 wells are a response to the decrease in pressure
11 caused by the pumping well and are unrelated to water
12 movement from offsite.

13 In regards to this, there is one nagging
14 question I still had in the back of my mind for you,
15 Dr. Kreamer, and that is, while we talk about
16 containment really of the mining fluids within the
17 aquifer is what we're talking about when we're trying
18 to assess containment, that really is slightly
19 different than just calling this, and we often call
20 that containment confinement. I think those terms do
21 get interchanged somewhat in the various documents
22 that I've seen related to this application. But do
23 you believe that the Basal Chadron is and has remained
24 a confined aquifer up to this point in the MEA?

25 DR. KREAMER: I believe there's evidence

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1 of leakage through the overlying strata, so that would
2 be lack of confinement.

3 JUDGE WARDWELL: But it's still a confined
4 aquifer by hydrogeologic definitions, is it not?

5 DR. KREAMER: It has a high piezometric
6 surface. So under that definition, yes, it could be
7 called a leaky confined aquifer.

8 JUDGE WARDWELL: Well, in fact, the
9 aquifer isn't leaking, but it's a confining layer
10 above it that's actually doing the leaking, correct?
11 It's the aquitard that's leaking, it's not the aquifer
12 that's leaking.

13 DR. KREAMER: To not quibble too much, the
14 confining comes from a high piezometric surface or the
15 level of the piezometric surface, and it is above the
16 top of the formation. Under that definition, it's
17 confined. But by another definition, if there are
18 leaky aquitards above and below, then it is not
19 entirely confined. It's quasi-confined.

20 JUDGE WARDWELL: And in actuality, there's
21 no such thing as a completely confined aquifer because
22 every aquitard leaks to some degree, does it not?

23 DR. KREAMER: No, relatively speaking,
24 there's some --

25 JUDGE WARDWELL: No, no, not relatively

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1 speaking. Excuse me. Not relatively speaking. Every
2 aquifer, to some degree, every aquitard, to some
3 degree, leaks. It may be so small that it's
4 insignificant, but it does leak, does it not?

5 DR. KREAMER: Under that definition, I
6 would agree.

7 JUDGE WARDWELL: Okay. Thank you. Just
8 to make sure we're all in the same line here. And I'm
9 doing that to support you actually, that just because
10 you're talking about lack of confinement you're not
11 saying that it's not a confined aquifer because most
12 people will think of it as a confined aquifer. That's
13 where I was going with that question. That's why I
14 wanted to make sure the records show that we
15 understand there are two different types of
16 confinements and we really ought to use containment
17 and confinement and not mix the two, like at least I
18 end up doing, not being disciplined enough to keep
19 that on track.

20 But, anyhow, back to where I was. Now I'm
21 back to this. You probably forgot what the rebuttal
22 said. But, basically, it was, their rebuttal, NRC's
23 rebuttal that you've, Dr. Kreamer, you've misconstrued
24 the actual flow dynamics in that the changes in the
25 potentiometric observed in the furthest monitoring

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1 wells are a response to the decrease in pressure
2 caused by the pumping well and unrelated to water
3 movement from offsite. Do you agree with that
4 statement?

5 DR. KREAMER: No, I do not. That's crazy.

6 JUDGE WARDWELL: Say again. Did he say
7 that's crazy? Well, if you're just talking about me,
8 I'll accept it, but I don't know about --

9 DR. KREAMER: When you bore the
10 piezometric surface, water is released from the column
11 of the aquifer underneath. If there was no movement
12 of water, where would that water go? In other words,
13 when you lower a piezometric surface anywhere through
14 pumping, water is released and it's got to be released
15 in some direction. So the statement that, yes, the
16 piezometric surface went down but no water moved is
17 antithetical to basic hydrogeology.

18 JUDGE WARDWELL: Thank you, thank you, Dr.
19 Kreamer. NRC staff, would you like to clarify that?
20 And I'll start off by just saying what about the
21 constant head boundary observed in two wells that are,
22 you know, that went off a fair amount of distance?
23 The CP 1-A and the monitoring 3 and what about Dr.
24 Kreamer's response? Do you want to tie both of them
25 together?

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1 MR. BACK: Yes, your Honor. David Back.
2 First of all, his testimony was that water was moving
3 from offsite. I mean, just a simple mathematical
4 calculation will show you that pumping 25 gallons a
5 minute, you're never going to get, you're never going
6 to get water moving from that far away in four days.
7 I mean, the other aspect of this is, as we testified
8 earlier, the water is coming from, primarily from the
9 expansion of water and collapse of the matrix, and
10 it's not moving huge volumes of water from 8,800 feet
11 away.

12 And so what we see, and this is why if a
13 train runs over a confined aquifer, you see changes.
14 I mean, you see changes long ways away that doesn't
15 have anything to do with water movement. This is why
16 when you see an earthquake you can see a change in
17 well a thousand, you know, literally a thousand miles
18 away. And so to think that those responses we're
19 seeing 8,000 feet away are because of water movement
20 from offsite, well, it's crazy.

21 JUDGE WARDWELL: Well, we've got two
22 crazies. So if I may rephrase it another way, you're
23 saying it is a more of a pressure drop than it is a
24 water movement?

25 MR. BACK: Absolutely. That's exactly how

1 a confined aquifer response. That's why you see
2 responses to such great distances. It's not water
3 movement through the aquifer that's causing that.

4 JUDGE WARDWELL: Dr. Kreamer, one final
5 response to that? And then all the crazies here will
6 move on to something else.

7 DR. KREAMER: I think the distinction
8 between what we're saying is only the water. Whenever
9 you have a water level drop, water is released from
10 storage. He just said that. Where does the water go
11 if it doesn't move? It doesn't go up, it doesn't go
12 down, it goes somewhere.

13 Now, the quantity of water when you don't
14 have much of a piezometric surface change is small.
15 But to say that there's no water movement is just not
16 hydrology, and that's crazy.

17 JUDGE WARDWELL: Thank you. Moving on to
18 2.1.7, opinion one, basis G, the variations of aquifer
19 thickness. OST Exhibit 003 at two states that under
20 this section that the report does not make it clear if
21 the actual aquifer thicknesses were used to calculate
22 transmissivity or only the average aquifer
23 thicknesses. Crow Butte, in their rebuttal at answer
24 17 at nine states, as stated throughout the pumping
25 test report in a reference CBR016 at 5, 13, 14, and

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1 Table 8, an average net sand thickness of 40 feet was
2 used to calculate out transmissivity of the Basal
3 Chadron Chamberlain Pass Formation sandstone at
4 Marsland. Ore grade uranium deposits underlying the
5 Marsland Expansion Area are located in the Basal
6 Chadron Chamberlain Pass Formation, which averages 50
7 feet in thickness, typically 40 feet net sand. While
8 there is some variability, the assumption is
9 reasonably satisfied over the test area, and they
10 reference CBR016 at 11.

11 So I'll start off with CBR in regards to
12 this. Let me just start off with about what is your
13 radius of influence of a production well during a
14 mining unit operation? And let's say the maximum if
15 it doesn't reach steady state.

16 MR. LEWIS: Bob Lewis, Crow Butte. It's
17 within one nine-spot pattern. There's really no flare
18 to that, so it's approximately 100-foot or less, 75 to
19 100-foot would be a good estimate.

20 JUDGE WARDWELL: And that's because you're
21 only drawing off a small amount of net waters. Is
22 that why the radius of influence stays fairly small?

23 MR. LEWIS: That's correct, your Honor.
24 About a half a percent difference.

25 JUDGE WARDWELL: So while you're pumping

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1 at higher rates, you're injecting it at 95 or
2 whatever, 99 percent of it back in, and so is that a
3 fair assessment of why that radius of influence is
4 much less than when you're pumping at low rates for a
5 pump test but for a long time?

6 MR. LEWIS: Yes, sir.

7 JUDGE WARDWELL: Thank you. Isn't
8 transmissivity, didn't I hear this morning that
9 transmissivity is determined from the pumping tests
10 and that hydraulic conductivity is back calculated
11 from that? Why are we now talking and being so
12 concerned about transmissivity being the
13 multiplication of the thickness times the hydraulic
14 conductivity?

15 MR. LEWIS: I'm sorry. I don't understand
16 the context, your Honor. I think they're both
17 important. Hydraulic conductivity is back calculated
18 from transmissivity.

19 JUDGE WARDWELL: So we're really concerned
20 about, because you really do most of your testing to
21 determine transmissivity more than you have for
22 hydraulic conductivity, haven't you?

23 MR. LEWIS: Your Honor, there is some
24 direct testing of hydraulic conductivity from falling
25 head permeameter tests or grain size analysis just to

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1 be complete. But for purposes of talking about the
2 pumping test, it's back calculated from
3 transmissivity.

4 JUDGE WARDWELL: Okay. So in regards to
5 why we're addressing it here then, if you were taking
6 your and you have taken a hydraulic conductivity value
7 from some other test besides a pumping test and coming
8 up with a transmissivity, is it true you used an
9 average thickness as you report in your rebuttal
10 testimony of 40 feet net sand?

11 MR. LEWIS: Yes, your Honor.

12 JUDGE WARDWELL: And what's the definition
13 of net sand? I haven't heard that before.

14 MR. LEWIS: Your Honor, when looking at
15 the geophysical log of the production interval, we
16 subtracted off the claystone thickness to make a net
17 sand thickness. Since the claystone does not
18 contribute to the transmissivity appreciably, it's
19 essentially better than underestimating transmissivity
20 using a larger thickness.

21 JUDGE WARDWELL: And where did this layer
22 of claystone come from? Is that part of the Basal
23 Chadron or --

24 MR. LEWIS: There are claystone stringers
25 within the total thickness of the Basal Chadron

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1 sandstone.

2 JUDGE WARDWELL: So the difference between
3 the sand thickness and the net sand thickness if your
4 estimation or at least an allocation, if you will, for
5 the presence of some claystone stringers within that
6 deposit?

7 MR. LEWIS: If they're present, yes.

8 JUDGE WARDWELL: Thank you. And does not
9 your measured Basal Chadron thicknesses that you've
10 gotten from your explorations performed at the site
11 vary from approximately 20 to 90 feet over the site?

12 MR. STRIVER: Jim Striver. That is
13 correct, your Honor.

14 JUDGE WARDWELL: And so I'll turn to Dr.
15 Kreamer. Do you have any comments in regards to the
16 use of the average thickness? Wouldn't that not seem
17 to be a reasonable thing to do since you're coming up
18 with average values anyhow with a pump test that
19 extends over 8,000 feet and using an average thickness
20 might not be such a bad idea, is it?

21 DR. KREAMER: I believe it is a bad idea,
22 and let me explain why just briefly. If you use
23 analytical methods and you get an average, that might
24 be okay for production. But remember we're talking
25 about closure. We're talking about the potential for

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1 migration and a potential for risk and vulnerability.
2 And if you look at the CBR site, the analytical
3 methods, including a leaky aquifer test that Mr. David
4 Back so highly touted as successful, when it came to
5 closure, they weren't able to close it, but they have
6 tremendous problems and, in fact, they had to abandon
7 analytical models and go to a numerical model, a much
8 more complicated numerical model.

9 And so I guess my concern with averaging
10 transmissivities and taking an aquifer which pinches
11 out, you know, offsite but goes from 20 feet to 90
12 feet, the average values, while good for production,
13 might not be as good for the overall safety and
14 calculations of risk and movement.

15 JUDGE WARDWELL: And that leads into
16 another question I had with that. While the 20 to 90
17 seems like a long range of thicknesses initially, if,
18 in fact, you look at that over the full length of the
19 MEA, that 70 feet difference, it's still a pretty flat
20 grade, isn't it? It's not like you're jumping off a
21 cliff with this 20 to 90, is it? That's not a huge
22 range for the distances we're talking is all I'm
23 questioning.

24 DR. KREAMER: I hear what you're saying.
25 So say if you had a constant hydraulic conductivity or

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1 transmissivity, that hydraulic conductivity would be
2 eight times faster or so, nine times faster, and that
3 would mean the rate of movement would be calculated
4 differentially, nine times different. But you got to
5 remember that the site was not characterized in some
6 of the places where it's thick. There were no pumping
7 tests in some of those areas, and so the thickness of
8 the formation becomes very important as far as leakage
9 and things of that sort go.

10 JUDGE WARDWELL: Okay. Thank you.

11 DR. KREAMER: In other words -- let me
12 just one other word of clarification. The difference
13 in transmissivities could be reflective of a
14 difference in additional water in a pumping test and
15 leakage. And so that error, that uncertainty, is not
16 calculated at all here when you average those
17 different thicknesses.

18 JUDGE WARDWELL: Thank you. NRC rebuttal
19 014, answer 23, pages 26 to 27, talks about Driscoll
20 1986 discussing simplifying assumptions to analytical
21 solutions used to determine aquifer properties under
22 both equilibrium and non-equilibrium conditions, and
23 they're referencing NRC Exhibit 016 at PDF page 3, 5.
24 It goes on to say that with respect to how well these
25 assumptions need to be satisfied in order to obtain

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1 meaningful results, Driscoll states as follows, and
2 this is a quote from that 016 PDF 3, these assumptions
3 appear to limit severely the use of the two equations.
4 In reality, however, they do not. For example,
5 uniform hydraulic conductivity is rarely found in a
6 real aquifer, but the average hydraulic conductivity
7 as determined from pumping tests has proved to be
8 reliable for predicting well performance. In confined
9 aquifers where the well is fully penetrating and open
10 to the formation, the assumptions of no stratification
11 is not an important limitation. Assumption of
12 constant thicknesses is not a serious limitation
13 because variation in aquifer thicknesses within the
14 cone of depression in most situations is relatively
15 small, especially in sedimentary rocks.

16 So, Dr. Kreamer, how would you counter --
17 so let me start more basic. Are you familiar with
18 Driscoll and the well test document that he has, and
19 do you consider him a reasonable source?

20 DR. KREAMER: I am familiar with Driscoll,
21 your Honor.

22 JUDGE WARDWELL: And how would you counter
23 Driscoll's arguments in this case?

24 DR. KREAMER: Well, the quote you said
25 talked about well production, and so, basically,

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1 they're talking about average values for well
2 production for a pumping well where you're trying to
3 get quantity of water. I just finished a text this
4 year on contaminant hydrology, and contaminant
5 hydrology is totally different. A little
6 heterogeneity can mean that contamination can move in
7 a constrained preferential pathway really far, and the
8 monitoring methods that are used in monitoring wells
9 by the Nuclear Regulatory Commission that they allow
10 right now allow screening throughout the entire
11 interval. What that means is we have a contaminated
12 zone. That well will draw clean water from some
13 vertical elevations and dirty water from another, and
14 it will be diluted.

15 And so even with that, at Crow Butte, when
16 they were trying to get closure, the analytical models
17 failed. They had to go to a numerical model because,
18 first of all, because of the monitoring. So when
19 Driscoll talks about monitoring wells, he's talking
20 about screened monitoring wells, which are
21 inappropriate in contaminant hydrology, high
22 resolution vertical sampling of a norm.

23 And then the second part of that would be
24 that what he's talking about there is well production,
25 and that's the overall water that comes in and not the

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1 ability of contaminants to maybe migrate. And,
2 lastly, remembering that the injection wells are one
3 the outside and the withdrawal well is in the inside
4 of this array, if you do have leakage, that 9,500
5 balance that you're talking about where you're always
6 pumping more than you're putting in sort of goes to
7 pot because there's leakage, you're adding water to
8 the system, and it's not as conservative to have
9 injection wells on the outside. It would be more
10 conservative to have one injection well on the inside
11 and intercept wells on the outside. So leakage really
12 would mess that up.

13 And so when Driscoll was talking about
14 pumping in this regard, he was talking about well
15 production and not contaminant hydrogeology.

16 JUDGE WARDWELL: But he was still
17 discussing, wasn't he, the simplified assumptions to
18 analytical solutions of well pumping aquifer testing
19 analyses? This is where the quote comes from, does it
20 not?

21 DR. KREAMER: Are you just talking -- I'm
22 sorry. Yes, this is for pumping well from quantity of
23 water and not pertaining to contaminant hydrology.

24 JUDGE WARDWELL: And he's talking about
25 evaluating pumping tests, aquifer pumping tests, is he

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1 not? It's not a general discussion of pumping,
2 period. It's dealing with how do you analyze the
3 results from pumping tests, is it not? I don't want
4 to ask you. I'll ask the NRC. They were the ones --
5 let me ask NRC.

