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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

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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

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4 ATOMIC SAFETY AND LICENSING BOARD PANEL

5 + + + + +

6 HEARING

7 ----------x

8 In the Matter of: :

9 CROW BUTTE RESOURCES, INC. :Docket No. 40-8943-MLA-2

10 (Marsland Expansion Area): ASLBP No. 13-926-01-MLA-

11 : BD01

12 ----------x

13 Thursday, November 1, 2018

14

15 Crawford Community Center

16 1005 First Street

17 Crawford, Nebraska

18 BEFORE:

19 G. PAUL BOLLWERK, Chair

20 THOMAS J. HIRONS, Administrative Judge

21 RICHARD E. WARDELL, Administrative Judge

22

23

24

25

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1 P R O C E E D I N G S

2 (8:01 a.m.)

3 CHAIR BOLLWERK: On the record, please.
4 Good morning, everyone. We're here for the third and
5 I think final day of our evidentiary hearing in the
6 Crow Butte Marsland proceeding. We're here today to
7 deal with Concerns 3 and 4 which we'll talk about in
8 a couple of minutes.

9 Before we do that, I want to go over a
10 couple of administrative things before, although it
11 looks like in the normal protocol with these hearings,
12 we're down basically to the parties and the Board.
13 But I'll mention again, cell phones should be off or
14 on vibrate. Any cell phone conversations need to be
15 made outside this room, obviously. Again, we'll try
16 to limit ourselves to water in here, certainly no
17 food, at least while we're in session.

18 Witnesses, all the witnesses, including
19 Dr. Kreamer, who's coming in remotely, all remain
20 under oath, and giving sworn testimony.

21 Looks like everyone is sitting in the same
22 order. You do not need necessarily to give your name
23 before you speak, although you're welcome to do so if
24 that makes you feel better, but our court reporter has
25 got everybody down in terms of their positions.

1 And, Dr. Kreamer, I take it as before, I
2 hate to lock you in your office for long periods of
3 time, but that's kind of -- we need to make sure that
4 at least there's nobody in there with you. So any
5 problems with that, sir?
6 DR. KREAMER: No. I'm alone, and the door
7 is locked.
8 CHAIR BOLLWERK: All right. We're glad
9 you could join us this morning.
10 All right, and I'll mention one more time
11 although I don't think there's anybody here that's
12 going to be filing one. Limited appearance
13 statements, if you want to put one in writing, they're
14 back in the back. There's a place to fill them out
15 and leave them with us, and we're glad to have them.
16 I hope everybody had a pleasant evening
17 last night. We saw some trick or treaters downtown
18 where we were, but some Smurfs came in with their
19 adult handlers and got some candy at one of the
20 restaurants. So it seemed to be a fairly nice night
21 here. Better than Washington, I understand, in terms
22 of trick or treat.
23 Okay, let me see first if any of the
24 counsel have anything we need to discuss this morning
25 before we start? Staff, Applicant, Intervenors? No.

1 MR. BALLANCO: No, Your Honor.

2 CHAIR BOLLWERK: All right. I think

3 there's one thing that we need to bring to your

4 attention that came to our attention, and let me ask

5 first of all do you all have anything that you're

6 aware of that you need to give us in terms of an

7 update on any issues that we've left kind of hanging

8 out there? Everybody good? I think that's our

9 impression, but if we're --

10 DR. KREAMER: I was asked --

11 CHAIR BOLLWERK: Except for one thing --

12 DR. KREAMER: -- Your Honor.

13 CHAIR BOLLWERK: I understand, Dr.

14 Kreamer, you've got one thing. Anybody here in the

15 room, let me put it that way. Okay.

16 All right, so Dr. Kreamer contacted us

17 early this morning, I guess it was, and he was asked

18 by Judge Wardwell with respect to Concern No. 2 to

19 provide some information, and he's prepared to do

20 that. But he has prepared a PowerPoint presentation.

21 Do you all know about this?

22 MR. BALLANCO: I do now, Your Honor, a few

23 minutes ago.

24 CHAIR BOLLWERK: So that PowerPoint

25 presentation we would need to treat as a piece of

1 evidentiary material. And with that goes two things.
2 One is that everybody has to be provided a copy
3 beforehand, either electronic or paper.
4 So I'll turn to counsel and see if that's
5 something that can be done.
6 MR. BALLANCO: I believe it can, Your
7 Honor. It's been emailed to me, so I don't know if
8 anybody else has access to the internet here. We can
9 email it around, or at the break I can print it, and
10 by break I mean lunch, Your Honor.
11 CHAIR BOLLWERK: I think from the Board's
12 perspective, if we get it by email, I'm assuming it's
13 going to be a PowerPoint file. We can certainly open
14 it and take a look at it. Does the staff have that
15 capability to send around?
16 MS. SIMON: Yes, I believe I can.
17 CHAIR BOLLWERK: Is that a problem for the
18 Applicant?
19 MR. SMITH: We should be able to access it
20 via email.
21 CHAIR BOLLWERK: Let's go ahead then, and
22 I don't' know if -- does Dr. Kreamer need to send it
23 to you first, I take it, or do you already have it?
24 MR. BALLANCO: He told me on the phone
25 that he sent it to me, Your Honor. I haven't gotten

1 to it yet, but I believe it's there.

2 CHAIR BOLLWERK: So, Dr. Kreamer, if you

3 haven't sent that PowerPoint presentation to Mr.

4 Ballanco, you would need to do that, and he's going to

5 distribute it here. What needs to happen, just so you

6 know, is everybody, the Board and all the parties, are

7 going to take a look at it. It's a piece of

8 evidentiary material. If anybody has an objection to

9 it, we would listen to that.

10 Then in terms of the processing of that,

11 assuming, at a minimum we will identify it for the

12 record, if anyone has an objection, obviously, we will

13 take that into account. We'll go ahead and proceed if

14 we decide that we're going to hear it based on the

15 identified exhibit. I will not admit it into evidence

16 until that's been filed through the e-filing system

17 with the NRC. So, again, we're glad to take some

18 testimony on it, but that testimony is essentially not

19 going to become official until that document is filed

20 with the NRC through the e-filing system. So just be

21 aware of that. If you don't file it, the testimony is

22 going to become useless. So just remember that.

23 MR. BALLANCO: I understand that, Your

24 Honor.

25 CHAIR BOLLWERK: Okay, so that's the

1 protocol. So we're really, Mr. Ballanco, kind of
2 keying off of what you tell us in terms of timing.
3 When it's come around, although I may see the email,
4 in terms of when we actually talk with Dr. Kreamer
5 about that particular document. Okay. Anybody have
6 any questions, concerns?
7 And again, Dr. Kreamer, this is the
8 evidentiary protocol we have to follow, so the big
9 thing initially is for you to send it to Mr. Ballanco,
10 so we can start this off.
11 DR. KREAMER: I understand, Your Honor.
12 It has already been sent both in PDF form and also in
13 PowerPoint form. I also have checked with Joseph, and
14 I can share my screen, so I can show the PowerPoints
15 directly from here, if it is acceptable as evidentiary
16 evidence. And I understand the procedure entirely,
17 and I appreciate you clarifying that.
18 CHAIR BOLLWERK: Thank you very much. All
19 right, hold on one second. Judge Wardwell has a
20 question.
21 JUDGE WARDWELL: Dr. Kreamer, could you
22 inform us of what the topic of this is in regards to
23 supposedly a request of mine that you submit this?
24 DR. KREAMER: Certainly, Your Honor. Your
25 Honor wanted more detail on early data in draw-down

1 tests. And where the distinction was when you throw
2 out data and you don't throw out data, and so the
3 slides are directly pertinent to that and the
4 interpretation of the pumping tests and whether
5 there's leakage or not.
6 JUDGE WARDWELL: Thank you.
7 CHAIR BOLLWERK: All right, so once
8 everyone has access to it, we'll proceed from there.
9 That would be the next step is to get access.
10 All right, any other questions anybody has
11 about evidentiary material at this point or anything
12 else?
13 At some point, I do have something about
14 an exhibit we'll get to in a minute. I think probably
15 Judge Wardwell is going to talk about it in a couple
16 of exhibits actually in the context of what he's
17 doing. OST-20, we --
18 JUDGE WARDWELL: Okay, yeah, it will be a
19 while for that.
20 CHAIR BOLLWERK: It will be a while, but
21 we'll deal with it then. Okay.
22 All right, at this point, do any of the
23 board members have anything they want to say before we
24 start?
25 All right, then as usual, Judge Wardwell

has some questions.