6 NRC, on your rebuttal, what is Driscoll
7 discussing? I read here that your rebuttal says that
8 Driscoll discusses simplifying assumptions to
9 analytical solutions used to determine aquifer
10 properties, so I assume that's what that quote refers
11 to. Does it or does it not refer to that?

12 MR. BACK: Yes, your Honor, that's what it
13 refers to, is the transmissivity of the aquifer.

14 JUDGE WARDWELL: I think, at this time, it
15 would be worthwhile to call up some of CBR 8-R, and
16 let's start off with 49 to 62. And these are various
17 cross-sections. Well, this will be a good one -- let
18 me think. Will it be now? No, go ahead. Go to pages
19 49 to 62. Go to 49 to start with, Joe. Yes, any one
20 of these is fine. These are fine. In fact, probably
21 you better go 50. This is fine, but it's too -- go to
22 another one. Yes, this is a better one to look at,
23 the one below. Fifty-one for now.

24 And these are -- let me ask CBR what these
25 are that we're looking at here.

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1 MR. STRIVER: Jim Striver, Crow Butte.
2 Geological structural cross-sections that were
3 constructed using geophysical logs that were drilled
4 across the MEA property.

5 JUDGE WARDWELL: We're not looking at them
6 now. I rather you left it the size you had it just to
7 start with our discussion. That isn't the size we had
8 it at. That's much smaller. Well, this is fine. We
9 can live with this, I guess. We'll get out our
10 magnifying glasses.

11 And is the bottom shaded level of each of
12 those cross-sections the Basal Chadron Chamberlain
13 Pass Formation?

14 MR. STRIVER: Yes, that's correct.

15 JUDGE WARDWELL: And then the unshaded
16 portion above that is what? The upper confining unit?

17 MR. STRIVER: That's correct. The middle
18 Chadron, upper Chadron, and the lower Brule.

19 JUDGE WARDWELL: And looking at this --

20 CHAIR BOLLWERK: To clarify the record,
21 which figures are we looking at?

22 JUDGE WARDWELL: We are looking -- well,
23 I can't read them now, but they are on --

24 CHAIR BOLLWERK: Can you go to 25 percent
25 maybe? Is that where it was before?

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1 MR. LANCASTER: Your Honor, it's 2.6-3.

2 JUDGE WARDWELL: All right. There we go.

3 MS. STRIZ: Which one is it? CC?

4 JUDGE WARDWELL: Yes, it is. We are now
5 looking at --

6 MS. STRIZ: It's 2.6-3C.

7 JUDGE WARDWELL: Thank you. Is a
8 horizontal scale of this the same as the vertical
9 scale?

10 MR. STRIVER: No, it is not.

11 JUDGE WARDWELL: Approximately how much
12 exaggeration is there?

13 MR. STRIVER: Let's see.

14 JUDGE WARDWELL: If it helps, you know,
15 the distance between your two knuckles is about an
16 inch, and if you lay that over that and then bring it
17 up to the top is what I did.

18 MR. STRIVER: Correct. The horizontal
19 scale is, the vertical scale is consistent as
20 indicated an inch for a hundred feet. Horizontal
21 scale is as indicated. It's not consistent, so it
22 just shows here, like on the left you have 2,400 feet,
23 on the right distance, it shows you what the distance
24 is between, you know -- if we did it correctly across,
25 not correctly but if we had the entire 2,400 feet, it

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1 would be way off scale.

2 JUDGE WARDWELL: If it was an exaggerated
3 scale is what you're saying, what would happen?

4 MR. STRIVER: It would be the geophysical
5 log on the left would be clear off paper by a
6 significant distance. So this is a relative view.

7 JUDGE WARDWELL: So it's certainly several
8 factors, maybe not maybe as much as a factor of ten
9 but it's somewhere between, there's some vertical
10 exaggeration here. And what would happen? Not only
11 would it be off the page, but would be the thickness
12 of the Basal Chadron as it showed up on that as far as
13 just the relative size of it?

14 MR. STRIVER: Okay. I don't understand
15 your question, your Honor.

16 JUDGE WARDWELL: If you drew it to true
17 scale both horizontally and vertically, what would be,
18 how thick would be the Basal Chadron at that --

19 MR. STRIVER: It would be very thin.

20 JUDGE WARDWELL: Probably almost the width
21 of a pencil possibly?

22 MR. STRIVER: It would be very thin. Yes,
23 that's probably a good correlation.

24 JUDGE WARDWELL: So with that in mind, I
25 think I'll turn to Dr. Kreamer and I think you have

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1 stated earlier today, I think I heard you say, talk
2 about abrupt changes with the level of the Basal
3 Chadron and you have talked about the 20 to 90 feet of
4 thickness differences. Without us going through all
5 of these cross-sections here, what cross-sections do
6 you suggest we look at on these pages, 49 to 62,
7 demonstrating this, what you consider to be a very
8 unlevel variable thickness strata?

9 DR. KREAMER: Your Honor, I don't have
10 those in front of me right now. I can only see the
11 one that's right in front of me. I don't have those
12 pulled up, and I'm not prepared to really tell you --

13 JUDGE WARDWELL: So you didn't have the --

14 DR. KREAMER: -- that we all agree that
15 this is localized channels, that there's silt, stone,
16 and other things. So this is not a uniform strata.

17 JUDGE WARDWELL: And when you were
18 commenting that this, that this thickness varies so
19 much over the distance of the Basal Chadron, you
20 didn't have one of these cross-sections in mind as
21 backup evidence for demonstrating that large
22 difference in thicknesses of this strata?

23 DR. KREAMER: I don't have that at this
24 time. There were some that were greater changes than
25 others. I'll be honest with you, I can't even read

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1 the scale on this magnification in front of me, on the
2 one in front of me, and I don't have those listed
3 right now.

4 JUDGE WARDWELL: Yes, and I understand
5 that.

6 DR. KREAMER: My recollection is that
7 there's some that the change over the cross-section is
8 more dramatic than others, the north -- south related
9 ones.

10 JUDGE WARDWELL: Yes, and so what you're
11 saying is you don't remember what you used to come up
12 with a conclusion in your mind that the Basal Chadron
13 had large dramatic changes in thicknesses? And if so,
14 that's fine.

15 DR. KREAMER: I didn't write that down,
16 and I don't have that in front of me. I can review
17 that and then perhaps get that information to you
18 later.

19 JUDGE WARDWELL: Yes. Why don't we do
20 that? Keep that in mind. If you're interested in
21 providing that evidence where you show these abrupt
22 changes in the thickness of the Pierre Shale looking
23 over all these cross-sections, and we can look at
24 those when you bring it up on Thursday. Is that a
25 suitable way to do it, Chair?

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1 CHAIR BOLLWERK: That's fine.

2 DR. KREAMER: From what I can see the
3 scale now, your Honor, it looks like there are 500-
4 feet intervals; is that correct? No, is it 100-foot
5 intervals between the cross-section size there?

6 JUDGE WARDWELL: Yes, it's 100-foot one.
7 So if I put my knuckle over that, that expands about
8 200 and then -- well, it's gone. So if you divide the
9 200 --

10 DR. KREAMER: Quite frankly, looking at
11 this, there's also, not the lines that have just been
12 drawn but the actual geophysical log, you have data
13 which are those squiggly lines that go down. And if
14 you notice that there's variations in those lines,
15 part of my statement there might have been related not
16 only to those green lines that were drawn at the top
17 of the Chadron formation were on the base of the
18 Chamberlain Pass Formation but also on the basis of
19 those geophysical logs that record electrical
20 conductivity.

21 JUDGE WARDWELL: Thank you. Moving on to
22 2.1.8, opinion one, basis H.

23 CHAIR BOLLWERK: One question. Is this a
24 good time for a break? Ten minutes?

25 JUDGE WARDWELL: Yes, I was just thinking,

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1 I was thinking of three. I was going to try to get to
2 three.

3 CHAIR BOLLWERK: Can you do this one by
4 three?

5 JUDGE WARDWELL: If not, we'll interrupt
6 it in the middle. Yes, this looks like a short one.
7 And I can keep them short because these are very small
8 -- anyhow, 2.1.8, opinion one, basis H, monitoring
9 well screen intervals where Dr. Kreamer has said that,
10 from Figure 2.6-9, that's CBR008 at 76, so if we can
11 pull that up. That's CBR008 again at 76. The
12 thickness of the Basal Chadron varies from 21 to 91
13 feet across the site. The screen intervals of the
14 monitoring wells vary from 22 to 50 feet, given the
15 possibility that these wells did not measure results
16 solely from the entire thickness of that aquifer or,
17 conversely, in part, measured water derived from
18 formations other than the Basal Chadron layer.

19 And Crow Butte's rebuttal at 033, answer
20 18 at 9, monitoring wells installed as part of the
21 pump test penetrated all or the majority of the Basal
22 Chadron Chamberlain Pass Formation thickness and are
23 sufficient to characterize the full thickness of the
24 aquifer. In any event, given the relative large
25 distances from the pump well to monitoring wells,

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1 partial penetration effects in the observation wells
2 are negligible.

3 And so I think I'll start off by asking
4 Crow Butte were they fully penetrating wells in
5 regards to both the pump well and the observation
6 wells?

7 DR. KREAMER: I'm sorry. If you were
8 talking to me, you were breaking up.

9 JUDGE WARDWELL: I was talking to Crow
10 Butte.

11 DR. KREAMER: Is this a question for
12 myself, Dr. Kreamer?

13 JUDGE WARDWELL: I was talking to Crow
14 Butte. I was asking Crow Butte that.

15 MR. STRIVER: Jim Striver, Crow Butte.

16 JUDGE WARDWELL: I was asking the Crow
17 Butte.

18 MR. STRIVER: Okay. Question is whether
19 the monitor wells were fully penetrating the
20 formations?

21 JUDGE WARDWELL: Right.

22 MR. STRIVER: The overlying Brule wells
23 were not fully penetrating the Brule formation. They
24 were placed in the sandstone in the upper Brule and
25 the brownstone member of the upper Brule. In the

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1 Basal Chadron formation, the intervals that were
2 completed nearly were completed completely through the
3 Basal Chadron.

4 JUDGE WARDWELL: Okay. And the well
5 screens were set through that and no further --

6 MR. STRIVER: Correct.

7 JUDGE WARDWELL: -- either side of that?
8 Thank you. NRC rebuttal 014, answer 22, pages 24 to
9 25, states that they opine that, based on the Figure
10 2.6-9 of CBR006, which, again, is the technical
11 report, while a Basal Chadron ranges in thickness from
12 20, approximately 20 to 90 feet, those numbers do not
13 reflect the thicknesses of the locations of the
14 aquifer pumping test observation wells. Comparing
15 CBR008, Figure 2.7-7 at 98 of the TR, which shows the
16 locations of the Basal Chadron Chamberlain Pass
17 Formation observation wells with Figure 2.6-9 at 76
18 showing the Basal Chadron Chamberlain Pass Formation
19 thickness contours, all of the observation wells
20 except for monitoring five are in areas where the
21 thickness shown in Figure 2.6.9 is less than the 50
22 feet, is less than 50 feet, referencing, again,
23 CBR008R at 75 and 97. Moreover, the completion
24 reports provided in Appendix A of the aquifer pumping
25 test report, and that's CBR016 at PDF 53 to 64,

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1 indicate that all of the Basal Chadron observation
2 wells were fully screened across the Basal Chadron
3 formation.

4 So I guess I'll ask Dr. Kreamer, is it
5 not, do you accept their testimony that the wells
6 appear to be fully penetrating the Basal Chadron?

7 DR. KREAMER: They may be over-
8 penetrating. I've done a quick search, pages 2
9 through 49, excuse me, 2-49 to 2-50 of the TR, that
10 would be CBR006 at 98, 99, is one. And then page 55
11 at 2.6-3F, that's the line F through F prime, are some
12 of the ones that you asked for before.

13 JUDGE WARDWELL: And what did you say
14 about the fully penetrating one? I didn't catch any
15 of that.

16 DR. KREAMER: The last testimony was a
17 little bit broken up. When people don't speak
18 directly, I mean just inches away from the microphone,
19 I lose some of the testimony. If what I heard
20 correctly is that these things, the monitoring wells
21 are drilled and the screened interval is longer than
22 thick, that indicates they have a potential to pull
23 water from formations other than the Chamberlain Pass.

24 JUDGE WARDWELL: They testified that it
25 was fully penetrating just within the zone of the

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1 Basal Chadron, and the references that you can look up
2 are the NRC014, answer 22 at 24 to 25 for the
3 discussion of that.

4 DR. KREAMER: I read that discussion and,
5 in fact, I included it in my textbook as an example of
6 poor monitoring technique. It's poor monitoring
7 technique not for pumping tests, but it's poor
8 monitoring technique for contaminant hydrology or
9 seeing if there's any excursions, those sort of things
10 for closure. I can get you the reference in
11 contaminant hydrology, if you would like.

12 JUDGE WARDWELL: That pretty much does it
13 for this section. When we come back, we'll talk
14 about, yes, we'll move on.

15 CHAIR BOLLWERK: So right now it's about
16 five til three. Why don't we take a ten-minute break?
17 We'll come back at five after three and continue on.

18 (Whereupon, the above-entitled matter went
19 off the record at 2:55 p.m. and resumed at 3:06 p.m.)

20 CHAIR BOLLWERK: Let's go back on the
21 record, if we could, please.

22 Well, you're just after the three o'clock
23 hour, and I wanted to remind counsel that, when we
24 finish with Concern No. 2, we will be allowing you a
25 brief interval to put together, if you already

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1 haven't, any proposed questions for us. And then,
2 we'll have to obviously take a brief break and look
3 those over, and decide which will be appropriate for
4 the Board to ask. But I hope, again, you're maybe
5 compiling those already to some degree, and we can
6 keep that interval brief in which we are in the
7 process of putting together the questions for our
8 consideration.

9 All right. Let me, then, go back to
10 Judge, turn back to Judge --

11 MR. SMITH: Your Honor? Your Honor, Tyson
12 Smith for Crow Butte.

13 If you would indulge us, we have a minor
14 correction or clarification that Mr. Striver would
15 like to make to his earlier testimony regarding the
16 interval thickness that was screened for the pump
17 test.

18 MR. STRIVER: Jim Striver, Crow Butte.

19 Regarding the pumping test monitor wells,
20 the completion intervals that were screens within the
21 lower Basal Chadron, some of them didn't completely
22 screen the entire interval of the lower, of the Basal
23 Chadron, within just a few feet. And typically, that
24 would occur when we have like a small, like a sand
25 lens followed by a shale layer, and then, the main

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1 sand body below it. So, the actual what would be
2 called the top of the Basal Chadron would be here,
3 where a monitor screen would be placed a few feet or
4 a couple of feet below the top of what's considered
5 the Basal Chadron. And then, the rest of the interval
6 is screened to the base of the Basal Chadron.

7 CHAIR BOLLWERK: All right. Thank you.

8 Dr. Kreamer, I saw you moving around, and
9 I want to make sure you heard that.

10 DR. KREAMER: No, I did not. I switched
11 quickly to computer audio. I was trying to get my
12 phone back online. I turn off my phone whenever I'm
13 not here. I can switch to phone.

14 Can you hear me clearly on my computer?

15 CHAIR BOLLWERK: At this point, yes.

16 The second question is -- and I apologize
17 for not recognizing you. There was a witness that
18 hadn't come back. I thought that's what the problem
19 was.

20 Do we need to repeat that for Dr. Kreamer?

21 I guess that's the question.

22 JUDGE WARDWELL: Yes, it would be
23 worthwhile.

24 DR. KREAMER: If you would repeat the
25 question, I would be most appreciative.

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1 MR. STRIVER: Jim Striver. Can you hear
2 me, Dr. Kreamer?

3 DR. KREAMER: I can hear you, yes. Speak
4 right into the microphone, please.

5 MR. STRIVER: Okay. This is regarding I
6 have a clarification regarding the screened intervals
7 of the Basal Chadron formation for the monitor wells
8 that were used for the pumping test.