JUDGE WARDWELL: And this, too, shall pass. We are on Concern 3.

CHAIR BOLLWERK: Let me read it into the record, hold on, sorry, I messed up.

JUDGE WARDWELL: I was going to read it into the record, but you can.

CHAIR BOLLWERK: Concern 3 challenges the failure to develop -- this is Contention OST 2 -- Concern 3 challenges the failure to develop in accord with NUREG-1569 Section 2.7 an acceptable conceptual model of site hydrology that is adequately supported by site characterization data so as to demonstrate with scientific confidence that the area hydrogeology including horizontal and vertical hydraulic conductivity will result in the confinement of extraction fluids and expected operational and restoration performance.

Off to the races.

JUDGE WARDWELL: And I know these concerns were generated by the Board, and this one does seem to be a bit of one where we're coalescing a lot of selected testimony from Concerns 1 and 2 already. But we have some other specific things that are covered within here, but I'd like to start with the NRC and

1 just ask them whether or not the regulations or the
2 guidance documents define what an acceptable
3 conceptual model is or even what a conceptual model
4 consists of, or is it mostly just a phrase of art.
5 MR. BLACK: Your Honor, the guidance
6 provides a lot of components of the conceptual model
7 to where if you were to place them all together in
8 context, that would result in a conceptual model. So
9 it really presents more pieces which is consistent
10 with other hydrogeologic studies where you take all of
11 the components and put them into a conceptual model.
12 JUDGE WARDWELL: That may be consistent
13 with kind of how I've broken this down then, and see
14 if this makes sense. But as I looked at this, there's
15 various things that go into a model, and it seems like
16 we're dealing with three different topic areas, if you
17 will, that either alone stand for -- represent that
18 topic area or even when you bring them all together,
19 gives you the full picture.
20 And I kind of look at it as one being the
21 geologic stratification model, if you would, the next
22 being a hydrogeologic model of the system, and then
23 any numerical, three, any numerical models of
24 groundwater movement or fate and transport or anything
25 like that. And so that each of those kind of stand

alone, but yet, when you look at all of them, even though it's not in one package, that information to me would all fit into what might be a conceptual model. Is that a fair assessment?

MR. BLACK: That's a fair assessment, except typically the numerical model that you described actually takes the components of the conceptual model and integrates them into a mathematical approach.

JUDGE WARDWELL: And I think I've included that one because we haven't talked much about the numerical or analytical calculations or modeling or whatever else you want to call it. It would be done as part of that, but this is a good time to start getting into more of the meat of that and the discussion effort. And it also helps, I think, because certainly with the public, when you're dealing with that, those calculations, they hear it called a model, and so, yes, I understand your point on that. But I think it does still fit in pretty good.

Dr. Striz, did you have something you wanted to contribute with that, too?

MS. STRIZ: Yes, yes, in our initial --

JUDGE WARDWELL: Get the mic.

MS. STRIZ: In our initial --

1 JUDGE WARDWELL: It really helps if you
2 pull the mic towards you rather than you leaning over
3 all the time, and then you won't have to worry about
4 leaning over all the time.
5 MS. STRIZ: I have so many papers.
6 JUDGE WARDWELL: And that still doesn't
7 help because like me, if you're like me I turn my head
8 and you lose it anyhow.
9 MS. STRIZ: In our initial testimony we
10 address very clearly that NUREG-1569 does describe all
11 the components that are necessary for the site
12 conceptual model and that we also demonstrate where
13 those components were in the application and how they
14 were sufficient to produce an acceptable conceptual
15 site model of both the surface water and the
16 groundwater systems.
17 JUDGE WARDWELL: Thank you. That helps.
18 Any comments Crow Butte would want to add to that?
19 MR. PAVLICK: No, Your Honor.
20 JUDGE WARDWELL: And, Dr. LaGarry?
21 DR. LaGARRY: No, Your Honor.
22 JUDGE WARDWELL: And, Dr. Kreamer,
23 anything you want to add to that?
24 DR. KREAMER: I have a comment if that's
25 all right. Can you hear me, is the audio --

1 CHAIR BOLLWERK: Yes, we can.

2 DR. KREAMER: Okay. I look at it slightly
3 differently. I think that there's two -- you have to
4 look at the purposes of the conceptual model. The
5 conceptual model for mine operations for pumping water
6 in lixiviant mobilizing the ore and extracting it, I
7 think that that is a conceptual model where simple
8 systems and average transmissivities and basic
9 rudimentary knowledge of how water flows is
10 sufficient. You don't need as much detail for
11 stratigraphy. And so I think the conceptual model
12 that's been developed and was developed at Crow Butte
13 for mining operations can depend on simplified models.

14 When you talk about contaminant movement,
15 risk to the public, there's a different whole realm of
16 conceptual models. I've just finished a text on
17 contaminant hydrogeology, and contaminant
18 hydrogeologists know that a simple fracture, a simple
19 preferential pathway can devastate a community, can
20 wipe out an ecosystem in a lake or surface water
21 systems, and so the conceptual model that's needed for
22 contaminant hydrology is starkly different from one
23 for just basic hydrology. And I think that that's
24 where the basic paradigm kind of shifts in this
25 discussion.

1 I think that when you have contaminant
2 hydrology there are other tests, there are other
3 monitoring techniques to ensure the public safety and
4 to ensure the ecological -- non-diminishment of
5 ecological resources.
6 And so I agree with what you said, but as
7 demonstrated at Crow Butte when it came to closure,
8 the conceptual model that was based on simple
9 equations was not sufficient. They had to go a
10 numerical model. They had to do many, many iterations
11 of that numerical model. They couldn't get down to
12 acceptable concentrations even though their monitoring
13 well system sort of was biased toward lower
14 concentrations. And so numerical models and
15 contaminant hydrology are much more common.
16 So we're really dealing with two different
17 -- it may be a little bit of a paradigm shift, but I
18 wanted to say that from the outset.
19 JUDGE WARDWELL: Thank you. The geologic
20 model we've already covered, I think, in sufficient
21 detail in Section 1.1.1, and we really don't need to
22 repeat it here.
23 I see you shaking your head, Dr. LaGarry.
24 You tend to agree?
25 DR. LaGARRY: I agree with you, Your

1 Honor.

2 JUDGE WARDWELL: Thank you, sir. In the

3 OST Exhibit 015 which was the rebuttal at 1, number 1,

4 states that neither the Crow Butte technical report

5 nor the NRC staff's environmental assessment contains

6 sufficient data and information to develop an adequate

7 conceptual model of the site hydrology. This is

8 especially the case regarding groundwater flow in the

9 Basal Chadron Chamberlain Pass Formation aquifer. The

10 TR contains no database information on the areas where

11 recharge occurs, and the sources of recharge are the

12 primary pathways which deliver recharge to the deep

13 confined aquifer.