9 The screened interval in some of the
10 monitor wells was not completely covering the Basal
11 Chadron. A screened interval may be within a few feet
12 of the top, what's considered the top of the Basal
13 Chadron. And typically, how that, why that is done
14 is, when like a sand lens right above the main Basal
15 Chadron sand body is encountered, then we have another
16 shale interval, the thin shale. Then, the top of the
17 screen would be placed at the top of the main body of
18 the Basal Chadron. So, what we consider the top of
19 the Basal Chadron would be that first sand. So, we're
20 not completely screening the entire interval of the
21 Basal Chadron with all the monitor wells, but within
22 a few feet.

23 DR. KREAMER: Thank you.

24 CHAIR BOLLWERK: I think with that, I take
25 it he heard that, so we can proceed forward, however

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1 you're ready, whenever you're ready.

2 JUDGE WARDWELL: Yes, I just have a few
3 lingering leftovers from before the break, just to
4 allow Crow Butte and, then, NRC to respond to my
5 question to Dr. Kreamer in regards to variable
6 thicknesses of the Basal Chadron.

7 What is your impression of the relative
8 abruptness of any changes of the thickness of the
9 Basal Chadron across the MEA site?

10 MR. LEWIS: Bob Lewis, Crow Butte.

11 Your Honor, I would agree with Dr.
12 Driscoll's characterization that the use of average
13 sand thicknesses are appropriate, given that the
14 radius of influence of the aquifer test covers a broad
15 area. The measurements of transmissivity at
16 monitoring well locations are not point data. They
17 represent transmissivity of a large portion of the
18 aquifer that represents an average value at that
19 point. So, just to summarize, I would agree with Dr.
20 Driscoll's assessment that average sand thickness is
21 appropriate for calculation of transmissivity and
22 storativity.

23 JUDGE WARDWELL: I think that was a
24 wonderful answer, but it wasn't my question, I'm sorry
25 to say.

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1 (Laughter.)

2 MR. LEWIS: Okay. I'm sorry.

3 JUDGE WARDWELL: My question was -- and
4 I'll rephrase it because I think I wasn't very clear
5 -- in reviewing the geologic sections that have been
6 made through the site, what is your interpretation of
7 the variability in the thicknesses of the Basal
8 Chadron as it relates to any abrupt changes in it
9 across the entire MEA? Is it abrupt? Is it there's
10 a lot of sites of abrupt changes or is it a fairly
11 level, constant thickness over the site, varying very
12 gradually rather than abruptly? It's the abruptness;
13 it's the degree; it's the slope, if you will, of the
14 change in the thickness, is what I am interested in,
15 which is what we were looking at before.

16 MR. STRIVER: Jim Striver, Crow Butte.

17 I would not say there are abrupt changes
18 in the thickness of the Basal Chadron. It does have
19 variable thicknesses within the range you spoke of.
20 But, as far as going from 20 feet to 90 feet within a
21 short distance, I do not believe we see that. I don't
22 think that's a significant issue. I think it's fairly
23 consistent across the MEA with some variability.

24 Now keeping in mind, may I add, that lots
25 of times when that gross thickness is calculated, it's

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1 including a thin sand lens or layer above the main
2 Chadron. So, it may go from a 50-foot thickness up to
3 where you have 5 feet of shale, and then, a 5-foot
4 sand lens on top. And that's considered part of the
5 gross thickness of the Basal Chadron. So,
6 encountering that is not significantly affecting
7 things, in my opinion.

8 JUDGE WARDWELL: Thank you.

9 Would anyone from NRC staff like to
10 respond to that?

11 MR. BACK: This is David Back.

12 Yes, one of the other lines of evidence is
13 the isopach map that is easier to look at than all the
14 cross-sections. We've looked at the cross-sections,
15 but the isopach is a thickness actually mapped out in
16 an aerial form. So, it gives you a good visual on the
17 thickness across the site and its variability.

18 JUDGE WARDWELL: And do you have a
19 reference number for that figure?

20 MR. BACK: Yes, yes, yes, Your Honor.

21 JUDGE WARDWELL: And then, what is your
22 interpretation of that as you look at that isopach
23 map?

24 MR. BACK: Oh, it's that our
25 interpretation -- I mean, we --

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1 JUDGE WARDWELL: First, just for the
2 record, so we've got it there, what is the figure
3 number that you're referring to?

4 MR. BACK: It's in the TR, and it's figure
5 2.6-9.

6 JUDGE WARDWELL: Thank you.

7 Now what is your, as you look at that,
8 what is your interpretation of the degree in change of
9 aquifer thickness across the MEA?

10 MR. BACK: Well, at the north part of the
11 site, it's 40-feet thick.

12 JUDGE WARDWELL: And I think what we're
13 interested in is where the pump test was taking place
14 in the 8,000-foot radius of influence, which is where
15 this started from I believe.

16 MR. BACK: Right. So, it ranged from like
17 40 to 90 feet within the radius of influence, from
18 what I recall our testimony.

19 JUDGE WARDWELL: And would you know what
20 kind of grade change that results in, in abruptness,
21 in degrees of abruptness? You know, what is the grade
22 of the top of the Basal Chadron?

23 MR. BACK: Well, we really interpret that
24 from the depositional environment being a stream
25 channel. And so, laterally, it would be relatively

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1 continuous and not very abrupt, but, vertically, you
2 might have these clay lenses and such that are
3 described within the TR and shown in the logs.

4 JUDGE WARDWELL: So, there could be some
5 cases where it is reasonably abrupt, is what you're
6 saying?

7 MR. BACK: Vertically, yes.

8 JUDGE WARDWELL: Okay. Thank you.

9 CHAIR BOLLWERK: For the record, that's a
10 figure, I take it?

11 JUDGE WARDWELL: Yes.

12 CHAIR BOLLWERK: So, we're talking about
13 CBR008-R? That would be the exhibit reference?

14 JUDGE WARDWELL: Yes, except we have to
15 get a page. I don't know the page number.

16 CHAIR BOLLWERK: Well, it's figure 2.6-9,
17 right?

18 JUDGE WARDWELL: Yes. It's probably --
19 no, it isn't a separate exhibit.

20 MR. SMITH: It's page 75, CBR0008-R, page
21 75.

22 CHAIR BOLLWERK: Thank you.

23 JUDGE WARDWELL: I was wondering when you
24 were going to chime-in with some wisdom, Mr. Smith.

25 MR. SMITH: I'm trying to add value

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1 wherever I can.

2 (Laughter.)

3 JUDGE WARDWELL: Okay. I think we're
4 ready to move on to 2.3, "Opinions for Utilization of
5 Alternative Pumping Test Methods".

6 Dr. Kreamer, Exhibit 003, Opinion 3 at 6,
7 says, "Aqui-Ver, Inc., in its Marsland hydrologic Test
8 Report No. 8, only presented one form of analysis for
9 an MEA site. That is the Theis methodology."
10 Although in their report they also refer to the semi-
11 logarithmic Cooper-Jacob technique, which was not
12 presented, and we've already clarified that it was,
13 but there's also another form of the Cooper-Jacob.

14 So, I'll start off with just some general
15 questions before referencing any other of the
16 testimony. And I'll address this to you, Dr. Kreamer,
17 if I might.

18 But I just wanted to get a feeling for how
19 difficult or easy is it to determine the hydraulic
20 conductivity of an aquifer or its transmissivity?
21 They're pretty much the same. But let's talk
22 hydraulic conductivity for an aquifer. And for that,
23 I'd like to put it in the range of, what's the maximum
24 range that hydraulic conductivity varies over all
25 strata?

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1 DR. KREAMER: That would be 14 orders of
2 magnitude maybe.

3 JUDGE WARDWELL: Okay. So, it's a large
4 number?

5 DR. KREAMER: Yes, sir.

6 JUDGE WARDWELL: So, hydraulic
7 conductivity varies by a large amount? And then, as
8 we get it down to defining pure types of porous media
9 -- i.e., let's say we're just talking, we had a nice
10 sieved sand. Would that always yield just one value
11 of a hydraulic conductivity if you were testing it
12 over a large area, even if it was composed of all the
13 same particle sizes?

14 DR. KREAMER: No, sir.

15 JUDGE WARDWELL: And about how much might
16 that vary? A couple orders of magnitude?

17 DR. KREAMER: It depends on the packing.
18 In your hypothetical here you said the same grain
19 size. If they were all the same shape and not
20 angular, and things like that -- it would have to do
21 with packing -- maybe an order of magnitude of 2
22 percent. Sandstone has got anywhere between
23 magnitude -- because it's different in duration,
24 because of its different potential fracturing and
25 secondary porosity. So, that's many orders of

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1 magnitude for sandstone, but, for sand, maybe one or
2 two orders of magnitude.

3 JUDGE WARDWELL: Okay. And then, if you
4 go away from that, and now we've got, as you said,
5 either lenses in there or just the grain size
6 distribution varies quite a bit through most sand
7 deposits; it's not all one size or one distribution.
8 So, we see all kinds of distributions. You would be
9 up to many orders of magnitude difference, correct?

10 DR. KREAMER: Absolutely. Absolutely,
11 yes. I agree that what we have is averages of what
12 we've all agreed is a heterogeneous system.

13 JUDGE WARDWELL: So, what we do, we are
14 doing quite a good job, if we aren't as geotech
15 engineers, to narrow down hydraulic conductivity to
16 half an order of magnitude, are we?

17 DR. KREAMER: Was that a question?

18 JUDGE WARDWELL: Yes.

19 DR. KREAMER: No, I disagree with that.
20 I think that, from the standpoint of well production
21 and pumping, I would agree. From a transport of
22 potential contaminants where you can have preferential
23 flow, the variety we're talking about is crucial to
24 understanding risk. And so, if we're just talking
25 about production wells and pumping, and how much they

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1 can pump down lixiviant, that's fine. But if we're
2 talking about pathways and where these things can go,
3 and what the risk is to surrounding communities, and
4 things like that, if we're talking about contaminant
5 transport, these generalized numbers, average
6 integrated numbers from a heterogeneous aquifer are
7 dangerous.

8 JUDGE WARDWELL: But, still, if we're
9 trying to characterize the aquifer beforehand, and we
10 take a sample at one point and we take another sample
11 at the other, do you agree there's potential to be the
12 same type of material? And yet, at the two different
13 points they can be an order of magnitude or different
14 off, even though that's the truthful hydraulic
15 conductivity at a given point, isn't that correct?

16 DR. KREAMER: In that type of -- yes, I
17 would agree with you, Your Honor.

18 JUDGE WARDWELL: Okay. For the sake of
19 argument, if the sandstone in the Basal Chadron
20 formation was not fractured, would you believe that
21 the Theis equation would be an acceptable model?

22 DR. KREAMER: No.

23 JUDGE WARDWELL: And why not?

24 DR. KREAMER: Well, sandstone can order
25 several orders of magnitude, and you can look at two

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1 different sandstones and they'll both be indurated and
2 they'll both look the same color. They'll both look
3 like they have the same grain consistency. But, when
4 you actually do hydraulic conductivity testing on it,
5 you can get several orders of magnitude from what
6 looks like the same sandstone. So, I would have to
7 state no to that.

8 And as far as the abrupt changes go --

9 JUDGE WARDWELL: Let me clarify for you.
10 Let me clarify for you. I have switched a little bit
11 because now I'm talking about --the acceptable model
12 I am talking about is in reference to evaluating
13 pumping tests, which is what this section is dealing
14 with, with your call for the criticism that only one
15 type of pumping test method was used.

16 And my question was whether or not the
17 sandstone was not fractured and was a true porous
18 media with no fractures in it --

19 DR. KREAMER: Yes.

20 JUDGE WARDWELL: -- would the Theis model
21 be an acceptable model, recognizing that now we are
22 looking at not just a point value, but a whole volume
23 area that is influencing the results of that test?

24 DR. KREAMER: Not necessarily -- oh, I'm
25 sorry.

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1 JUDGE WARDWELL: And so, I'm saying, would
2 the Theis be acceptable for that, in your opinion?

3 DR. KREAMER: I'm sorry, I talked over the
4 end of that question. Could you repeat just the end
5 of that question?

6 JUDGE WARDWELL: Would you believe that
7 the Theis equation would be an acceptable model for
8 that situation, an unfractured sandstone?

9 DR. KREAMER: No, not necessarily, Your
10 Honor.

11 JUDGE WARDWELL: Say it again?

12 DR. KREAMER: No, not necessarily, Your
13 Honor. You could have a sandstone -- if you're saying
14 if you assume that it's homogenous, yes, but sandstone
15 which is unfractured and the same thickness, it could
16 have a different genesis. It could have a different
17 history. And you could have two sandstones in the
18 same unit that would be totally different in their
19 hydraulic conductivity. And so, if you make the
20 assumption that it's homogenous and isotropic, yes,
21 you could use that analogy. But, in reality, real
22 sandstone systems, that's not always the case.

23 JUDGE WARDWELL: Is there anything like a
24 homogenous aquifer? Does it exist?

25 DR. KREAMER: It depends. It depends what

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1 your goal is. For pumping wells and things like that,
2 there are things that are close enough to a homogenous
3 aquifer --

4 JUDGE WARDWELL: That wasn't my question.

5 DR. KREAMER: Pardon?

6 JUDGE WARDWELL: Again, Dr. Kreamer, that
7 wasn't my question. It wasn't close enough. I said,
8 is there anything that's a truly homogenous aquifer?

9 DR. KREAMER: No. No, the nature of that,
10 it's absolutely --

11 JUDGE WARDWELL: So, they're all
12 heterogeneous in some aspect? Is that correct?

13 DR. KREAMER: The beginning of your
14 question was covered up by your audio. It didn't hit
15 the microphone.

16 JUDGE WARDWELL: We don't hit microphones
17 here. It may have been my turning my head or
18 anything. Just so you know, we're not pushing buttons
19 or anything.

20 DR. KREAMER: I'm so sorry.

21 JUDGE WARDWELL: But let me say it a
22 different way, in fact. At a certain scale, aren't
23 all aquifers heterogeneous? And that scale may change
24 between the aquifers, but for every aquifer, if you're
25 dealing with a certain scale, is it not heterogeneous?

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1 If we were looking at a pinpoint little area, and it's
2 all I was concerned about, isn't it going to be
3 heterogeneous in nature?

4 DR. KREAMER: I absolutely agree with you.
5 If you consider all scales, there's scales where it
6 has to be heterogeneous.

7 JUDGE WARDWELL: And likewise, at a large
8 enough scale, if we were trying to evaluate the total
9 flow of water through all of Nebraska, isn't it also
10 essentially homogenous at a certain scale? There is
11 some scale where it will act like a homogenous
12 material, will it not?

13 DR. KREAMER: Not as a function of scale,
14 Your Honor. If you looked at a whole, big aquifer,
15 and it might -- are you assuming non-fractured and
16 equal thickness? Yes, maybe.

17 JUDGE WARDWELL: And it's a porous media.

18 DR. KREAMER: But, if you're assuming --

19 JUDGE WARDWELL: It's a porous media.

20 DR. KREAMER: If you're assuming a large
21 scale for a homogenous isotropic aquifer over a large
22 scale for equal thickness, same genesis, yes, you
23 might be able to say that it's near homogenous
24 isotopic.

25 JUDGE WARDWELL: If we pumped enough of

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1 the Basal Chadron and did it at the same volume enough
2 different places, it may very well act as the same
3 analysis, have the same result for each of those?
4 Isn't that possible at a largest enough scale?

5 DR. KREAMER: I think it's possible, but
6 it's not in the data that we have seen.

7 JUDGE WARDWELL: Where in the process of
8 pumping you basically average out all the
9 heterogeneities?

10 DR. KREAMER: In some systems, yes. In
11 this system, no.

12 JUDGE WARDWELL: Well, I guess I'll ask it
13 another way. You agreed that at a very small scale it
14 will be heterogeneous. As we increase that scale,
15 such that we're influencing more of the given porous
16 media, would not the heterogeneity drop?

17 DR. KREAMER: Well, it depends on the
18 structure. If you have at a larger scale fractures
19 and things like that -- I think your hypothetical said
20 no fractures. And so, yes, we would be moving in that
21 direction if there were no structural features. But,
22 when you go to a larger scale, then you get structural
23 things that make it just as complicated.

24 JUDGE WARDWELL: Yes. Yes. Okay, that's
25 fine. That's giving me, I think, the feedback that I

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1 need on this.

2 So, and returns to now entering in
3 fractures, let's start off with very small,
4 disconnected fractures within this. Then, wouldn't
5 the one point analysis still be heterogeneous? And
6 probably, as we increase the scale, it would stay
7 heterogeneous until we got to some point where those
8 little, small, disconnected fractures start acting
9 just like porous voids, and we'd be back to homogenous
10 type of a situation if we were at that large enough
11 scale? Isn't that a fair assessment?