14 And we have already covered discharge and

15 recharge in Section 1.2.1.1 and don't need to repeat

16 them here. But I will ask Dr. Kreamer whether or not

17 you have any evidence demonstrating that more detailed

18 quantification of the recharge/discharge zones would

19 have the potential -- whether you have any more

20 evidence demonstrating the more detailed

21 quantification of recharge/discharge zones that would

22 have the potential to change -- to create a change in

23 the scientific conclusions that are already in the

24 Applicant's TR or in the staff's environmental

25 assessment and safety evaluation report?

1 DR. KREAMER: Well, some simple tests
2 would have been able to clarify these issues. I do
3 not have -- information. Contaminant hydrology,
4 simple groundwater dating could give us average
5 residence times.
6 JUDGE WARDWELL: Dr. Kreamer, you're
7 repeating yourself. We're aware of that. You've
8 already testified to that. My question to you is do
9 you have any evidence that would help us in your
10 demonstration that more detailed quantification of the
11 recharge and discharge zones have the potential to
12 change those scientific conclusions?
13 DR. KREAMER: I'm not sure if stable
14 isotope analysis which is about $100 a sample was
15 done, but that would tell us the elevation of recharge
16 which would be --
17 JUDGE WARDWELL: Thank you. OST in
18 rebuttal at 1 number 1 says CBR testimony states that
19 the groundwater flow in the Basal Chadron Chamberlain
20 Pass aquifers towards the northwest, and I think we've
21 covered pretty well the groundwater flow in the Basal
22 Chadron aquifer under Section 1.2.1.2 and don't have
23 to repeat it, but, again, I'll like to offer the
24 opportunity to Dr. Kreamer if you do have any
25 additional evidence demonstrating that the more

1 detailed quantification of groundwater flow in the
2 Basal Chadron Formation, then please provide it and
3 show how it might have a potential change in the
4 scientific conclusions in the Applicant's technical
5 report, staff's environmental assessment, and in the
6 SER.
7 DR. KREAMER: The average data that's
8 given is sufficient -- is not sufficient --
9 contaminant -- consideration where you might have --
10 flow.
11 JUDGE WARDWELL: Okay. Thank you. Again,
12 the OST Exhibit 015 rebuttal at 2 number 1 says that
13 Section 3.3.2.1 of the environmental assessment, and
14 that's NRC's Exhibit 006 at 67, states that the
15 groundwater flow in the Basal Chadron aquifer is not
16 affected by the Pine Ridge escarpment even though the
17 escarpment functions as a groundwater divide in the
18 Arikaree and Brule aquifers, and OST is stating that
19 there's no discussion to support this statement. And,
20 again, I think we've covered this in regards to the
21 hydrogeologic effects of the Pine Ridge escarpment in
22 Sections 1.2.1.2 of -- and, again, those are my
23 section numbers that I referenced as we went through
24 this hearing, and I don't need to repeat them here.
25 But, again, I'll offer the opportunity to

1 Dr. Kreamer, if you do have any evidence demonstrating
2 that the hydrologic effects of the Pine Ridge
3 escarpments would have a potential change in the
4 scientific conclusions that were provided by the
5 Applicant and the staff.
6 DR. KREAMER: Your Honor, my audio
7 completely cut out halfway through the morning. I was
8 -- to all those discussions. Quick answer to that is
9 no, I do not. I'm not sure what was said in those
10 discussions from about mid-morning. Again, I
11 apologize if I repeated any information -- covered --
12 the audio was --
13 JUDGE WARDWELL: But in the areas of the
14 Pine Ridge escarpments, you do not have any evidence,
15 additional evidence to submit at this time that you
16 can think of?
17 DR. KREAMER: Additional, no. I don't
18 know what was presented before. I don't have
19 substantive information.
20 JUDGE WARDWELL: Thank you. OST's
21 rebuttal at 2 number 2 states that CBR assumes that
22 the NRC staff accepts that the hydrology of the Basal
23 Chadron aquifer downgrading of the MEA has been
24 adequately characterized. CBR has not installed any
25 monitoring wells upgrading or downgrading of the

license area and that these wells are necessary to provide the data to fully evaluate the impacts of the Basal Chadron aquifer.

And, again, we have already covered upgrading and downgrading monitoring of wells in Sections 1.2.1.3. And I'll, again, offer to Dr. Kreamer the opportunity to provide any additional evidence that he might have in regards to demonstrating how additional upgrading and downgrading of wells might have the potential to change the scientific conclusions in the Applicant's and staff's documents.

DR. KREAMER: I do not -- the -- for -- hydrology, I still hold it -- they're not -- for mining operations, I think characterization -- be okay.

JUDGE WARDWELL: Did we get all of his? You need to repeat that. You were in and out. You were cut out. Everything flowed, except there was big chunks missing out of -- every other word was kind of missing, Dr. Kreamer, I'm sorry to say.

DR. KREAMER: That might be an advantage.

JUDGE WARDWELL: I wasn't going to say that, but the thought crossed my mind.

DR. KREAMER: I'll speak more slowly.

1 Essentially -- is aware that adequacy for contaminant
2 hydrology -- I have no extra information as far as
3 adequacy for contaminant hydrology as the wells are --
4 so I have nothing -- I have no additional information.
5 JUDGE WARDWELL: Okay. Thank you. Crow
6 Butte 006 technical report Section 2.7.2.3 at 2-86
7 states that regional water level information for the
8 basal sandstone of the Chadron formation is currently
9 only available in the vicinity of the current
10 production facility and that the North Trend expansion
11 -- and the North Trend expansion area but suggest the
12 discharge point at an elevation of at least 3700 feet
13 AMSL or below located east of Crawford.
14 I wanted to ask this question again. I
15 know I did earlier, but I want to ask it again to make
16 sure that that is still correct because I know we
17 corrected where the White River was in regards to some
18 -- in regards to the MEA. I just want to make sure
19 and confirm that you do mean to say that this
20 discharge point is located east of Crawford.
21 MR. STRIVER: That is correct, Your Honor.
22 JUDGE WARDWELL: Thank you. I was just
23 tying up a loose end, and I wanted to make sure the
24 discussions we had on -- that those directions didn't
25 affect this also.