12 DR. KREAMER: It depends on the
13 orientation of fracture aperture, and that sort of
14 thing. But your basic thesis here is correct, that if
15 you have enough fractures that are in great enough
16 numbers, you can begin treating it with an analogy to
17 a porous media?

18 JUDGE WARDWELL: Thank you.

19 And I think I'll leave it -- that sets
20 some baseline. That whole section was just trying to
21 get some base feeling in the record of what hydraulic
22 conductivity does, how much it varies, and then, what
23 are we dealing with with the heterogeneities that we
24 have to deal with.

25 So, the first real topic that came up, it

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1 was the inappropriate use of the Theis equations for
2 leaky aquifer analysis. And in your rebuttal, OST014,
3 Dr. Kreamer, at 2-3, No. 5, you state that, "CBR does
4 not address the omission of other forms of pumping
5 test analysis, nor does NRC staff require more
6 scientifically appropriate analysis. A leaky aquifer
7 evaluation of pumping test data was not performed.
8 Standard analytical methods such as the De Glee
9 method, the Hantush-Jacob method, and the Walton
10 method, or numerical analyses, were not performed or
11 the more appropriate approaches indicated from the
12 observed data. Analysis with these other methods
13 would be consistent with the lack of confinement
14 indicated by the departure from the Theis curve
15 observed during a solitary pumping test."

16 And I'm going to start off with Crow
17 Butte, if I might. How difficult is it to do a leaky
18 aquifer analysis as opposed to a traditional Theis
19 analysis

20 MR. LEWIS: Bob Lewis, Crow Butte.

21 Your Honor, it's not overly difficult to
22 perform a different type of analytical analysis based
23 on a different conceptual model.

24 JUDGE WARDWELL: And one being a leaky
25 analysis wouldn't be particularly difficult?

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1 MR. LEWIS: No, sir.

2 JUDGE WARDWELL: Or more involved?

3 MR. LEWIS: No, sir.

4 JUDGE WARDWELL: And did you try a leaky
5 analysis once you showed the deviations from the Theis
6 curve that you did receive?

7 MR. LEWIS: No, sir.

8 JUDGE WARDWELL: And why didn't you?

9 MR. LEWIS: The aquifer, the overwhelming
10 preponderance of evidence is that this acts as a
11 confined system; that there's no significant leakage
12 in this system.

13 I mentioned earlier this morning the fact
14 that the currently operating mine has a radius of
15 influence of 13 miles that encompasses the MEA. We
16 have over 20 feet of drawdown historically that has
17 occurred at the MEA due to pumping at the Crow Butte
18 facility. That's inconsistent with a leaky aquifer.
19 If we have a leaky aquifer, the radius of influence of
20 a 200-gallon-a-minute withdrawal from this mine will
21 be substantially less, even at a small leakage rate,
22 substantially less than 5-7 miles. So, in my opinion,
23 that conceptual model simply didn't apply to the MEA,
24 and all the other lines of evidence that we discussed
25 this morning concerning transmissivity variations

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1 being the more likely cause of the deviations from the
2 Theis curves.

3 JUDGE WARDWELL: Would the leaky analysis
4 be able to filter out the transmissivity variations
5 within this?

6 MR. LEWIS: I'm sorry, can you repeat
7 that?

8 JUDGE WARDWELL: Yes. Would the leaky
9 analysis allow you to filter out some of the
10 transmissivity variations in the inherent solution to
11 the equations associated with it? Or are they --

12 MR. LEWIS: I'm sorry, I just don't
13 follow, Your Honor. I'm not sure what the answer to
14 that is.

15 JUDGE WARDWELL: Well, why don't you
16 repeat to me what you just said in regards to
17 transmissivity? And maybe I misinterpreted what you
18 were saying when I asked that follow-up question.

19 MR. LEWIS: With regard to transmissivity
20 at what point?

21 JUDGE WARDWELL: It was your last sentence
22 before I asked a question. You went on and on about
23 the previous side, and then, you said, with the
24 transmissivity variabilities we see within it -- or
25 something to that effect. What was that sentence

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1 again?

2 Do we have any abilities to read back his
3 last sentence he said before -- or has that gone by
4 the wayside with modern technology?

5 Do you remember what you said about
6 transmissivity?

7 MR. LEWIS: I don't believe I mentioned
8 transmissivity, Your Honor.

9 JUDGE WARDWELL: Okay. Well, we'll move
10 on. Maybe it will come up.

11 But I'll ask another question anyhow.
12 But, still, if it doesn't take any effort, and
13 certainly looking at the Theis curve, you would say,
14 well, geez, I wouldn't mind checking that out. You
15 didn't feel a need to do that?

16 MR. LEWIS: No, sir. I think that the
17 analysis should be consistent with the conceptual
18 model of the system from all lines of evidence. And
19 if I was doing a leaky aquifer analysis, that would
20 suggest that it is a leaky aquifer, that that is what
21 I believe that that's the way I'm doing this analysis.
22 And there's no evidence in my mind, given the
23 variation in transmissivity to the west of the pumped
24 well, that explains the flattening of the curve that
25 we see in monitoring Well No. 3. There's no concept

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1 that I would want to apply a leaky aquifer curve to
2 that.

3 JUDGE WARDWELL: But wouldn't you be
4 interested in a sensitivity analysis to say, okay, I'm
5 starting off with no leaks? Gee, why don't I throw in
6 a couple of leaks and just see how sensitive the
7 system is to various assumptions, to comfort myself
8 that, yes, I'm pretty confident of my conceptual
9 model? But if, all of a sudden, I found that if I
10 changed the amount of leakage by a half a percent,
11 and, all of a sudden, the transmissivities changes by
12 two orders of magnitude, I'd be concerned about that,
13 wouldn't I?

14 MR. LEWIS: Well, Your Honor, I don't
15 believe the transmissivities would change by that
16 magnitude.

17 JUDGE WARDWELL: No, what I'm saying, it's
18 just that's what it would show you, though, wouldn't
19 it? And why wouldn't -- isn't that kind of standard
20 practice to do sensitivity analyses whenever you're
21 doing any modeling?

22 MR. LEWIS: No, sir.

23 JUDGE WARDWELL: And this is essentially
24 modeling.

25 MR. LEWIS: No, sir, not for this system.

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1 This system has a lot of --

2 JUDGE WARDWELL: What do you mean by "this
3 system"?

4 MR. LEWIS: This system, the production
5 aquifer in this region has a lot of information that
6 classifies it as a confined system. Again, the most
7 convincing piece of evidence is that this mine has a
8 radius of influence of more than 15 miles. It
9 encompasses the entire MEA facility. If you have any
10 small amount of leakage --

11 JUDGE WARDWELL: Okay. You don't have to
12 repeat that. I understand that.

13 MR. LEWIS: Okay. So --

14 JUDGE WARDWELL: So, by the answer to my
15 question of "this system," you mean the conceptual
16 model that is built for the Basal Chadron all through
17 this area?

18 MR. LEWIS: Absolutely. And the types of
19 leakage that we're suggesting exist, if those did, in
20 fact, exist, the radius of influence of this mine
21 couldn't, would be nowhere near that size.

22 JUDGE WARDWELL: And how do you know that
23 isn't going to take place at MEA if, in fact, with the
24 given geological information you have there, and the
25 analysis of the pump test analysis there, that the

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1 sensitivity of that isn't a little bit different, if
2 not a lot different, than what has been shown before?
3 And it seems to me that it would be prudent to take a
4 look at that sensitivity, wouldn't it? I mean, just
5 to prove that "the system" is still functioning down
6 in your new area as you apply your application?
7 Wouldn't you want to know that, as a professional, in
8 regards to, all of a sudden, seeing -- protecting
9 yourself from any things that are more sensitive where
10 you happen to be having them now have a lot of
11 geologic information that was never had before with
12 "the system"?

13 MR. LEWIS: Yes, Your Honor, I understand.
14 We had a similar situation in the previous hearing
15 with the flattening of the curves, and we discussed
16 the various reasons for this and that type of
17 analysis. There was a leakage analysis applied at
18 that time, and the conclusion of the partners involved
19 was it was due to variations in transmissivity. I
20 agreed with that conclusion.

21 So, we're in the same basic regional
22 system here at the MEA. I have a similar situation
23 that I'm in. So, again, I'm saying I need to do a
24 leakage analysis when I know that there's a
25 transmissivity variation here that explains this

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1 situation, and I know that the leakage in this system
2 is very low because of the large radius of influence
3 of this mine. And I haven't touched on the hydrologic
4 impact assessment, which is consistent with that
5 analysis of drawdown. We calibrated another model
6 using the Theis methodology that fits the data. So,
7 all things considered, Your Honor, I am not willing to
8 do a leakage analysis of the system that I am
9 convinced does not have a significant characteristic.

10 JUDGE WARDWELL: I'm pondering your words,
11 because I see -- I have an uneasy feeling there's some
12 circular reasoning in there that I'll have to just
13 contemplate more.

14 Would staff like to comment on this?

15 MS. STRIZ: I believe that it is
16 plausible, exactly for the reasons that he's stated;
17 that if there was a recharge boundary, that you would
18 have seen it, given the drawdown from the main
19 facility.

20 Also, you would have seen it in this
21 pumping test. It wouldn't have reached out 8800 feet,
22 nowhere near it, for the short period of time, if
23 there had been significant recharge.

24 Now I do have a little intellectual
25 curiosity. So, I did look at it, but I looked at it

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1 from a different angle in terms of I was struck by the
2 fact that the wells that showed recharge were very
3 close to the pumping well; that that feature only
4 appeared on the wells that were close to the pumping
5 well. Could there be something about the pumping well
6 that was affecting this and making it look like there
7 was a recharge boundary?

8 In fact, I looked at the data and
9 determined that, if you fit later time, because of the
10 impacts of the well being so efficient, which means it
11 had a lot of drawdown just because of the way it was
12 interacting with the formation -- so, there was extra
13 drawdown with that. And also, the wells were so
14 close, so they could have been infected by vertical
15 flow effects due to just the interaction.

16 And when I looked at that, I found that
17 there appeared to be well effects for about 800
18 minutes, and that fully developed radial flow, which
19 is the one requirement of a Theis equilibrium, non-
20 equilibrium test, is that you have to be in radial
21 flow before you can fit the curve. And I determined
22 that it should be fit to late time because the
23 drawdown that you see at early is due to well
24 inefficiencies. And if you fit it to late time,
25 miraculously, it comes up with a transmissivity of

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1 about 700 feet squared per day and a storage
2 coefficient that is much more in line with what you
3 see in the rest of the aquifer.

4 So, if you look at, in particular, graph
5 C4 -- no, excuse me.

6 JUDGE WARDWELL: Speak into your mic, or
7 look it up, and then, speak into your mic.

8 MS. STRIZ: If you look at C3, I mean,
9 immediately when you look at it, the transmissivity is
10 much lower.

11 JUDGE WARDWELL: You're speaking of --

12 MS. STRIZ: The Theis drawdown --

13 JUDGE WARDWELL: -- CDR008 --

14 MS. STRIZ: Oh, it's 0016.

15 JUDGE WARDWELL: Or just, no, 016? 016?

16 MS. STRIZ: Yes.

17 JUDGE WARDWELL: The pump test report?

18 MS. STRIZ: Yes, graph C3. The
19 transmissivity is much lower and the storage
20 coefficient is not reflective of a confined aquifer,
21 because it's only .0017, when we should be around 1
22 times 10 to the minus 5th.

23 And if you fit to the later time data,
24 where the effects of the well are not impacting the
25 drawdown, you get a value of somewhere around 700 feet

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1 squared per day, and then, 1 times 10 to the minus
2 5th.

3 So, that was just my quick-and-dirty
4 analysis of the wells close by that, when you fit the
5 later time data, when it's truly radial flow, not
6 impacted by the well, you get values of transmissivity
7 and storage that are much more in line with the
8 others.

9 JUDGE WARDWELL: Mr. Back, did you want to
10 say anything?

11 MR. BACK: No. I agree with everything
12 she said.

13 JUDGE WARDWELL: Turning to Dr. Kreamer,
14 which of your suggested methods -- well, first of all,
15 are you suggesting --

16 DR. KREAMER: I'm sorry, could you speak
17 into the microphone? I'm sorry to interrupt, but I
18 can't hear you.

19 JUDGE WARDWELL: Okay. Are you suggesting
20 that, in regards to the various methods, are there any
21 others besides those three that you mentioned, and
22 then, the general category of numerical analyses?

23 DR. KREAMER: Absolutely. Absolutely.
24 There's ones that I didn't mention there.
25 Essentially --

1 JUDGE WARDWELL: Now wait a minute. Wait.
2 No, no, no, no. No, didn't ask any -- or you gave me
3 the answer to my question. Okay?

4 DR. KREAMER: Okay. Sorry.

5 JUDGE WARDWELL: So, those are the three
6 that you're talking about as regards to what you would
7 use if you were evaluating this data? Is that what
8 you were saying?

9 DR. KREAMER: No. Those are the first
10 ones I would use. Those are the simplest ones.

11 JUDGE WARDWELL: Okay.

12 DR. KREAMER: It's like simple method 1,
13 Theis; simple method 2, leaky aquifer. There are
14 wedge-shaped aquifer equations that are analytical.
15 There are a number of other analytical approaches that
16 could be used. These are the two absolutely simplest
17 ones that could ever be used. And to do leaky aquifer
18 analysis, that's fairly straightforward.

19 JUDGE WARDWELL: And that's what you --

20 DR. KREAMER: I want to mention one other
21 thing, Your Honor. They keep saying in this analysis
22 that the reason why you have these diversions, these
23 apparent leaks, is because of inconsistencies in
24 transmissivity; that the transmissivity varies,
25 variation in transmissivity.

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1 That alone is the opposite of the
2 assumptions with the methods they're using. The
3 methods they're using, the simple analytical methods
4 assume the transmissivity does not change.

5 JUDGE WARDWELL: And what are the
6 assumptions -- and you're speaking that you said two
7 equations, two different methods, but I'm looking at
8 three, the De Glee method, the Hantush-Jacob, and the
9 Walton method, are the ones you proposed.

10 DR. KREAMER: Yes. Those are the ones I
11 proposed in writing. I could probably go into greater
12 depth in other proposals or aquifers that are not
13 exactly horizontal. There are analytical methods --

14 JUDGE WARDWELL: I'm not interested in
15 that.

16 DR. KREAMER: I just went through the
17 simplest ones.

18 JUDGE WARDWELL: You've got to be
19 cognizant of our time element here, Dr. Kreamer.

20 DR. KREAMER: I'm sorry.

21 JUDGE WARDWELL: I'm not interested in
22 what we could do if we were in some other universe or
23 some other planet or even if we were in the good old
24 State of Maine. I'm interested in what we are doing
25 right here in Nebraska, if we might.

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1 So, you've raised three, and let's tackle
2 those three. And then, maybe we'll tackle the
3 universe later. But, of these three methods, do you
4 know what assumptions are inherent with their
5 solutions?

6 DR. KREAMER: Similar assumptions to the
7 Theis equation.

8 JUDGE WARDWELL: What did you say? You
9 were cut out.

10 DR. KREAMER: A leaky --

11 JUDGE WARDWELL: Excuse me. Start again,
12 because you were cut out with a keyword. You said
13 something about the Theis equation.

14 DR. KREAMER: Similar assumptions to the
15 Theis equation with the exception that you have an
16 overlying or underlying strata that leaks water. And
17 therefore, the response of the aquifer to pumping
18 shows the sort of things we're seeing in the diversion
19 in the data we're seeing now. In other words, the
20 leakage --

21 JUDGE WARDWELL: Okay. So, you still have
22 the assumption of homogeneity. You still have the
23 assumption of infinite lateral extent. You still have
24 the assumption of constant thickness. All of those
25 still are in the equations you proposed. The only

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1 difference would be the leakage? Am I correct in
2 understanding that?

3 DR. KREAMER: Exactly. What I propose --

4 JUDGE WARDWELL: Okay. Thank you.

5 DR. KREAMER: -- is going from simple 1 to
6 simple 2 --

7 JUDGE WARDWELL: What do you mean by --

8 DR. KREAMER: -- but I also mentioned
9 numerical.

10 JUDGE WARDWELL: What do you mean by
11 numerical analyses? Are you referring to a finite
12 element or a finite difference? Or, I mean, the
13 others do use numbers, don't they? So, they're
14 numerical analyses. What's your definition of that?