1 With that said, I'm now going to kind of
2 summarize the numerical modeling at least that I
3 discovered in reviewing the testimony that was
4 submitted, the pre-filed testimony and the rebuttal.
5 And they all serve the purposes of supporting the
6 various issues that we've been dealing with with
7 Contention 2.
8 I want to do this for a couple of reasons.
9 One, I want to make sure that I have captured all of
10 the modeling efforts that have been done and have not
11 missed any of them buried in all of the information
12 we've gotten. But also I want to clarify, at least in
13 my mind, what the source of some of the input
14 parameters were. And so we may have an issue where
15 you'll have to retreat into a side room and do that
16 for each of the modeling efforts and come back to me.
17 I'm well aware that it may even take more than that,
18 but I do want to have a little bit more clarification
19 in regards to the justification for the selection of
20 the input parameters that at least I did not see in
21 the written reports that were submitted for the
22 various modeling efforts.
23 And I'm using modeling in a very --
24 numerical modeling in a more generic sense than
25 strictly a digital model. I would look at both

1 analytical models and digital discrete modeling and
2 even just calculations. I'm using it in a broader
3 term. We're using numbers to represent what we think
4 is a physical activity that's taking place in the
5 environment. And so any time that's happened, that's
6 what I'm including in this for myself just to make
7 sure the record shows what's involved with it.
8 So I really encountered six discrete
9 different types of efforts made to represent nature
10 with numbers is probably the best word to say with it.
11 The first one we've touched upon already. It is --
12 I'm calling it the first modeling effort which is
13 entitled the MEA Agricultural Well Impact Analysis.
14 It's CBR 010 exhibit. It's Appendix AA of that
15 exhibit. As I understand it, it's an Aqui-Ver report
16 dated 12/10/13.
17 The second one is a modeling -- I call
18 modeling 2, which is a recalibration and revised
19 validation of MEA agricultural well impact analysis.
20 It's in Exhibit CBR 011, Appendix A-2, dated 5/11/16.
21 The third is merely a calculation of
22 groundwater velocity. It was in Crow Butte's
23 technical report, Exhibit 006 Section 3.1.7 at 3-25.
24 The fourth was analysis of hydraulic
25 containment in Crow Butte Exhibit 012 technical

1 report, Appendix AA-3, and that is an AquiferTek
2 report, dated 12/17/14.
3 The fifth is an analysis of extended
4 facility shutdown on containment. It was presented in
5 Crow Butte's technical report, Exhibit CBR 006 at
6 Section 3.1.7 at 3-26 to 3-27.
7 And then the last that I want to discuss
8 is the sixth one which is drawdown impact analysis,
9 assessment analysis. It's in CBR Exhibit 017. It's
10 in Appendix GG, and that is an AquiferTek report,
11 dated 5/11/16.
12 Do you need me to repeat any of those in
13 regards to the references or have you pretty much --
14 I figured Mr. Smith would have gotten them all, and he
15 nods to the front table that he has.
16 MR. PAVLICK: We've got them. Thank you.
17 JUDGE WARDWELL: He's right on top of it.
18 CBR, have I left out any that you think we
19 ought to raise or talk about?
20 MR. LEWIS: No, Your Honor.
21 JUDGE WARDWELL: Sorry?
22 MR. LEWIS: No, Your Honor.
23 JUDGE WARDWELL: Thank you. And while
24 you're on the phone, Mr. Lewis, which of these were --
25 which of these were you responsible for?

1 MR. LEWIS: Your Honor, I was --

2 JUDGE WARDWELL: And state which company
3 name did they fall under because they seem to be lots
4 of different names and sometimes there are some that
5 didn't have any name and I want to know who was the
6 author of these. So if you don't -- if you weren't,
7 if you know who the author of -- or the one that's
8 performing this, that would be a nice response to my
9 question also.

10 MR. LEWIS: Your Honor, for the first
11 report you reference which was CBR 010, the
12 agricultural well analysis was an Aqui-Ver report. I
13 worked for Aqui-Ver at that time, and I was
14 responsible for that report.

15 The second reference which was the impact
16 analysis of CBR 011, that was an AquiferTek report
17 2016. I was also responsible for that report.

18 The third reference you made I believe was
19 groundwater velocity calculations, CBR 006 in the TR.
20 And that calculation would have been a Crow Butte. I
21 may have had some input to that calculation, but I'd
22 have to check. But I believe that was a Crow Butte
23 production.

24 CBR 012, the fourth, was analysis of
25 containment. 012 was an AquiferTek report in 2014,

1 and that was my doing.

2 The fifth reference was extended shutdown

3 analysis of CBR 006. I did perform that analysis.

4 The company --

5 JUDGE WARDWELL: The reference I have for

6 that is just those pages within the -- it was a

7 description of what took place as provided in the

8 technical report 006, but it was just a narrative of

9 it.

10 MR. LEWIS: Yes.

11 JUDGE WARDWELL: Without any reference to

12 a report or who performed that analysis. You might

13 want to take a quick look at it to see to what degree

14 your fingerprints are on that.

15 MR. LEWIS: Yes, Your Honor. I'll have to

16 check that.

17 JUDGE WARDWELL: Okay.

18 MR. LEWIS: The sixth item was the

19 drawdown impact assessment, CBR 017. That's my

20 report, and it's dated 2016 for AquiferTek.

21 JUDGE WARDWELL: And is there anything

22 significant with this -- the Aqui-Ver versus the

23 AquiferTek?

24 MR. LEWIS: No, sir. Just different

25 companies.

1 JUDGE WARDWELL: Within these modeling
2 efforts, I did see the phrase in regards to software
3 used for them referencing AquiferWin32 software which
4 I believe also uses at least as a sub algorithm
5 WinFlow software, and I just want to verify that
6 that's a correct representation of it and what else
7 might be included in the AquiferWin32 software.
8 MR. LEWIS: Your Honor, my recollection,
9 AquiferWin32 software is a modular software that
10 allows you to do the pump test analysis. It also uses
11 analytical elements, basically forms of analytical
12 models to create aerial flow models, and WinFlow is
13 the module that contains the analytical element
14 models.
15 JUDGE WARDWELL: Which of these modeling
16 efforts incorporated WinFlow, and then which of these
17 incorporated other modules out of AquiferWin in your
18 best estimation?
19 MR. LEWIS: Your Honor, WinFlow and the
20 analytical element analysis was performed for your
21 first reference which was the agricultural well
22 analysis. It was utilized for the CBR 011
23 agricultural well impact as well. It was used for
24 analysis of containment in CBR 012. It was used for
25 the drawdown impact assessment in CBR 017, and I

1 indicated I would check on CBR 006, the fifth element
2 of the shutdown analysis.
3 JUDGE WARDWELL: Okay. Could you explain
4 a little bit more what WinFlow is? Is it a direct
5 solution of a Darcian flow? Is it a finite
6 difference, finite element, mass balance, or fate and
7 transport, or what is the model as much as you can
8 describe it in a couple of minutes?
9 MR. LEWIS: Your Honor, there's a variety
10 of solutions that can be used, analytical solutions to
11 groundwater flow problems that are integrated in an
12 analytical element basis which basically allows
13 instead of a point calculation, it's making
14 calculations on a grid so that you can see the results
15 in plan view maps and contour maps, but it's basically
16 the selection of analytical models. You can choose
17 the Theis solution for confined aquifer. You can
18 choose the leaky aquifer solution. You can use
19 unconfined aquifer, a variety of analytical solutions
20 that are then computed on a grid.
21 JUDGE WARDWELL: Thank you. And those
22 solutions are essentially then solutions of the --
23 it's more than just a solution of curve fitting to
24 data. It's used also in regards to flow directions
25 and velocities or is it strictly solutions of type

1 curves?

2 MR. LEWIS: You can fit a type curve to

3 any particular time that the grid is calculated on.

4 So if you went to a point using a specific set of

5 transmissivity values, et cetera, you would be able to

6 fit that to the type curve for that solution.

7 JUDGE WARDWELL: Thank you. Let's start

8 with modeling, the first modeling one, the MEA

9 agricultural well impact analysis. What was that

10 performed for and what were -- as I have documented at

11 least the hydrologic parameters that you use for

12 input, in my notes, you used a hydraulic conductivity

13 of 8.2 feet per day, an aquifer thickness of 202 feet,

14 transmissivity which was -- is just a multiplication

15 of those two values, I believe, regional hydraulic

16 conductivity of 0.004 to the southeast, a specific

17 yield of 0.1, aquifer porosity of 0.15, and a pumping

18 rate of 373 gallons per minutes for 5 months

19 continuously and then off for 7 months.