15 DR. KREAMER: Probably in this sense, the
16 standard is mod flow, which is a finite difference
17 model. And specifically, Your Honor, what I'm
18 referring to is, if you look at the -- a lot of
19 mention has been talked about the Crow Butte site and
20 the big cone of depression that comes off that, and
21 how that is characteristic. But, again, they used the
22 numerical number for the closure. And the closure
23 couldn't use analytical models because the conceptual
24 model was wrong. And so, they used many, many
25 iterations of a numerical model, a finite difference

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1 model, to try and characterize why they weren't able
2 to clean up the site like they were going to --

3 JUDGE WARDWELL: Okay. Well, we're not up
4 there. That's fine.

5 For the numerical analysis here, don't you
6 have to assume homogeneity also with any numerical
7 analyses, if nothing else, just within the size of the
8 elements or the size of the space between the
9 differences and the finite difference? There still is
10 that assumption of homogeneity at a certain scale,
11 isn't it, with those models?

12 DR. KREAMER: At a certain scale, yes.
13 But the whole idea of a numerical model --

14 JUDGE WARDWELL: Okay. Thank you.

15 DR. KREAMER: -- is to get away from that.
16 In other words, from the geophysical logs, you could
17 actually specify where the silt layer, the silt stone
18 layers were, where the channels, where the
19 heterogeneities are, and you could, in a 3-dimensional
20 model, you could actually map those out as well as you
21 could from the geophysical data. So, the whole idea
22 of a numerical model is to get away from homogeneity
23 isotropic. But, if you go down to a very small scale
24 of one node, yes, around that node you assume that
25 there's homogeneity, but that would only --

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1 JUDGE WARDWELL: Yes, but, even in between
2 them, in between your data points where you have
3 information from your geophysical work, you're going
4 to have to assume that it's a linear relationship or
5 some homogeneity associated with the in between where
6 you don't have any data.

7 DR. KREAMER: You're correct in that, but
8 I might point out that the abrupt changes we were
9 talking about had two wells over a great, great
10 distance and a change in the thickness. And whether
11 that thickness changed abruptly or whether it changed
12 slowly over between those two -- they were thousands
13 of feet apart -- is something that we don't know,
14 either.

15 JUDGE WARDWELL: Does the fact that an
16 aquifer -- let me rephrase what I was thinking, you
17 not hearing what I was thinking yet, but I'm
18 rephrasing it anyhow.

19 (Laughter.)

20 Does the fact that the aquitard overlying
21 a confined aquifer is leaky mean that there is no
22 containment?

23 DR. KREAMER: You broke up just a little
24 bit. Could you repeat that one?

25 JUDGE WARDWELL: Sure.

1 DR. KREAMER: The aquifer, the aquitard
2 overlying it?

3 JUDGE WARDWELL: Does the fact at a -- now
4 I can't remember what I said. Does the fact that the
5 aquitard overlying an aquifer leaks mean that there is
6 no containment within the aquifer?

7 DR. KREAMER: It depends on the
8 configuration entirely. If there were a secondary
9 porosity like --

10 JUDGE WARDWELL: Let me interrupt. I
11 don't want to hear your -- I'm going to rephrase it
12 for you, so I can make it quicker then.

13 DR. KREAMER: Okay.

14 JUDGE WARDWELL: I know there's always
15 something that will say, yes, I mean that will say,
16 yes, there is no containment. I'm going to go the
17 opposite way. Is it always true that, no matter what,
18 if the aquitard above an aquifer leaks to any degree,
19 that there is no containment?

20 DR. KREAMER: No, minor leaks, we
21 generally characterize it as contained.

22 JUDGE WARDWELL: Right. So, we're now
23 talking about, we can agree that we're talking about
24 the scale of the amount of leakage that's occurring in
25 regards to whether it really is going to be considered

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1 a leaky aquifer or a need for a leaky aquifer
2 analysis. Is that a fair assessment?

3 DR. KREAMER: That's pretty fair, and in
4 this case it's diversion of the Theis curve we draw.

5 JUDGE WARDWELL: Right, and that's part of
6 it also. And the same thing with the Theis curve.
7 Thank you.

8 Can you point to any evidence that shows
9 that at the MEA site -- that's why I wanted to fix the
10 first point, so we could now get on to the second
11 point. Is there any evidence that you have, that you
12 can point to, that shows that the leakage is so
13 extensive at the potentiometric levels, does not rise
14 to the aquifer and it actually becomes an unconfined
15 aquifer? Do you have any data that you could point to
16 or analysis that you have performed, or anything like
17 that, that demonstrates that we've got that issue here
18 at the MEA?

19 DR. KREAMER: You're talking about the
20 Chamberlain Pass, the Basal Chadron, and that the
21 drawdown is such that it becomes unconfined? We call
22 that, actually, a semi-confined aquifer. And the
23 answer to that is there's no evidence of that.

24 JUDGE WARDWELL: But that isn't what I was
25 asking. I'm asking, do you have enough leakage that

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1 is so extensive -- and maybe I'm using the wrong --
2 probably I shouldn't use the fact that the
3 potentiometric level drops. But do you have any
4 evidence that the leakage is so extensive that the
5 impacts to control of the mining fluids within the MEA
6 is made impossible, such that there would be
7 uncontrolled migration of those fluids? That's
8 probably a better way to word the question.

9 DR. KREAMER: The limited analysis that
10 was done with Theis indicates that that's a
11 possibility. As far as an assured possibility --

12 JUDGE WARDWELL: Excuse me. If I could
13 interrupt quickly?

14 The limited analysis with what? I didn't
15 catch that word. That's why I just wanted to stop you
16 quickly.

17 DR. KREAMER: The Theis diversion
18 indicates that it's a possibility.

19 JUDGE WARDWELL: Okay.

20 DR. KREAMER: It depends on the
21 configuration, where the leak is.

22 JUDGE WARDWELL: Thank you.

23 Crow Butte, are you familiar with these
24 other methods that Dr. Kreamer is proposing? And is
25 it true that the only difference between those methods

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1 and what you did use was the leaky -- I call it the
2 leaky aquitard analysis.

3 MR. LEWIS: Bob Lewis, Crow Butte.

4 Yes, Your Honor.

5 JUDGE WARDWELL: And you agree with the
6 statements he's made about those particular methods,
7 including any statements he's made on the numerical
8 analyses?

9 MR. LEWIS: Yes, I agree with the
10 differences between the analytical and the numerical
11 solutions.

12 JUDGE WARDWELL: Thank you.

13 And I'll turn to NRC staff. Who would
14 like to answer that? Or say that you have no
15 comments? Fine, too.

16 MR. BACK: David Back.

17 Yes, we agree and have no further
18 comments.

19 JUDGE WARDWELL: Dr. Kreamer, in your
20 Opinion 3 at 6 -- that's Exhibit 003 and, likewise,
21 your rebuttal at 014 at 2, and it's No. 4 -- you made
22 a following discussion about saying that -- no, I
23 don't have the -- I'll go ahead with it.

24 You say, "A false argument is made for
25 using only a Theis analysis of the pumping test. One,

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1 that it is argued that it is" -- I believe it's the
2 Applicant that you're referring to when you say, "It
3 is". I believe it's the Applicant "argued that it is
4 a standard method and that, two, almost everyone uses
5 it in an analysis of a pumping test, no matter whether
6 the assumptions associated with its use are violated
7 at night" -- oh, "or not". And it is both the
8 Applicant and the NRC because you cite to both in
9 CBR001 at page 15 and 29 and NRC001 at 16 to 18 and
10 page 26.

11 You go on to say that, "This false
12 argument, consistent with the lack of confinement, is
13 demonstrated by departure from the expected Theis
14 curve from the single pumping test, coupled with low
15 permeabilities observed in the strata and nearly
16 overlying the Basal Chadron formation, are indicative
17 of and consistent with the existence of secondary
18 porosities and fracture flow. Robust fracture
19 analysis has not been performed by CBR nor required by
20 the staff."

21 And I think my question for you, Dr.
22 Kreamer, is, with the stipulations that we had that
23 the unconfined -- that the upper confining unit is 360
24 to 400 feet of clay-rich middle and upper Chadron
25 confining units that underlie 350 to 500 feet of the

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1 Brule Formation and 400 to 160 feet of the Arikaree
2 Group, is not the upper confining unit encountered at
3 depths of excess of about 390 feet, if you just add
4 the 360 with what's available, with what's in the
5 Arikaree Group? Is that about where those depths --
6 we're talking about 400 feet in depth or so where
7 the --

8 DR. KREAMER: Are you talking depths or --

9 JUDGE WARDWELL: -- where the upper
10 confining unit is?

11 DR. KREAMER: -- or thicknesses?

12 JUDGE WARDWELL: Sorry? I stepped on you.

13 DR. KREAMER: Depths or thicknesses?

14 JUDGE WARDWELL: Depth. The depths to it.

15 DR. KREAMER: The depths to it? I believe
16 that's consistent with the data, yes.

17 JUDGE WARDWELL: Let me verify that with
18 CBR. Is that about the depth of the upper confining
19 unit? I think that's what I did with the stipulations
20 that we had in regards to the thicknesses of the
21 various deposits that I read off.

22 DR. KREAMER: You said "depths".

23 JUDGE WARDWELL: Right, the depth to it.

24 DR. KREAMER: Okay. Now you're saying
25 "thicknesses". I misunderstood.

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1 JUDGE WARDWELL: Do you agree it's about
2 that deep? The upper layer of the upper confinement
3 unit?

4 DR. KREAMER: I thought you were referring
5 to the thicknesses, and I agreed with that.

6 JUDGE WARDWELL: Okay. And I'm just
7 wondering if you have any evidence that shows there
8 fractured groundwater flow through that 360-to-500,
9 450-foot-thick clay-rich upper confining unit that is
10 at depths of 390 feet or more, besides those that you
11 have already brought up. That is, not fitting of the
12 Theis equations, et cetera. We've covered all of
13 that, and I understand your position on that. I just
14 want to make sure there isn't something else that
15 you'd like to offer in regards to evidence of fracture
16 flow at that particular depth of the ground.

17 DR. KREAMER: You're absolutely right,
18 Your Honor; if you don't do fracture analysis and you
19 don't look for it, you won't find it.

20 JUDGE WARDWELL: Okay. Thank you.

21 Crow Butte's rebuttal of that, 033, Answer
22 19 at 10, says, "Crow Butte used appropriate
23 analytical techniques for such aquifers, but,
24 nevertheless, was prepared to use more complex
25 analytical techniques, had it been necessary. It was

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1 not."

2 And I was just curious in regards to what
3 complex analytical techniques you were prepared to
4 use, Crow Butte, and what preparations you had made.

5 MR. LEWIS: Bob Lewis, Crow Butte, Your
6 Honor.

7 The concept of using a numerical model had
8 come up. In the event that there was extreme
9 heterogeneity or there were some boundary conditions
10 that were unexpected, those would be some things that
11 you might want to go to another level to get a better
12 handle on reasonable estimates for transmissivity in
13 aquifer parameters. But, 7 out of 8 monitor wells fit
14 the normal-type curve. I don't believe that type of
15 level of effort is necessary.

16 JUDGE WARDWELL: Thank you.

17 Dr. Kreamer, your testimony, Exhibit 003
18 at 6, said, "Both mathematical forms of analyses"
19 -- that is the Theis the Cooper-Jacob -- "are
20 considered the simplest forms of an aquifer pumping
21 test analysis. They require the same fundamental
22 assumptions to be fulfilled for accurate results."

23 And I guess is, isn't it fair to say that
24 the vast majority of groundwater analyses start with
25 Theis-Cooper-Jacob solutions and only alter the

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1 approach if the results point to a clear violation of
2 the assumptions, especially when in regards to the
3 techniques you, sir, pointed out have essentially all
4 the same assumptions as does the Theis and Cooper-
5 Jacob analysis?

6 DR. KREAMER: Your Honor, that would be
7 accurate for well flow, but for contaminant flow it
8 would not be.

9 JUDGE WARDWELL: In that previous
10 reference that I made, you talked about a robust
11 fracture flow, and in your rebuttal at OST Exhibit
12 014, page 2, No. 4, again, repeating "A robust
13 fracture analysis had not been performed by CBR nor
14 required by the NRC staff. Fracture flow would also
15 diminish the value of spatially limiting monitoring
16 wells in a shallow Brule Formation whose
17 interpretation depends on homogeneous layers and not
18 discrete fractures."

19 And I guess I'm just clarifying it. Are
20 you also, in regards to those other methods,
21 suggesting that a fracture flow analysis be used for
22 interpreting the pumping tests, or is that not
23 appropriate?

24 DR. KREAMER: It would help give insight
25 into the results from the pumping tests from well

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1 flow. I think it's appropriate in this case. We
2 obviously have heterogeneities in the formation of
3 interest that we all agree on in our writing. And so,
4 I think it would be a robust fracture analysis would
5 clarify all these things.

6 If one fracture were to come down in the
7 middle of one of their arrays, the amount of water
8 they're pumping in versus pumping out could be
9 compromised, and that would mean that this 95 percent
10 safety net that they have might not work. And that's
11 why suggest the fracture analysis is important in this
12 case.

13 JUDGE WARDWELL: And what type of fracture
14 data is needed to analyze fracture flow in this, which
15 is basically in bedrock as opposed to soil? You
16 wouldn't do it in soil. Correct?

17 DR. KREAMER: That's a good question, Your
18 Honor. Essentially, what you do is, through --
19 there's several different ways to do this. Certainly,
20 geophysics can help you. Down-hole TV monitoring can
21 tell you the aperture size and the orientation of
22 apertures. By connecting up different wells and
23 different bore holes, you can see if there's a
24 continuity in fractures. That's sort of the first
25 step.

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1 Lineament analysis on the surface, looking
2 for lineaments on the surface are sometimes indicators
3 of fractures below. There's several different
4 approaches to use, and this even includes satellite
5 information and high-altitude photography.

6 JUDGE WARDWELL: And so, this seems more
7 like a geologic investigation as opposed to -- a
8 geologic scientific investigation as opposed to any
9 type of one system -- I hate to use the word "system"
10 -- one robust fracture flow analysis analytical
11 solution type of approach? Is that what you're
12 saying --

13 DR. KREAMER: Yes. Most --

14 JUDGE WARDWELL: -- that this fracture
15 flow analysis that you're interpreting encompasses
16 lots of different things that you had pulled together
17 and, then, interpret in regards to what you believe to
18 be the flow through that system?

19 DR. KREAMER: Analytical solutions do not
20 usually consider fracture flow because it's not
21 homogenous and isotropic, although these can be hugely
22 important in different circumstances.

23 I guess if your question is whether this
24 could be quickly and easily done, a first analysis or
25 fracture analysis would be very helpful at this

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1 particular site.

2 JUDGE WARDWELL: And where would you get
3 this information on this fracture characteristics of
4 it? I think you're talking the density of them and
5 the gap sizes and any sediment in them, and the
6 fracture connectivity, and things like that, I kind of
7 heard you say. How is one to get that information?

8 DR. KREAMER: There's several different
9 ways to do it. Probably the cheapest is aerial
10 photography to start off with, looking for lineament
11 analysis. And then, there is bore hole work. Just TV
12 monitoring, you can sometimes see the orientation and
13 the aperture size.

14 The next is packer testing where you pack
15 off a fracture. You identify a fracture. You put
16 essentially a big balloon above and below, and you can
17 do a hydraulic test on just that fracture and see what
18 the characteristics, hydraulic characteristics, of the
19 fracture are by isolating it.

20 But, yes, you're right; we're in a realm
21 now where homogeneous isotropic doesn't fit,
22 analytical doesn't fit, and Spandex Fruit of the Loom
23 one-size-fits-all does not work.

24 JUDGE WARDWELL: And with this done, then
25 is there a commercially available software or program

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1 or analysis technique where you feed in this data and,
2 then, they're able, through some flow algorithm,
3 determine the amount of groundwater movement through
4 this fractured system?

5 DR. KREAMER: There are ways to do that,
6 but what's typically done is you identify what looks
7 to be a large fracture and you do a packer test on it,
8 isolating it, and doing a hydraulic test or a dye-
9 tracer test between fractures to get the hydraulic
10 properties of that fracture. So, it's usually step 1,
11 step 2, step 3 sort of analysis rather than --
12 although the programs will give you a general idea if
13 you have good bore hole analysis.