20 And I understand it, and I'll ask you, are

21 these the parameters -- let me back up a bit. Could

22 you explain what this modeling was conducted for?

23 What was the purpose of it?

24 MR. LEWIS: Your Honor, if I recollect,

25 the purpose of this model was to assess the impact of

1 the agricultural well that is installed just outside
2 of the MEA boundary to the east, I believe, and
3 whether or not that well could potentially collect and
4 impact from any spills or things of that nature within
5 the boundary cause a problem.
6 JUDGE WARDWELL: And this well is set in
7 what formation?
8 MR. LEWIS: It's the shallow aquifer which
9 is the Arikaree Brule Formation.
10 JUDGE WARDWELL: And so supposedly these
11 hydrologic parameters are for the Arikaree Brule
12 Formation?
13 MR. LEWIS: That's correct.
14 JUDGE WARDWELL: And do you know -- I'd
15 want a source justification for your selection of
16 those at some point. If you're prepared to say it
17 now, that's fine. If you want to wait and do it
18 later, that's fine also.
19 MR. LEWIS: I think I can take a crack at
20 that, Your Honor.
21 JUDGE WARDWELL: Take a crack at it, okay.
22 MR. LEWIS: The hydraulic conductivity 8.2
23 feet per day was from the grain size analysis that is
24 included in Attachment B of this report. It's the
25 higher end of those calculations so it represents the

1 upper end as a conservative estimate. And 1.6 is on
2 the low end of that hydraulic conductivity of the
3 grain size analysis.
4 There was also a calculation of --
5 JUDGE WARDWELL: Let me interrupt then
6 just so I don't forget it. So you conducted it at
7 both those levels, at both high and low ends of that?
8 MR. LEWIS: Yes, Your Honor.
9 JUDGE WARDWELL: Okay. Thank you.
10 MR. LEWIS: The aquifer thickness was
11 taken from the boring logs and its transmissivity is
12 calculated directly from the multiplication of those
13 two conductivity and thickness.
14 The hydraulic gradient of .004, we
15 actually referenced yesterday. It was from the map of
16 the shallow potentiometric surface of the Arikaree
17 Brule from the pre-aquifer test monitoring.
18 Specific yield and aquifer porosity were
19 estimates from the literature for material of this
20 nature and were selected on the lower end of the range
21 for literature values for a material of this nature in
22 order to provide a higher velocity conservative
23 estimate of movement of water.
24 And the pumping rate I was given from
25 Cameco. I believe that was from the records of pumping

of the agricultural well from the State Engineer's Office, I believe, in which the estimate of 373 gallons a minute for 5 months and off for 7 months, Mr. Beins, I believe, actually had contacted the owner of that well to determine how long was it on and how long was it off and whether the pumping rates were in that range. And it was confirmed that that was a reasonable estimate for the pumping rates.

JUDGE WARDWELL: Thank you. I guess this is kind of left over from yesterday and probably if I had -- or the day before, it would really be the day before, the technical report, I believe, referenced the 0.011 for the Brule. Do you remember talking about that one of these days that we've been here? I think it was in the Exhibit 006 at page 2-86.

I remember we talked about it, and then we got off on looking at the diagrams, but I think that's referenced before the Brule and was just curious of why the difference in the two gradients and how you happened to select the one you did?

MR. LEWIS: Your Honor, Figure C-1 in my report that we're referencing, Attachment C, is a potentiometric surface map that I used in this particular calculation. And the 004 comes from the middle of the site closer to the agricultural well.

1 I deemed it more representative for that reason,
2 .0037, rounded up to .004.
3 JUDGE WARDWELL: But do you have any idea
4 where the 011 came from in the technical report?
5 MR. LEWIS: Your Honor, it's from the
6 northern portion of the site where you can see that
7 the gradient is slightly steeper up in that
8 neighborhood.
9 JUDGE WARDWELL: Thank you. In the
10 technical report at 2-1 118 says that the pumping rate
11 was 401 gallons per minute for 3.3 months (100 days)
12 while your report used the 373 gallons per minute for
13 5 months. And I was wondering which is actually
14 correct in regards to what was physically used in your
15 modeling and why -- which -- where did the 401 come
16 from, and you already testified to where the 373 came
17 from.
18 MR. LEWIS: Your Honor, I can't vouch for
19 the value in the technical report. I can tell you
20 that my -- the pumping rate that I used in this
21 modeling effort, I had discussions on the telephone
22 with Mr. Beins, and the 373 came out of those
23 communications.
24 JUDGE WARDWELL: Does anyone from Crow
25 Butte know where that number comes from in regards to

1 the TR? And you don't have to answer now, but if you
2 want to get back to me on that.
3 MR. STRIVER: Your Honor, we'd like to
4 look at that. Thank you.
5 JUDGE WARDWELL: Let's move on to --
6 MR. LEWIS: Your Honor, that's Exhibit 11.
7 CHAIR BOLLWERK: CBR 011?
8 MR. LEWIS: Yes, sir.
9 JUDGE WARDWELL: Okay. What is?
10 MR. LEWIS: Exhibit 11 is a validation
11 report of the agricultural impact analysis, so it's a
12 similar analysis.
13 JUDGE WARDWELL: But I haven't gotten to
14 that, have I?
15 MR. LEWIS: No, sir. But that's, I think,
16 some of the clarification to that question is in that
17 report.
18 (Simultaneous speaking.)
19 JUDGE WARDWELL: There's some of that --
20 the clarification of the 401 versus the 373 is in the
21 report, the next report that we'll talk about is what
22 you're saying. Is that correct?
23 MR. LEWIS: Yes, sir.
24 JUDGE WARDWELL: Okay, great. Thanks.
25 Dr. Kreamer, would you like to have any

1 comments in regards to that first report? Have you
2 reviewed it, and any reaction you have to the
3 selection of the parameters that went into that
4 modeling specifically?
5 DR. KREAMER: Very quickly, Your Honor, if
6 you put your finger over a -- the water goes more
7 quickly. The Brule is known to have -- permeability.
8 It's -- and so if I put my finger over the hose -- the
9 low conductivity layers -- higher conductivity --
10 faster flow -- in these layers.
11 The higher -- that were noted from grain
12 --
13 JUDGE WARDWELL: Dr. Kreamer, hold on one
14 second. Can you hold on one second?
15 Is there anything we can do? I'm getting
16 about half of this. I don't know if the court
17 reporter is getting any more of it.
18 DR. KREAMER: I'm on the phone.
19 CHAIR BOLLWERK: You're on the phone
20 because you're breaking up on a regular basis.
21 DR. KREAMER: The reason is -- an echo.
22 JUDGE WARDWELL: Hold on one second.
23 DR. KREAMER: And the echo goes back and
24 forth. If you lower the volume just a tad, it might
25 work better. I apologize.