14 JUDGE WARDWELL: And then, how would you
15 separate that out from the -- maybe I'll go quickly.
16 Do you agree that the Basal Chadron is a porous
17 material as well as a fractured material?

18 DR. KREAMER: A what material? I'm sorry.

19 JUDGE WARDWELL: Does the Basal Chadron
20 behave similar to our granites in the great Northeast
21 part of this country? Does it have, still has a
22 porous media associated through it, even though the
23 sandstone may be fractured? Is not that correct?

24 DR. KREAMER: Yes, you can have what's
25 called dual porosity, that is, and even triple

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1 porosity in some cases, where you have fracture
2 porosity and, then, you have matrix flow in the rock
3 itself, where it invites water, sort of like blotting
4 paper.

5 JUDGE WARDWELL: And so, in fact, if
6 you're going to do this, wouldn't you consider the
7 Basal Chadron and Chamberlain Pass Formation dual
8 porosity, which I think people have brought up the
9 primary and the secondary porosity of this unit. And
10 I believe, were they not, referring to the porous
11 fraction of the flow and, then, the fractured part of
12 the flow?

13 DR. KREAMER: Yes, I think it would be
14 appropriate in this case. And again, the fact that
15 it's coarse-grained sandstone, it's indurated; it's
16 got silt beds and clays of varying thickness. And
17 we've all agreed on that. I think it's an indicator
18 that that's something that ought to be done to see if
19 there is potential risk.

20 Again, my concern with fractures is how it
21 might upset the injection rates and things like that
22 and alter the simplified version of the Theis; and
23 secondarily, and importantly, the contaminant flow
24 would be on a whole different level than just simple
25 analytical models.

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1 JUDGE WARDWELL: Okay. Thank you.

2 We'll move on a bit to 2.4, Opinion 4,
3 "Homogeneity and Isotropic Assumptions". And I think
4 we've covered most of this. This is kind of a repeat
5 from -- we've touched upon this an awful lot. So,
6 there's only a couple of questions I've really got on
7 that.

8 And that is, your Opinion 4 states, "The
9 second major assumption inherent in this analytical
10 mathematical This approach employed in the MEA
11 hydrology report is that the Basal Chadron aquifer is
12 homogeneous and isotropic and of uniform effective
13 thickness over an area influenced by the pumping.
14 This foundation requirement is violated and it's not
15 consistent with the data in evidence. And again, this
16 fundamental condition of accurate use of the This
17 methodology is presumed, but is inconsistent with the
18 evidence."

19 And I guess, in regards to that, you have
20 already testified that your other methods that you
21 suggested, while they would cover the leaky aspect of
22 that, they still wouldn't dodge the assumptions of
23 homogeneity and isotropic conditions within that. Is
24 that not correct?

25 DR. KREAMER: That is correct.

1 JUDGE WARDWELL: Yes.

2 DR. KREAMER: That is correct, Your Honor.

3 JUDGE WARDWELL: And your basis, you
4 mention that the transmissivities range from 230
5 square feet per day to 1780 square feet per day, and
6 the values of storage coefficient range from 1 times
7 10 to the minus 3 to 8.32 times 10 to the minus 5.
8 And you're stating that these are not consistent with
9 homogeneous conditions. Homogeneity also means that
10 the thickness of the formation is uniform, and it is
11 not.

12 Okay. Those questions we've already
13 answered.

14 In your testimony on page 5 of Exhibit
15 003, you say, "There is a large difference in the
16 magnitude of conductivity, indicating the complete
17 lack of homogeneity in the likelihood of a
18 preferential flow path." And I was curious on what's
19 your definition of a large difference in conductivity.
20 We've already talked about that. I think we're fine
21 with that. I'm more interested in your definition of
22 a complete lack of homogeneity.

23 DR. KREAMER: Sure. Homogenous, you have
24 the same hydraulic conductivity in two different
25 places. If you drill down through the formation that

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1 we're interested in, the Chamberlain Pass-Basal
2 Chadron, you will hit, you will go from sandstone, and
3 you'll go to claystone. That's heterogeneity. Now
4 that's the definition of heterogeneity. And it's
5 extreme heterogeneity when you go to a claystone, you
6 know, to a stringer of completely different material.

7 JUDGE WARDWELL: Okay. Thank you.

8 In your testimony, Exhibit 003, at 6, you
9 say, "The first major assumption inherent in this
10 analytical mathematical approaches employed in the MEA
11 hydrology report" -- and that's CBR016 at 15 -- "is
12 that the Basal Chadron aquifer is confined and has
13 apparent infinite extent. The presumption by the
14 authors is not consistent with the data in evidence.
15 The main foundation for the analytical approach was
16 presumed, but inconsistent with the test data."

17 And I said I guess the question I have for
18 you, Dr. Kreamer, is, with geosciences, is not the
19 consistency between professional interpretations and
20 the data extremely subjective and varies widely with
21 professional judgment of the individual engineer or
22 scientist?

23 DR. KREAMER: Well, that's true. I think
24 we all agree. Hydrologists on both sides agree. The
25 other side clearly said that the differences in the

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1 data were due to transmissivity variation. And
2 transmissivity variation, by its very nature, violates
3 the assumptions of the methods they used. And so, I
4 think that they agree with me that they violated the
5 assumptions in what they did, and by their statement
6 that the transmissivity varies. So, I don't think
7 we're in disagreement here. I think we're in
8 disagreement as to they don't think that these
9 variations in transmissivity are important and that
10 they can be ignored, and it still does not invalidate
11 the methods that they used, even though it violates
12 the assumptions.

13 JUDGE WARDWELL: I'll turn to CBR. Do you
14 believe that you don't think the variations of
15 transmissivity are important and could be ignored?

16 MR. LEWIS: Bob Lewis, Crow Butte, Your
17 Honor.

18 Variations in natural systems are
19 expected. There is no perfectly homogeneous system,
20 as we've discussed earlier. The variability we see is
21 typical in natural systems. It's not unusual. I
22 would say this system is unusually homogeneous for
23 natural fluvial systems. The transmissivities,
24 hydraulic connectivities don't vary by orders of
25 magnitudes. They vary by factors of 2 to 5 to 7.

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1 That's relatively homogeneous, in my opinion. So, for
2 purposes of practical application and developing
3 reasonable estimates, which is what our purpose is, is
4 to develop reasonable estimates of transmissivity,
5 aquifer parameters, boundary conditions, that the
6 analytical methods that we are using are completely
7 appropriate for that purpose.

8 JUDGE WARDWELL: Thank you.

9 NRC Staff, would any of you like to
10 comment on that?

11 MS. STRIZ: Totally agree. There is
12 really only one well that I pointed out earlier, which
13 was monitor 3, which was only 100 feet from the
14 pumping well that I think was impacted by the pumping
15 well effects. And so, they should have analyzed later
16 time, and if they had, they would have come up with a
17 value of transmissivity and storage coefficient very
18 much in line with the others.

19 JUDGE WARDWELL: Thank you.

20 MS. STRIZ: And I think that was the
21 effect.

22 JUDGE WARDWELL: Can you pull up table 8,
23 CBR016? That's the pumping test report, and it's
24 figure 3.1 -- I mean on page 31.

25 And now, we would like that a bit bigger,

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1 so people can see it.

2 Dr. Kreamer, can you see that table all
3 right? It's table 8.

4 DR. KREAMER: It just came up as you asked
5 the question. So, there's a delay on this side, but
6 I now see it.

7 JUDGE WARDWELL: Okay. In regards to the
8 drawdown analysis, the Theis drawdown analysis, under
9 hydraulic conductivity, it appears to me, when I
10 looked at that, that it varied from 6 to 45 feet per
11 day, with one of them high and one of them low, and
12 the other six pretty consistent. Do you agree?

13 DR. KREAMER: The print is a little small,
14 but, yes, I can see that, Your Honor.

15 JUDGE WARDWELL: Okay.

16 DR. KREAMER: I agree.

17 JUDGE WARDWELL: And then, in the recovery
18 analysis, the permeability, the hydraulic conductivity
19 went from 6 to 62 feet per day, one high, one low, and
20 seven pretty consistent.

21 DR. KREAMER: Yes, that's true. The
22 transmissivity is orders of magnitude, but yes --

23 JUDGE WARDWELL: Right.

24 DR. KREAMER: -- in order of magnitude.

25 JUDGE WARDWELL: Yes, I was just looking

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1 at the hydraulic conductivity.

2 Okay. Thank you.

3 DR. KREAMER: And the storativity is two
4 orders of magnitude.

5 (Pause.)

6 JUDGE WARDWELL: I apologize for pausing
7 here, but some of these we've already answered.

8 On CBR, your rebuttal, 001, not
9 rebuttal -- it's your original testimony -- 001 at R1,
10 at 30, "Hydraulic conductivity values near the pumping
11 well" -- and that's CPW1A and CPW1 -- "and monitor 3
12 were approximately 3 to 9 times greater than the
13 hydraulic conductivities estimated for other
14 observation wells in the pumping test area. An
15 apparent higher conductivity boundary condition effect
16 in these wells was indicated by the flattening of the
17 drawdown or recovery curves."

18 But isn't this just opposite of what you
19 hypothesized for rationalizing the flattening of the
20 drawdown curves that you set in the pump tests in
21 regards to what's stated in CBR016 at 13, where it's
22 just the opposite, isn't it?

23 MR. LEWIS: I'm sorry, Your Honor, I don't
24 follow.

25 JUDGE WARDWELL: In your testimony on page

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1 30 of Exhibit 001, you're saying that the conductivity
2 values near the pumping well were approximately 3 to
3 9 times greater hydraulic conductivities estimated for
4 other observation wells in the pumping test area. You
5 finish it off by saying, "An apparent higher
6 conductivity boundary condition effect in these wells
7 was indicated by a flattening of the drawdown and
8 recovery curves."

9 It seems to me that what you said in your
10 aquifer report, CBR016, at 13, says just the opposite
11 in regards to interpretations of, I believe, the
12 flattening. Do you see that?

13 MR. LEWIS: Yes, sir.

14 JUDGE WARDWELL: Yes, sir; no, sir, or
15 what did you --

16 MR. LEWIS: Yes, sir.

17 JUDGE WARDWELL: Okay. So, I'm
18 asking -- I'm at a bit of a quandary with that.

19 MR. LEWIS: I believe there may be a
20 misstatement in terms of the hydraulic conductivity
21 variability in that case. There is a lower
22 permeability zone in the vicinity of the pumped well,
23 is the intention of the statement.

24 JUDGE WARDWELL: Thank you.

25 NRC, in your rebuttal, 014, Answer 23 at

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1 27, you state that the second assumption Dr. Kreamer
2 questions is that "the aquifer is confined of an
3 apparent infinite lateral extent. By definition, the
4 Basal Chadron aquifer is a confined aquifer because,
5 as explained in Answer 21 of our initial testimony,
6 it's potentiometric surface rises above the top of the
7 elevation of the aquifer."

8 And I guess a question for NRC is, is a
9 confined aquifer necessary for operation of an ISR
10 facility?

11 MS. STRIZ: No, it's not necessary, but
12 it's preferred.

13 JUDGE WARDWELL: Is it a confined aquifer
14 sufficient for the operation of an ISR facility?

15 MS. STRIZ: If it has sufficient
16 transmissivity and doesn't have other features would
17 cause a safety issue.

18 JUDGE WARDWELL: Not every confined
19 aquifer is sufficient for operation of an ISR
20 facility, then, if you've added these other caveats?

21 MS. STRIZ: Yes. I mean, if there's other
22 issues that are unrelated to its transmissivity, it
23 doesn't matter whether it's confined or not.

24 JUDGE WARDWELL: Thank you.

25 Yes, we've covered the infinite lateral

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1 extent. Good shape.

2 CBR006, the Technical Report, Section
3 3.1.7, at 3-25, says, "As a conservative measure, the
4 maximum groundwater velocity was computed using
5 maximum reserve values for hydraulic conductivity of
6 61.7 feet per day and a hydraulic rating of 0.00048."

7 And I was curious as to what was the
8 source of that value of hydraulic rating for the Basal
9 Chadron and Chamberlain Pass Formation.

10 MR. PAVLICK: Doug Pavlick.

11 We'll need some time to answer that.

12 JUDGE WARDWELL: Sorry?

13 MR. PAVLICK: Could we have some time
14 to --

15 JUDGE WARDWELL: Oh, yes.

16 MR. PAVLICK: -- answer that later?

17 JUDGE WARDWELL: Tomorrow or whatever,
18 yes.

19 MR. PAVLICK: Thank you.

20 JUDGE WARDWELL: No problem.

21 We've got about, I think, a half-hour left
22 to finish up Concern 2. Do you want to take a quick
23 break now or plow on through? Because, then, once we
24 get --

25 CHAIR BOLLWERK: If we plow on through, we

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1 will take a break, then, while they do their potential
2 cross-examination or additional questions. So, maybe
3 that's better, yes.

4 JUDGE WARDWELL: Sure.

5 CHAIR BOLLWERK: And then, everybody can
6 -- we'll take a break and do the questions.

7 I think Judge Hirons may have a couple of
8 questions when you're done.

9 JUDGE WARDWELL: Sure.

10 Section 2.5, Opinion 5, is Analysis for
11 Anisotropy where Dr. Kreamer challenged -- "The
12 rigorous analysis of anisotropy were not demonstrated
13 and undertaken for the EA or the hydrologic report,
14 and the nature of directional hydraulic conductivity
15 differences remains undefined and not quantified,
16 particularly in the vertical direction."

17 Dr. Kreamer's testimony, at page 7, is
18 saying, "Regarding to the lack of rigorous analyses
19 for anisotropy, the Applicant, in its aquifer pumping
20 test report, CBR016 at 18, with the acceptance by the
21 staff's EA," referencing NRC006 at 70 and 255, "argue
22 that no anisotropy exists in the small area of the MEA
23 which underwent a pumping test, and it was based on a
24 two-dimensional hand-drawn visual rendering with a few
25 data points," referencing CBR016 at 48, "rather than

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1 a standard serious data evaluation-based" -- yes, "a
2 serious data-based evaluation. This is not consistent
3 with the professional practice."

4 CBR rebuttal at 033, Answer 23 at 12,
5 says, "The cone of depression at the end of the
6 pumping test shown in figure 16" -- that's CBR016 at
7 48, and if we could pull that up, Joe, I'd appreciate
8 it -- "utilized drawdown data from all monitoring
9 wells. More detailed analyses of anisotropy are not
10 necessary, given the lack of conceptual basis and the
11 geometry of the depression cone."

12 And that's what we're looking at here in
13 figure 16 on page -- and that is, yes, that is 48.
14 And I'd just verify with Crow Butte -- yes, I don't
15 have to. It says right there "figure 16". So, that
16 is the figure you were referring to in your rebuttal,
17 is that not correct, Crow Butte? Sorry, I need to
18 look at you.

19 MR. LEWIS: Yes, sir. However, it's not
20 hand-drawn. It's a computer diagram.

21 JUDGE WARDWELL: Okay. And how were those
22 drawn? Are they least-squares to describe it? Was it
23 a software? How was that created?

24 MR. LEWIS: They were created with a
25 computer software program, Surfer.

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1 JUDGE WARDWELL: Surfer? That's what you
2 used? Yes?

3 MR. LEWIS: Yes, sir.

4 JUDGE WARDWELL: And how many data points
5 do you have here? How many wells are you using? It's
6 shown in green, right?

7 MR. LEWIS: I believe that's 11, Your
8 Honor.

9 JUDGE WARDWELL: What's that?

10 MR. LEWIS: I believe that's 11 data
11 points.

12 JUDGE WARDWELL: Do you have any analysis
13 that demonstrates, with that range of wells, that
14 you've got the accuracy to justify the position that
15 anisotropy doesn't exist? Basically, I'm asking,
16 what's the sensitivity of those contours, and could
17 there not be more of an elliptical shape presented in
18 there that didn't use least-squares or some designated
19 algorithm, but, yet, could still match those contours,
20 that would show some anisotropy?

21 MR. LEWIS: Your Honor, I believe you
22 could use different contouring algorithms and get the
23 same result. It's non-biased. It's not a hand-drawn
24 diagram. So, there's not an inherent bias in the way
25 those contours are drawn. So, my opinion would be,

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1 no, it doesn't demonstrate anisotropy with a different
2 gridding method.