1 CHAIR BOLLWERK: We are going to take a
2 break here and see if we can't fix this audio problem
3 because this isn't working very well at all. So let's
4 see what we can do.
5 JUDGE WARDWELL: And before we go --
6 CHAIR BOLLWERK: Hold on, one second.
7 JUDGE WARDWELL: I'm basically going to
8 ask the same questions for all the modeling, so if you
9 want to look over those parameters because I didn't
10 see it in the report that you justified the selection
11 of those, and I want to tie a loop on that. It's
12 something that I think is needed for every modeling
13 effort, and I'd like to have that same justification.
14 So during this break, if you could, start looking
15 ahead at the other models, the six, the other five
16 left that we have to do.
17 CHAIR BOLLWERK: Let me mention also that
18 OST 21, 021 has been -- which is Dr. Kreamer's
19 PowerPoint, has been distributed to everyone now. I
20 think everybody should have it. We should take a look
21 at that, and we'll deal with that at some point in the
22 near future as well. Take a chance over the break to
23 look at that as well. Thank you. We'll start with
24 ten minutes and see how it goes.
25 (Whereupon, the above-entitled matter went

1 off the record at 8:52 a.m. and resumed at 9:06 a.m.)
2 CHAIR BOLLWERK: All right, we're back
3 after a short break trying to fix our audio problem,
4 which I think we have done. At least we're going to
5 give it a shot here.
6 Just with respect to what we're now
7 calling OST021, I'm going to take a cue from Judge
8 Wardwell as to when he's in a position that we can
9 talk about that a little more. So we're not going to
10 do it right this second but we will do it, I suspect,
11 in the not too distant future in the morning. So
12 anyway, I will look for your cue as to when you're --
13 when it's okay to bring that up in terms of OST021.
14 JUDGE WARDWELL: I'm back on?
15 CHAIR BOLLWERK: You're back on. You're
16 in.
17 JUDGE WARDWELL: Yes, so I think we left
18 off with me asking Dr. Kreamer if he had some comments
19 in regards to the source of the parameters, where they
20 came from, and you were in the process of discussing
21 that. So, if you want to continue, please do.
22 I do want to mention one thing to you. I
23 don't know if you see -- what you see in your screen
24 but I see both you and myself, waiving my hand. And
25 you might see that I'm not turning my head towards the

1 screen to look at you. It's not that I'm sick of
2 looking at you, although that may have something to do
3 with it, but there is a bit of a delay and I find out
4 it's easier to hear you if I just look straight ahead
5 and not at you.
6 So I'm not ignoring you. It's I can hear
7 better without seeing your mouth move.
8 DR. KREAMER: Judge Wardwell, also when
9 you divert your head, just even slightly from the
10 microphone, I lose -- and that goes for all the
11 speakers -- just a slight a diversion from the crown
12 of the microphone, you are inaudible on this side.
13 JUDGE WARDWELL: So this position will be
14 better also because then there will be less tendency
15 to turn my head away from the mike. Thank you.
16 So, please continue.
17 DR. KREAMER: Oh, well I was just saying
18 that you know you hold your finger over a hose and the
19 water squirts out faster. The Brule Formation, we've
20 all agreed, has got lots of heterogeneities, which is
21 like putting your finger over the hose. The whole
22 hose being open is the 220 feet, I believe, thickness
23 that they said. That comes into play mostly again
24 with the contaminant hydrology, not with these
25 calculations, per se, because with preferential

1 pathways, some pathways are much, much faster, some
2 pathways are much, much slower. And so you can get
3 what's called mechanical dispersion, a longitudinal
4 mechanical dispersion, which means that even though
5 the average water will arrive at a certain time,
6 you'll have some precursor water that gets there way
7 ahead of time and some water lagging behind. So it's
8 not just one arrival. It's an arrival over a period
9 of time with the advance party precursors getting
10 there first, which would be the harbingers of things
11 to come.
12 JUDGE WARDWELL: Okay, thank you.
13 DR. KREAMER: One other thing, Your Honor,
14 I want for the record to make sure that you know that
15 when I use the word numerical or did before, I did not
16 have your catholic, with a small c, interpretation of
17 what numerical was.
18 In the cleanup or in the closure of Crow
19 Butte, they used a mathematical computer-based
20 numerical model that was very complicated that had to
21 take into consideration heterogeneities. The simple
22 analytical models we call are like Theis and Coopic --
23 Cooper-Jacob, easy for me to say. And then finally,
24 the kinds that use analytical models and are on a
25 grid, that were just described, we call semi-

analytical models. So we make a different distinction between those two. I just, for the record, want you to know that what I was talking about was a more complicated numerical model, which is a computer-based model.

JUDGE WARDWELL: Thank you for that clarification and I was aware of that. I recognized that that's probably what you meant.

Before we move on to the next model, do you want -- Mr. Lewis, do you want to clarify anything in regards to modeling the first modeling effort or are you pretty much set with all those parameters?

MR. LEWIS: I am comfortable with that, Your Honor.

JUDGE WARDWELL: Okay. And now into the second model, it's labeled a recalibration and a revised validation of the aquifer -- of the MEA Agricultural Well Impact Analysis. And it used a hydraulic connectivity of 8.2, transmissivity of 1656, a hydraulic rating of 004, and now it says it's at 300 degrees to the northwest, porosity of 015, specific yield of 0.101 adjusted downward from 0.15 to calibrate the model, and then a pumping rate of 401 gallons per minute for 3.3 months.

And I guess my first question is how does

1 this model differ from -- and this model being AA-2,
2 referencing AA-2, Appendix AA-2 of the technical
3 report, differ from -- and it's also in CBR011 --
4 differ from the CBR010 Exhibit Model AA-1?
5 MR. LEWIS: Your Honor, the CBR011, the
6 validation report, that modeling differs from the
7 original agricultural well monitoring in that we have
8 some water level monitoring data from an adjacent
9 monitoring well, the closest monitoring well to the
10 active well fields AOW9 and BOW9 well pair.
11 We were asked to validate or to increase
12 the confidence in the predictions we had made in the
13 previous modeling effort. So we collected continuous
14 water level data from the nearest monitoring well and
15 we tried to reproduce the drawdown that we observed,
16 while the agriculture well was pumping for a period of
17 100 days and then the recover after the well was shut
18 in so that we could improve our estimates of the
19 aquifer parameters, validate those estimates to give
20 some greater degree of confidence in the predictions
21 that we made.
22 JUDGE WARDWELL: And so what did you
23 really recalibrate or what resulted from the
24 recalibration? The only difference in the input
25 parameters that I see are in the hydraulic gradient.

1 Am I correct or is there others?

2 MR. LEWIS: The specific yield was

3 adjusted, Your Honor, to fit the drawdown that we

4 observed primarily.

5 JUDGE WARDWELL: And was that the

6 calibration part of your -- is that what you saw was

7 the best parameter to modify in order to establish

8 this recalibration?

9 MR. LEWIS: It's the parameter that fit

10 the observed curve the best and it also had some

11 uncertainty that made me feel comfortable in adjusting

12 that parameter.

13 JUDGE WARDWELL: And supposedly all of

14 these are still the Brule aquifer parameters. Is that

15 correct?

16 MR. LEWIS: Yes.

17 JUDGE WARDWELL: Why the gradient now

18 heading towards the northwest at 300 degrees?

19 MR. LEWIS: Your Honor, it's on the same

20 vector but the opposite direction. The flow in the

21 aquifer is towards the southeast in the Brule aquifer.

22 It's towards the Niobrara River.

23 So that's a misprint. It's on the same

24 line but opposite direction.

25 JUDGE WARDWELL: And you're confident of

1 that?

2 MR. LEWIS: Yes, sir.

3 JUDGE WARDWELL: The reason I say that is

4 it doesn't seem like it's a typo or a misprint when it

5 says 300 degrees, parenthesis northwest. Both the

6 number and the abbreviation says that you were doing

7 this towards the northwest.

8 MR. LEWIS: I understand. It's an input

9 variation but the gradient being used in this modeling

10 is flow towards the southeast. And I can also

11 validate that by the shape of the capture zone that is

12 shown in the figures.

13 If I was using an opposite direction, the

14 capture zone would be reversed.

15 JUDGE WARDWELL: Okay, thank you.

16 And where does the results for this

17 analysis show up?

18 MR. LEWIS: Your Honor, the results are in

19 Figure 2 and 3 and Figure 4.

20 JUDGE WARDWELL: Thank you.

21 And why don't you, at this time, explain

22 the difference between specific yield and storativity?

23 MR. LEWIS: For unconfined aquifer, Your

24 Honor, water primarily is coming from storage and so

25 specific yield is essentially the storage parameter

1 for an unconfined aquifer.

2 JUDGE WARDWELL: Thank you.

3 CBR Exhibit 006 is a technical report.

4 Section 2.9.3.2 at 2-118 describing AA-2, which is the

5 modeling we are talking about, says augmenting this

6 study, CBR recalibrated the December 2013 groundwater

7 flow model using subsequent irrigation seasons and

8 applied the calibrated flow model in conjunction with

9 the particle tracking to calculate and illustrate the

10 30-year capture zone around the well.

11 For purposes of this analysis, a

12 conservative worst case scenario was simulated. A

13 hydraulics -- hypothetical shallow casing well leak

14 occurring along the down-gradient portion of the

15 adjacent MEA well fields while irrigation well 732

16 pumps the maximum amount of groundwater, 373 gallons

17 per minute for five months. These are the same

18 operating conditions assumed in the original 2013

19 analysis and revised 30-year capture zone of the

20 irrigation well indicates that MEA wells fall within

21 the capture zone of the irrigation -- that no MEA well

22 fields fall within the capture zone of irrigation well

23 732.

24 And I notice that the different pumping

25 rate showed up again in regards to this discussion,

1 the 373 as opposed to the 401. And again, you've used
2 the 401 in regards to direct communications you've had
3 with the previous Crow Butte employee who talked with
4 the irrigation --
5 MR. LEWIS: Your Honor, the 401 in the
6 validation report comes from a different period of
7 operating time. It's 100 days gives you a higher rate
8 of pumpage and that was the actual operating period.
9 JUDGE WARDWELL: Okay, thank you.
10 CBR -- hang on just a second. Moving on,
11 I've placed this in 3.2.2, Modeling of Operational and
12 Restoration Groundwater Control. And under section --
13 my Section 3.2.2.1, Lateral Flow Velocities, this
14 modeling 3 is calculations of groundwater velocity.
15 And in the CBR Exhibit 006, which is a
16 technical report, again, Section 3.1.7 at 3-25, said
17 for modeling lateral flow on the Basal Chadron
18 Chamberlain Pass Formation, the following equation and
19 hydraulic parameters were used. And first is the
20 equation that V is equal to Ki divided by Phi sub-N
21 and it stats that where V is the groundwater velocity,
22 K is the hydraulic connectivity of the Basal Chadron
23 Chamberlain Pass Formation listed at 2.2 times 10 to
24 the minus 2 centimeters per second or 61.7 feet per
25 day, Phi sub-N is its effective porosity of 0.2, i is

1 the hydraulic gradient of 0.00048 for the
2 potentiometric level of the Basal Chadron Chamberlain
3 Pass Formation and the results are that the velocity
4 is 0.15 feet per day or 54 feet per year.
5 It goes on to say it was concluded from
6 this calculation that mining solutions from ISR
7 operations would only migrate a very small difference
8 over any reasonable period of time, representing
9 temporary facility shutdown.
10 And could someone from CBR answer the
11 question of where the values of these parameters come
12 from?
13 MR. STRIVER: Your Honor, we are still
14 working on that.
15 JUDGE WARDWELL: Okay. And I guess I'll
16 ask Dr. Kreamer that looking over these, even if the
17 hydraulic connectivity value was off by an order of
18 magnitude, wouldn't it still mean that it would take
19 a pretty long time to reach the discharge zone? And
20 even if it's two orders of magnitude, it still would
21 take quite a long time to reach the discharge zone,
22 wouldn't it?
23 DR. KREAMER: It would depend on the
24 heterogeneities and the longitudinal dispersion, which
25 I'm not sure was calculated here.

1 So for average calculations, you are
2 correct. An order of magnitude might not make a
3 difference; when you throw in dispersion, that might
4 make a significant difference.
5 JUDGE WARDWELL: Okay, thank you.
6 Moving down to my Section 3.2.2.2,
7 Hydraulic Containment and 3.2.2.1, under typical
8 operating conditions, we have modeling effort number
9 4, Analysis for Hydraulic Containment. And this
10 CBR012 is the exhibit number, AA-3, an AquiTek report
11 dated 12/17/14, number 6 at page 4. And it's stated
12 that as further evidence to support the lateral
13 containment of mining solutions at the MEA, a
14 groundwater modeling simulation was performed to
15 demonstrate hydraulic containment of mining solutions
16 under typical operating conditions.
17 The operation of Mining Unit 1 at the MEA
18 was simulated for this purpose, given a total flow of
19 1600 gallons per minute and a bleed, parenthesis, next
20 production rate of 1.2 percent per the MEA water
21 balance. Details and results of the simulation are
22 provided in Attachment B.
23 Results of the simulation demonstrate the
24 hydraulic containment of mining solutions can be fully
25 maintained, given proposed operating parameters.

1 Under CBR012, AA-3, Attachment B at 7,
2 which is the Groundwater Flow Simulation of Hydraulic
3 Containment, groundwater flow was simulated using
4 WinFlow, an analytical element flow model developed by
5 environmental simulations. The flow model simulation
6 was run for a period of three years, equivalent to
7 approximately production of MU -- of Mine Unit 1.
8 Particle tracking techniques were utilized to
9 illustrate groundwater flow paths from injection wells
10 towards production wells. Results of the simulation
11 are provided in CBR012, Appendix B, Figure B-1 at 9.
12 And if we can pull that up, Joe, that would be great.
13 It's, again, CBR012 and then go to Appendix B and
14 Figure B-1.
15 Results of the simulation demonstrate
16 mining solutions in MEA will be fully contained under
17 normal operating conditions with minimal well field
18 flare, as evident by the particle capture zone in the
19 inward hydraulic gradient across MU1.
20 MR. BACK: Joe, it's the last page.
21 MR. DEUCHER: Thank you.
22 JUDGE WARDWELL: That is it, yes. As I
23 looked over -- this is Crow Butte and, I assume, Mr.
24 Lewis but whoever would like to answer. So I looked
25 over the CBR012 AA-3. It seemed to me it's primarily

1 an expert witness report -- position report to prepare
2 to address containment at 2, except for this number 6
3 item, which I just read to you on page 4, which
4 discusses modeling. Is that a fair assessment?
5 MR. LEWIS: Yes, Your Honor.
6 JUDGE WARDWELL: And what is the date of
7 this simulation summarized in Attachment B? And
8 Attachment B is the only thing that deals with this
9 particular modeling effort. Is that correct?
10 MR. LEWIS: Yes, Your Honor.
11 JUDGE WARDWELL: So this Appendix B isn't
12 an Appendix B to the modeling report. This is all
13 that is provided in regards to this modeling. Is that
14 correct?
15 MR. LEWIS: I believe so, Your Honor, yes.
16 JUDGE WARDWELL: But it also references
17 AquiferTek Report 12/17/14. And where is -- does that
18 show up in narrative in the previous pages to the
19 figure we've now got called up?
20 MR. LEWIS: I'm sorry, Your Honor. I
21 don't see the reference.
22 JUDGE WARDWELL: On CBR012, the Appendix
23 AA-3. Okay, so that's the date of that report, which
24 is primarily an expert witness report dealing with
25 other issues besides this modeling, correct? And then