3 JUDGE WARDWELL: And so, if I hear you
4 correctly, then, you haven't performed any analysis to
5 demonstrate that the number of wells or other data
6 points are sufficient to provide the accuracy that you
7 need to detect anisotropy? You just --

8 MR. LEWIS: No, I --

9 JUDGE WARDWELL: The program did its
10 thing, and you said there's not much, if there is? I
11 mean, there's a little egg-shape, but not much.

12 MR. LEWIS: Yes, sir, I did no other
13 analysis.

14 JUDGE WARDWELL: I'll turn to Dr. Kreamer.
15 Do you think their computer-drive plot -- I'm not
16 saying you have to agree with the plot. I just want
17 to say, if that plot was truth, do you think it shows
18 anisotropy as drawn? Simply yes/no.

19 (No audible response.)

20 Can't hear you.

21 CHAIR BOLLWERK: Dr. Kreamer, can you hear
22 us?

23 DR. KREAMER: I'm sorry, I muted. I
24 muted, so I wouldn't have any background noise. I
25 apologize, I didn't unmute.

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1 JUDGE WARDWELL: Shame on you. That has
2 never happened to any of us.

3 (Laughter.)

4 DR. KREAMER: It might be a more pleasant
5 inquiry if I muted the whole thing.

6 (Laughter.)

7 But, in answer to your question in your
8 hypothetical if this is an accurate representation, it
9 looks fairly, it looks fairly isotropic, at least in
10 the horizontal plane.

11 JUDGE WARDWELL: Would you like to comment
12 more or just in regards to your professional opinion
13 in regards to the wells and their distribution and the
14 accuracy of that plot?

15 DR. KREAMER: Absolutely. There are three
16 elements here that indicate that it may not be
17 sufficient. The first is the number of wells.
18 Statistically, that's a pretty low number.

19 Secondly, we just a second ago looked at
20 the different hydraulic conductivities and the
21 variation in transmissivities in different directions,
22 and that indicates a certain amount of lack of
23 isotropy. That, in itself, is an indicator of
24 anisotropy.

25 But I think, importantly, if you go back

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1 to the Crow Butte data and the pumping tests there,
2 it's documented in the Crow Butte pumping test that
3 they did have anisotropy. I think everybody was in
4 agreement. There were two tests that showed definite
5 anisotropy and, in fact, there was anisotropy in two
6 different principal directions in the test at Crow
7 Butte. So, the third line of evidence that there's a
8 possibility of anisotropy comes from previous pumping
9 tests over at Crow Butte.

10 But, if you just looked at this, it looks
11 isotropic if you hypothesize that this is correct.

12 JUDGE WARDWELL: You mention that the
13 numbers and the spacing of wells or something led you
14 to believe there was some -- oh, no, it was -- I'm
15 sorry -- it was your reviewing of the transmissivity
16 values that you say demonstrated some anisotropy. And
17 yet, I was wondering, I assume you mean that it's only
18 some anisotropy in a directional sense, and not a
19 vertical sense, because we didn't really have anything
20 to resolve the vertical sense of that, did we?

21 DR. KREAMER: No, we did not.

22 JUDGE WARDWELL: Were you referring to
23 some type of directional and, then, if so, what
24 direction was it?

25 DR. KREAMER: Again, high-resolution

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1 vertical sampling would have been able to tell us
2 that, but we had screens that were fully penetrating.
3 And so, therefore, these are averages of the
4 heterogeneous aquifer. And so, no, we don't have any
5 vertical information in this particular
6 representation.

7 JUDGE WARDWELL: Right. And so, when you
8 referred beforehand to the transmissivity values, you
9 were referring only to directional, the horizontal
10 directional, the XY, if you will, directional
11 anisotropy, and not a vertical, because, as you say,
12 you have no information for that?

13 DR. KREAMER: That is correct. That is
14 correct, Your Honor.

15 JUDGE WARDWELL: Yes.

16 DR. KREAMER: And the hydraulic
17 conductivities as well.

18 JUDGE WARDWELL: Did you see any -- what
19 were the orientation of the primary axes in regards to
20 those values that you look at in the table?

21 DR. KREAMER: Oh, in Crow Butte, they were
22 actually almost in 90 degrees --

23 JUDGE WARDWELL: No, here. Here, here.
24 Here, here. I'm not interested in -- if you mean Crow
25 Butte, you mean the existing facilities. No, I'm

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1 interested in the -- you said you looked, you saw the
2 table of transmissivities that we had up there from --

3 DR. KREAMER: Yes.

4 JUDGE WARDWELL: -- the MEA that created
5 this map that we're looking at here. Or were from the
6 same MEA location as this map. And so, I was curious
7 as to whether -- you said you saw some anisotropy and
8 it's directional. I'm interested in what is the
9 orientation of those axes of the anisotropy.

10 DR. KREAMER: I did not do analysis as to
11 where the principal directions were. I considered
12 this not enough data. But, if you look at the
13 hydraulic conductivities for these different wells
14 that are listed here, the hydraulic conductivities do
15 vary and they're not the same directionally. But I
16 didn't do analysis of the principal directions. I
17 just thought that this was too sparse data. There's
18 a paucity of data here, and I think the results would
19 be suspect. I could do a principal direction analysis
20 if you would like.

21 JUDGE WARDWELL: The NRC rebuttal at 014,
22 A-24 at 29, "Similarly, if there's a significant
23 anisotropy within a production zone, such as a large
24 difference in directional conductivity" -- that's
25 KX/KY -- "the aquifer test will show on elliptical

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1 drawdown. As discussed in A-23 above, that was not
2 apparent for the MEA aquifer pumping test. Finally,
3 if vertical anisotropy exists within a production zone
4 in an aquifer, that is KX and KY are greater than KZ,
5 that is considered beneficial for ISR operations
6 because it creates preferential horizontal flow."

7 I'll ask NRC, is anisotropy common in
8 sedimentary rocks?

9 MR. BACK: Yes, Your Honor.

10 This is Dave Back.

11 JUDGE WARDWELL: And wouldn't it have to
12 be pretty extensive anisotropy really to show up in
13 the drawdown curves, given the limited number of
14 wells?

15 MR. BACK: Yes, Your Honor. And moving
16 away from the well, even if you have partially
17 penetrating wells, like what CTS did, you lose the
18 anisotropy effects in the horizontal direction.

19 JUDGE WARDWELL: Thank you.

20 Back to Dr. Kreamer. Do you believe that
21 anisotropy is common in sedimentary rocks, the
22 vertical --

23 DR. KREAMER: Yes, and particularly in
24 this case. You talked about vertical. If we were to
25 just look at the well logs where you have lenses of

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1 clays and other things like that, that is a vertical
2 anisotropy. So, there is vertical anisotropy,
3 according to the well log data, although you couldn't
4 tell it from this data here.

5 And also, there are geologic processes for
6 how this was laid down. The genesis of this, a very
7 common thing in streambed flows is imbrication.
8 Should I explain imbrication?

9 JUDGE WARDWELL: Sure.

10 DR. KREAMER: Okay. If you have elongated
11 particles in a streambed and the stream is flowing in
12 one direction, they will lay down preferentially in
13 layers pointing in a direction of the stream flow.
14 So, imagine a lenticular pebble of some kind and a
15 series of these. They would lay down not quite
16 horizontally, but at a little bit of a slant in the
17 direction of flow. That's called imbrication. That
18 gives anisotropy usually greater horizontal hydraulic
19 conductivity and less in the vertical direction.

20 Also, because of these layers here, you
21 would expect maybe a horizontal conductivity to be an
22 arithmetic mean; whereas, you would expect a vertical
23 hydraulic conductivity to be a geometric mean.

24 JUDGE WARDWELL: Okay. Thank you.

25 If the horizontal was, in fact, greater

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1 than the vertical, wouldn't you believe that to be an
2 asset in controlling the lateral migration of
3 production fluids during the mining operation?

4 DR. KREAMER: It would depend. Or are you
5 speaking to me, Dr. --

6 JUDGE WARDWELL: Yes, I am, sir.

7 DR. KREAMER: Yes. Okay. I'm sorry.

8 It would probably bring more things
9 vertical. It depends on how consistently horizontal
10 the clay lens is, and things of that sort. Obviously,
11 if they vary, it would not be, but that -- we're
12 talking about well production; we're not talking about
13 contaminant flow. The heterogeneities could greatly
14 impact preferential pathways in a horizontal
15 direction.

16 JUDGE WARDWELL: Okay. Thank you.

17 2.6 --

18 CHAIR BOLLWERK: Can I ask one question
19 before you move on?

20 JUDGE WARDWELL: Sure.

21 CHAIR BOLLWERK: So, in BRD001, at 3 and
22 4, we had defined a number of terms. Anisotropy was
23 not one of them. Is that something we need to think
24 about or is that not critical?

25 JUDGE WARDWELL: Have we defined isotropy?

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1 CHAIR BOLLWERK: So, it's just the
2 opposite of? I see. All right, all right. You just
3 defined it then. Thank you.

4 JUDGE WARDWELL: Did I define that
5 correctly, Staff?

6 MS. STRIZ: Anisotropy -- so, if something
7 is isotropic, at a point all the vectors, KX, KY, and
8 KZ, will be equal, and if it's homogeneous, they will
9 be equal in different locations. So, homogeneous and
10 isotropic, all the vectors are equal.

11 JUDGE WARDWELL: I think what Chair
12 Bollwerk was asking was -- we haven't defined
13 anisotropy. We defined --

14 MS. STRIZ: Anisotropy, at a point, is
15 where KX is different than KY --

16 JUDGE WARDWELL: Is where their --

17 MS. STRIZ: -- and different than KZ.

18 JUDGE WARDWELL: -- properties are
19 different directionally?

20 MS. STRIZ: In different directions.

21 CHAIR BOLLWERK: We didn't define
22 isotropy, either.

23 JUDGE WARDWELL: Okay. So, if we're going
24 to define isotropy, then the variation in parameters
25 in direction are zero, that they're all the same.

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1 There are similar properties in all directions. Now
2 did I define that correctly, Staff?

3 MS. STRIZ: Yes.

4 JUDGE WARDWELL: CBR?

5 MR. LEWIS: Yes.

6 JUDGE WARDWELL: Mr. Wireman, would you
7 agree that we've defined isotropy, so that I don't go
8 through the system --

9 MR. WIREMAN: Yes, I agree.

10 JUDGE WARDWELL: Anisotropy is the
11 opposite. Okay. Good. Thanks.

12 MS. STRIZ: I would like to correct Dr.
13 Kreamer. If it's vertical anisotropy, it's a harmonic
14 mean, not a geometric mean, that's used to create the
15 average conductivity through vertical layers.

16 JUDGE WARDWELL: And, Dr. Kreamer, would
17 you have any comment on that? Or is that a nice fine-
18 tuning of your statement?

19 DR. KREAMER: I'll accept that for now,
20 but there are several textbooks that treat layered
21 systems as geometric means. But I know where the
22 doctor is coming from, and I will accept that
23 modification at least now.

24 The point is the scale. If you take one
25 individual clay layer, it is homogeneous -- I mean,

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1 it's isotropic, because at that point it's isotropic.
2 But, if you take the whole system, the vertical and
3 horizontal conductivities are different. So, it's
4 anisotropic. There's anisotropy when you look at the
5 entire system.

6 JUDGE WARDWELL: But you do accept her
7 position as stated, as you mentioned earlier? And
8 while you might accept it, I don't, and I expect the
9 two of you to be out here Saturday morning with
10 dueling slide rules to resolve this thorny issue of
11 harmonic versus the -- what did you say it was, Dr.
12 Kreamer? Regardless --

13 DR. KREAMER: Geometric.

14 CHAIR BOLLWERK: Talk to the right crowd.
15 Most of these folks probably know what a slide rule
16 is.

17 (Laughter.)

18 JUDGE WARDWELL: Yes, that's right.

19 Okay. 2.6, Opinion 6, Discontinuity in
20 the Basal Chadron Thickness. We have covered that
21 before in depth.

22 2.7 was Opinion 7, Analyzing Selected Pump
23 Test Data. We've addressed that.

24 And that brings me to a close of the
25 questions I had on Concern 2.

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1 CHAIR BOLLWERK: All right. Judge Hirons,
2 you said you had a couple of questions?

3 JUDGE HIRONS: I have a couple of
4 questions for Mr. Wireman.

5 The license condition 10.1.6 requires that
6 an inward hydraulic gradient within the Basal Chadron
7 sandstone be maintained during operation. Do you
8 agree with that statement?

9 MR. WIREMAN: Could you read it again?
10 I'm sorry.

11 JUDGE HIRONS: The license condition
12 10.1.6 requires that Crow Butte maintain an inward
13 hydraulic gradient within the Basal Chadron sandstone
14 when operating.

15 MR. WIREMAN: On a mine unit basis, yes.

16 JUDGE HIRONS: I'm sorry, on a?

17 MR. WIREMAN: I said on a mine unit basis,
18 yes.

19 JUDGE HIRONS: Okay. Thank you.

20 I lost my place.

21 In Section A10 of its rebuttal testimony,
22 the staff states that, "Any heterogeneity in the
23 overlying aquifers is not germane to the confinement
24 of the Basal Chadron sandstone." Do you agree or
25 dispute that statement?

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1 MR. WIREMAN: I don't think that's a
2 black-and-white statement. I would say it depends.
3 And I apologize for that answer, but it's not black
4 and white.

5 JUDGE HIRONS: Okay. Thank you.

6 CHAIR BOLLWERK: Anything else?

7 JUDGE HIRONS: No, that's all I have.

8 CHAIR BOLLWERK: All right. I just had
9 one question, and mine's for Mr. Lancaster. I want to
10 get some clarification for a second.

11 You mentioned about, talked about the
12 requirement for additional pumping tests and
13 possibility of license conditions that could follow
14 from that. And you kind of indicated that the license
15 conditions would be imposed as appropriate. So, what
16 kind of appropriate license conditions might follow
17 from that?

18 MR. LANCASTER: Well, what I said was a
19 license amendment would be required, according --

20 CHAIR BOLLWERK: A license amendment. I'm
21 sorry, did I say --

22 MR. LANCASTER: Yes.

23 CHAIR BOLLWERK: That might result in a
24 license condition or --

25 MR. LANCASTER: No, it's a license

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1 amendment.

2 CHAIR BOLLWERK: You would actually amend
3 the license?

4 MR. LANCASTER: They would have to amend
5 the license if they want to operate in that mine unit.

6 CHAIR BOLLWERK: Let me circle back then.
7 They would come to you and ask for a license
8 amendment, which you would then grant? Is that the
9 right process?

10 MR. LANCASTER: We would --

11 CHAIR BOLLWERK: I'm a lawyer, so I'm
12 trying to --

13 MR. LANCASTER: It would be required per
14 the license, License Condition 9.4 specifically.

15 CHAIR BOLLWERK: So, what kind of
16 amendment would they ask you for, if they were -- I
17 recognize that there's a lot of things that could go
18 wrong, but what kind of things, in your experience,
19 have you seen that they might come and ask for in
20 terms of this license, based on the pumping tests that
21 were run?

22 MR. LANCASTER: Well, if conditions are
23 such that, you know, these wellfield packages that are
24 submitted later after the license, right, has been
25 issued -- and it has been issued -- these wellfield

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1 packages, if in our review we find an issue that is a
2 potential safety issue, that's where this would play
3 in. And in order to proceed, they would have to amend
4 the license to show that it's going to be a safe
5 operation.

6 CHAIR BOLLWERK: Okay. Well, let me ask
7 two questions. And if you need to talk with one of
8 your lawyers, you can certainly do that. But I take
9 it that we're talking about a license amendment and
10 there are hearing rights that apply to license
11 amendments. Would that be one of those instances?
12 Wouldn't that would be the case?

13 MR. LANCASTER: That would be the case,
14 from my understanding with talking with my lawyers.
15 They can certainly chime-in, if they would like.

16 MS. SIMON: Your Honor, this is Marcia
17 Simon.

18 Yes, license amendments in these cases are
19 subject to request for hearing.

20 CHAIR BOLLWERK: All right. Then, I guess
21 my second part of my question, then, is, for instance,
22 could the NRC put a condition on their ability to
23 operate within the new well area that they're trying
24 to open up that, basically, says, no, you can't do
25 that because there's a problem here?

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1 MR. LANCASTER: Well, if it is shown to be
2 that their new amended plan to operate is shown not to
3 be safe -- and there are various options for NRC to
4 make it so that they don't operate there. And one of
5 those is an order from NRC. You know, if it's not
6 going to be safe, they will not be able to operate in
7 that mine unit, at that mine unit.

8 CHAIR BOLLWERK: And then, there could be
9 other things besides that? That would be the
10 ultimate, I guess, license condition in terms of their
11 ability to operate, but there could be other things
12 that could be imposed as well?

13 MR. LANCASTER: Yes, sure. Sure. You
14 know, this would go into a very detailed technical
15 review, and additional license conditions could come
16 out of it specific to that mine unit or mine units,
17 depending on what we're talking about. I mean, we
18 could speculate here about various things that could
19 happen, but it would be a review like this, a very
20 detailed review.

21 CHAIR BOLLWERK: And in your experience,
22 or the experience of any of the NRC staff witnesses,
23 has there ever been an instance where you've actually
24 told them they cannot, any of the ISR operators, that
25 they cannot operate a particular mine unit, based on

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1 these tests?

2 MS. STRIZ: I'm not aware of any, but I
3 recently had a review where I did not license one
4 particular mine unit because it was not fully
5 characterized.

6 CHAIR BOLLWERK: All right. Thank you
7 very much.

8 At this point, let's go ahead and give you
9 all -- it's right at about 10 'til 5:00. Is 15
10 minutes enough time for your questions? All right.
11 So, let's say about, let's say 10 after 5:00 maybe, to
12 throw in an opportunity for a quick break.

13 So, we'll say 10 after 5:00, we would like
14 to have any proposed questions back. We'll, then,
15 take a quick look at those, and hopefully, come back
16 probably promptly with any additional questions we
17 need to ask. And then, I take it tomorrow we'll start
18 with Concern No. 1. Does that make sense? All right.

19 JUDGE WARDWELL: It makes sense to me.

20 CHAIR BOLLWERK: All right. Unless
21 anybody has another -- so, why don't we take a break
22 until 10 after 5:00, and we'll be back then.

23 JUDGE WARDWELL: The only thing I would
24 like to add, before I forget it, is that, starting
25 tomorrow -- starting tomorrow -- I'm going to start

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1 with Mr. Wireman as the second half of Concern 1,
2 rather than Dr. LaGarry, just because Dr. LaGarry
3 doesn't want to be anywhere but right here, and Mr.
4 Wireman will not be here on Thursday, is my
5 understanding. So, I want to make sure I get through
6 his before I come back to you for Concern 1 later in
7 the day.

8 MR. WIREMAN: Thank you for doing that,
9 Your Honor. I appreciate it.

10 CHAIR BOLLWERK: All right.

11 DR. KREAMER: May I say something, too?
12 This is Dave Kreamer.

13 CHAIR BOLLWERK: Yes, sir?

14 DR. KREAMER: I haven't even told my
15 lawyers this, but my class tomorrow starts at 11
16 o'clock Pacific time. If you need me to be present
17 video-wise, beginning through noon your time, I can be
18 there before I go to class. We've already arranged
19 that I'll be here for Thursday, and if you need me
20 Wednesday morning, I do not teach -- I don't have to
21 leave for class until 11 o'clock Pacific time.

22 CHAIR BOLLWERK: So, that would be 10
23 o'clock.

24 JUDGE WARDWELL: Noon. Noon here.

25 CHAIR BOLLWERK: Noon here? It's really

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1 up to you.

2 Go ahead.

3 JUDGE WARDWELL: The answer to that, I
4 think it would be advantageous for your party to be
5 here, if you can, to comment on what Mr. Wireman's
6 going to say. I don't have any questions for you
7 directly, but, yet, there may be times, based on just
8 normal operations, that you may have something to be
9 able to contribute, and that's what we're here for.

10 DR. KREAMER: Okay. Well, Joe, if there's
11 a different hookup for the technical part, please
12 email me and let me know. I'll plan on being ready to
13 go video-wise at eight o'clock.

14 And again, thank you for all the hooking
15 me up with the audio here. It's not been easy, I
16 know.

17 Thank you, Joe.

18 CHAIR BOLLWERK: All right. So, we'll
19 take our break. The proposed questions, if any, will
20 be presented to the Board at the end of it.

21 Everybody, the witnesses please stick
22 around because who knows what will come out of that.
23 So, we're not quite done yet.

24 Let's take a break.

25 (Whereupon, the above-entitled matter went

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1 off the record at 4:52 p.m. and resumed at 5:17 p.m.)

2 CHAIR BOLLWERK: Why don't we go back on
3 the record, please.

4 We're back after a brief break, and the
5 Board has looked at the questions that were submitted,
6 the proposed questions for the Board to ask that were
7 submitted by the NRC staff and by the Oglala Sioux
8 Tribe.

9 Before we proceed to those, however, I
10 think we have an update from Crow Butte Resources
11 about one of the questions that was sort of left in
12 the -- what's the best way? I don't know.

13 MR. SMITH: Yes, Your Honor. This is
14 Tyson Smith for Crow Butte.

15 And the question involved page 3-25 of
16 Crow Butte Exhibit CBR006. There's a sentence that
17 says, "As a conservative measure, the maximum
18 groundwater velocity was computed by using the maximum
19 observed values for hydraulic conductivity and
20 hydraulic gradient, identified from baseline sampling
21 and aquifer testing at MEA."

22 And Mr. Lewis here is going to explain the
23 basis for that calculation.

24 MR. LEWIS: Your Honor, the 61.7 feet per
25 day comes from the maximum transmissivity at monitor

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1 well No. 2 during the pump test of 2469 square feet
2 per day transmissivity, which was the maximum; average
3 thickness of 40 feet over the aquifer gives 61.7 feet
4 per day for the hydraulic conductivity.

5 The gradient, hydraulic gradient of .0048,
6 was from the figure 14 of that reference, the pre-
7 monitoring baseline water levels for the Basal Chadron
8 aquifer, .0048 for the gradient.

9 CHAIR BOLLWERK: All right. Anything
10 further?

11 (No audible response.)

12 All right. Thank you very much for your
13 providing that information.

14 Let's move to the questions. And since
15 Judge Wardwell has been the question person today,
16 we're going to go ahead and let him ask the ones that
17 the Board has decided to put forth.

18 Go ahead, Judge Wardwell.

19 JUDGE WARDWELL: Okay. I'll start off
20 with asking the staff, does demonstrate containment in
21 the Basal Chadron and Chamberlain Pass Formation mean
22 that contaminated fluids cannot migrate to unwanted
23 places?

24 MR. BACK: Yes, Your Honor.

25 JUDGE WARDWELL: Okay. Thank you.

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1 Would you like to elaborate a little more
2 or?

3 MR. BACK: Yes. It's constrained in the
4 vertical direction, and it will be confined in the
5 lateral condition, lateral due to the inward hydraulic
6 gradients.

7 JUDGE WARDWELL: Doesn't that mean, if you
8 answer yes to that question, doesn't that mean you
9 would never get an excursion anywhere?

10 MR. BACK: Keep in mind, the excursions
11 are still within the exempt aquifer. And so, when the
12 staff looks at this, excursions are part of the
13 program. They're not considered a spill or a release.
14 And so, yes, it's unwanted to have an excursion, but
15 it's not considered completely beyond the operations
16 of the mine, of the facility.

17 MR. LANCASTER: Yes, and, you know, they
18 are required to correct these excursions within the
19 excursion monitor --

20 JUDGE WARDWELL: And this is Mr.
21 Lancaster, is that correct?

22 MR. LANCASTER: This is, yes, Mr. -- yes.

23 JUDGE WARDWELL: Yes, I just wanted to
24 verify that.

25 MR. LANCASTER: Right. No, no, no, I

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1 understand.

2 JUDGE WARDWELL: You're not the first to
3 forget.

4 (Laughter.)

5 Go ahead.

6 MR. LANCASTER: Well, you know, under
7 license, they are required to monitor and detect the
8 excursions down in, laterally, down in the Basal
9 Chadron sandstone aquifer. And so, when they do
10 detect it, they're also required, then, to increase
11 the monitoring and go into corrective action by
12 adjusting their pumping rates and their injection
13 rates, and that has always been successful. So,
14 excursions detected have been corrected. There's a
15 history in all of our facilities, shall I say, that
16 these excursions are corrected, and that program, you
17 know, would make it so that excursions don't go
18 outside of the license boundary.

19 Also, as required by the license, they're
20 required to maintain an overall inward hydraulic
21 gradient at the mine units. So, laterally, we don't
22 expect excursions to be a problem. And vertically,
23 I'm sure we'll get into this more, but we have this
24 downward hydraulic radial and we've got confining
25 units that are shown to be very confining.

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1 JUDGE WARDWELL: Thank you.

2 MR. LANCASTER: Yes.

3 JUDGE WARDWELL: CBR, would you like to
4 comment on those that demonstrate a containment in
5 Basal Chadron, meaning that containment fluids cannot
6 migrate to unwanted places?

7 MR. LEWIS: Yes, I agree with that
8 interpretation.

9 JUDGE WARDWELL: Thank you.

10 And have you investigated likely flow
11 patterns and/or preferential pathways along which
12 contaminants may move, based on the results of the
13 aquifer pumping tests? This is for Crow Butte.

14 MR. LEWIS: I have not from the results of
15 the pumping test analyzed flow paths from the mine.
16 That wasn't part of the analysis of the pump test.

17 JUDGE WARDWELL: And then, what would
18 happen if, in fact, some of the mining fluids starting
19 running through a preferential pathway, resulting in
20 contaminants moving beyond what you anticipated them
21 to move beyond?

22 MR. LEWIS: Hypothetically, if there was
23 a loss of containment along a preferential pathway,
24 that would be detected by the monitor well network,
25 and as previously explained, it would increase the

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1 pumping rate, pull that excursion back into the
2 wellfield as part of their license condition.

3 JUDGE WARDWELL: And I'll repeat the
4 question for NRC. Does NRC staff evaluate
5 preferential pathways based on aquifer characteristics
6 demonstrated by the aquifer pumping test?

7 MR. BACK: David Back.

8 No, Your Honor.

9 JUDGE WARDWELL: Thank you.

10 For the Oglala Tribe, you mentioned the
11 use of mod flow as a numerical approach. Does mod
12 flow simulate groundwater flow and contaminant
13 transport through fractures?

14 MR. WIREMAN: Mod flow -- this is Mike
15 Wireman -- mod flow has the capability to link
16 groundwater flow with transport and fate of
17 contaminants. That can be done. So, it's a linkage,
18 two sort of separate models, but they're linked
19 together. And so, the outcome of those models
20 addresses both of those. So, the answer is yes. You
21 can put layers in mod flow that are clearly
22 characterized by preferential flow.

23 JUDGE WARDWELL: So, they would be
24 characterized as fractures?

25 MR. WIREMAN: You could -- yes, it could

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1 be fractures or other types of preferential flow.

2 JUDGE WARDWELL: How do the variability
3 and aquifer thickness and transmissivity values affect
4 CBR's or Crow Butte's ability to maintain inward
5 hydraulic gradients, as required by License Condition
6 10.1.6?

7 MR. WIREMAN: Inward flow can be
8 maintained within a mine unit scale. The issue we
9 have has to do with the entire MEA area. And as you
10 move progressively from one mine unit to the next, and
11 you're done maintaining that gradient in the previous
12 mine unit, within that mine unit that's done, there is
13 still groundwater that has concentrations of
14 contaminants greater than you want.

15 And the concern, then, is that those can
16 move, and they won't be caught by the inward gradient
17 of the active mine unit, or they could go beyond
18 excursion monitoring in a preferential flow path and
19 not be detected. And that movement is controlled by
20 both the properties of the contaminant and the
21 properties of the geologic material, including the
22 hydraulic properties, transmissivity, and other
23 storage coefficients, and all of those. So, yes,
24 there is a control there.

25 JUDGE WARDWELL: Thank you.

1 In Answer 18 of its rebuttal testimony
2 -- and that's Exhibit NRC014 -- the NRC staff
3 identified three plausible explanations for deviations
4 of the late time data. I think we talked about these
5 and the Theis curves. And these include the increased
6 transmissivity, which was Crow Butte's explanation;
7 release of waters from storage, and then, well bore
8 storage or near well bore effects. Do you dispute
9 that the explanations identified by the staff are
10 plausible?

11 MR. WIREMAN: No, I don't dispute that
12 they're plausible.

13 JUDGE WARDWELL: Thank you.

14 Do you agree that the pumping well in an
15 aquifer test can affect drawdown in close observation
16 wells?

17 MR. WIREMAN: Yes, with the caveat that
18 you have to define "close". Depending on the aquifer
19 you're testing, close may be 10 feet or it may be 100
20 feet. So, that's kind of a gray area. Clearly, bore
21 hole effects and pumping effects can have an effect on
22 the aquifer for some distance out, but that distance
23 is very site-specific.

24 JUDGE WARDWELL: Thank you.

25 Do you agree that such pumping well

1 effects on drawdown and close observation wells must
2 be accounted for in the selection of the portion of
3 the drawdown curve to be evaluated?

4 MR. WIREMAN: I agree that that needs to
5 be considered, but I would not agree that you would
6 ignore it.

7 JUDGE WARDWELL: Okay. Thank you.

8 CHAIR BOLLWERK: Is that it?

9 JUDGE WARDWELL: Yes.

10 CHAIR BOLLWERK: All right. And you're
11 satisfied? You obviously felt you could handle those
12 questions? So, we don't need to --

13 MR. WIREMAN: I'm fine with those, yes.

14 CHAIR BOLLWERK: All right. Very good.
15 Thank you.

16 JUDGE WARDWELL: Way too professionally,
17 though.

18 (Laughter.)

19 MR. WIREMAN: I'll check with Dave later.

20 (Laughter.)

21 CHAIR BOLLWERK: All right. Well, at this
22 point, I think we're basically done for today. We've
23 finished with Concern No. 2, subject to anything, any
24 second thoughts that any of the Board, including Judge
25 Wardwell, might have about anything that comes up

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1 later.

2 So, the schedule for tomorrow, we're going
3 to start again at 8:00. We want to make sure that we
4 have a full day with Mr. Wireman. And I understand
5 that Dr. Kreamer will be available from 8:00 until
6 noon. So, that's actually a plus because we didn't
7 expect to see him at all tomorrow. And, of course,
8 Dr. LaGarry will be here as well for the Intervenors,
9 as well as the staff and witnesses. And we do
10 appreciate --

11 JUDGE WARDWELL: They'd better be here.

12 (Laughter.)

13 CHAIR BOLLWERK: We do appreciate your
14 making yourselves available.

15 I know that, talking with Judge Wardwell,
16 we got a lot of good information today. We're
17 appreciative of your candor with the Board and the
18 answers that you were giving us. So, it was
19 definitely a useful exercise for us.

20 We actually made pretty good time. I
21 think Judge Wardwell focused himself to some degree,
22 given the incident this morning.

23 I would simply add, again, that I
24 understand very well the passion that those
25 individuals brought to the situation. Unfortunately,

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1 this is just not the right forum. We really could not
2 address their concerns here.

3 Having said that, I will mention for
4 anyone that's interested, that the Licensing Board in
5 the Powertech case, of which I'm a member, issued a
6 cultural resources decision today. It's LBP-18-05,
7 and you're certainly welcome to go out and look on the
8 NRC website. We have a ruling with respect to
9 cultural resources for the Dewey Burdock ISR facility
10 that was issued today. So, that is something that's
11 on the NRC's docket and mind as we go.

12 I would, again, like to thank Mr. Ballanco
13 -- I don't know if Mr. Frankel was involved -- any of
14 the members of the Tribal Council that might still be
15 here, for helping to resolve that situation in a
16 manner that I think was very appropriate; and also,
17 our folks from -- Mr. Lam from NRC security, and,
18 also, our deputies from the Sheriff's Office here in
19 Dawes County. We very much appreciated your service
20 to the Board in making sure the situation stayed at a
21 low level and was resolved I think favorably. So,
22 again, we appreciate it.

23 Again, we'll see you tomorrow at 8:00. We
24 very much appreciate your efforts today, and we're
25 looking forward to tomorrow. And I think Judge

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1 Wardwell probably has some more questions -- maybe.

2 All right. We stand adjourned.

3 (Whereupon, the above-entitled matter went
4 off the record at 5:37 p.m.)

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