1 Attachment B is the modeling of associated --
2 MR. LEWIS: Yes, they all concern
3 containment but different -- the modeling is one
4 aspect of that report, yes.
5 JUDGE WARDWELL: So this is the modeling
6 associated with the general discussion of containment
7 that you -- that was part of the expert report?
8 MR. LEWIS: Yes, sir.
9 JUDGE WARDWELL: Okay, thank you.
10 And so this has the same date as the
11 report then in Attachment B. It's not an excerpt from
12 some other report is what I'm driving at because I
13 didn't see a normal modeling-type report. It was this
14 expert witness report, which is number 6, showing some
15 narrative of what was in Appendix B.
16 MR. LEWIS: That's correct.
17 JUDGE WARDWELL: Okay, that's fine.
18 And what are we seeing with these results?
19 Figure B-1 is your presentation of the results, isn't
20 it in essence? We can go to any other figure, if you
21 want, or narrative if there is any under Appendix B.
22 I can't remember.
23 MR. LEWIS: Your Honor, the Figure B-1
24 illustrates the basic path of groundwater flow during
25 a simulated mining operation, using a production rate

that is 1.2 percent higher than the injection rate, which is an approximation of the normal estimated operating condition.

So when I look at this figure, none of the paths are essentially leaving the mining area. They are contained within the mining area that would be expected. There is no excursion, is what I'm trying to say, when I look at this figure.

JUDGE WARDWELL: What are all the red little guys? Are those the radius of influences of each of the wells or is that just --

MR. LEWIS: Your Honor, at this scale, it's a little difficult to show. The lines that you see, the red lines, are pathlines that sketch the flow of water from an injection well to a production well. And there are seven production wells in a seven spot pattern around a production well. So the flow is very tightly contained within a single pattern area.

But you can see that the particles are traced from injection wells to production well. So basically, all of the pathlines are contained within the mine unit proper and are not leaving the area.

JUDGE WARDWELL: And so the only variation -- you don't have the pre-mining overall flow pattern shown here, the contours, this is what happens during

1 the mining but is it -- have these numbers of the
2 contours themselves changed dramatically? The 3705
3 pre-mining, would it be essentially at the same
4 location as shown here, except where you see the
5 interception from the various pumping wells, as that
6 contour lines goes in and joins up with the red little
7 circles?
8 MR. LEWIS: I'm sorry, Your Honor, I may
9 not have understood the question entirely but I
10 believe that there is a relatively small amount of
11 drawdown that is superimposed on that pre-mining
12 surface, pre-mining potentiometric surface that leads
13 to the circular contours.
14 JUDGE WARDWELL: That's just the way I
15 described it.
16 MR. LEWIS: Thank you.
17 JUDGE WARDWELL: And likewise with the
18 3706, it only gets a little bit distorted there,
19 right, when it's captured by the northwest portion of
20 the -- I don't know what WH-1 means but in the WH-1
21 area?
22 MR. LEWIS: Yes.
23 JUDGE WARDWELL: And so if you did -- to
24 ask this another way, if the pumps were shut off and
25 fully recovered, is it your testimony that the 3705

contour would pretty much look the same way it is; it just wouldn't have the little capture zones in it? It would be more of a uniform arc of a contour line.

MR. LEWIS: Yes, it would be rending northeast, southwest with the pre-mining gradient. It would look like the pre-mining potentiometric surface.

JUDGE WARDWELL: Yes, thank you. Yes.

You mentioned the word flare. There is very little flare. What is flare and how does a model or how would the model illustrate it if it was here?

I think you're saying this shows there isn't any flare. But what is flare and what would it look like if this model results had flare on it in regards to the changes in the configuration of B-1?

MR. LEWIS: Your Honor, at this scale, again, it's a little hard to demonstrate but the answer to the question is that when you inject water on the perimeter of a well field, so if you look at the perimeter wells, injection wells that are in the well field, the pathlines extend slightly outward of the perimeter pattern area.

So the flare refers to, essentially, those pathlines that extend slightly out from a straight line pattern area, usually it is ten percent. You know 1.1 would be an estimate from this particular

simulation of the flare that exists from the injection on the perimeter.

JUDGE WARDWELL: Okay, thank you. And if it was large, those just would be larger, more extensive?

MR. LEWIS: Yes.

JUDGE WARDWELL: Okay, thank you.

CBR012, which is the exhibit that has this pump test report that we're talking about or the results from it, the model hydraulic containment simulation under typical operating conditions had representative hydraulic parameters for the Basal Chadron Chamberlain Pass Formation aquifer were established from baseline water level monitoring and aquifer testing as follows: a transmissivity of 10 -- 1012 square feet per day. And that's stating that's average from the aquifer testing storage coefficient of 2.56 times ten to the minus four average value of aquifer testing and the hydraulic gradient of 003 -- 0.003 bearing 324 northwest direction and a porosity of 0.2.

This is the first time that we've used -- we're doing the modeling associated with the Basal Chadron. Is that correct? This is the first time we have hydraulic parameters for that. Is that correct?

1 MR. LEWIS: Yes, Your Honor.

2 JUDGE WARDWELL: And where did you pull

3 the hydraulic gradient value from of 0.0003?

4 MR. LEWIS: Your Honor, the 0.003 is the

5 gradient estimated in approximate area of Mine Unit 1

6 from the baseline monitoring potentiometric map.

7 JUDGE WARDWELL: Okay, thank you.

8 And the porosity, I assume, is similar to

9 how you estimated it for the upper Brule?

10 MR. LEWIS: Yes, Your Honor.

11 JUDGE WARDWELL: And this modeling really

12 has no relationship whatsoever to the modeling in AA-1

13 and AA-2 or the calculation of velocity. This is --

14 MR. LEWIS: That's correct.

15 JUDGE WARDWELL: -- a brand new effort.

16 I'll turn to the NRC. As best I can

17 ascertain in looking over your Exhibit 008, which is

18 your Safety Evaluation Report, there was a discussion

19 of both AA-1 and AA-2 and I could also find a

20 discussion of Appendix GG, which we will talk about in

21 the future here in a minute, but I couldn't find any

22 discussion of AA-3. Is there a reason why you didn't

23 deem this of any interest?

24 MR. BACK: Your Honor, do you mean in the

25 Environmental Assessment or in the SER?

1 JUDGE WARDWELL: The SER. And I could
2 have been wrong. Maybe I was looking at the
3 Environmental. Show me where it has been, if it has.
4 That's all. That's fine. I just couldn't -- my notes
5 said I couldn't find it.
6 MR. BACK: Regardless, when I reviewed the
7 -- a few things struck me. When I reviewed their
8 recalibration based on the well being moved to the
9 east -- or actually moved to the west, to me it was
10 kind of remarkable how close that calibration came to
11 -- with only bearing one parameter based on the
12 uncalibrated model.
13 And so in terms of an environmental
14 assessment, it just to me it wasn't that relevant to
15 say okay, we got a good calibration. That was just
16 inherent in my review of the work that they did.
17 JUDGE WARDWELL: And this is in discussion
18 of AA-1 and AA-2. Is that correct?
19 MR. BACK: That is correct.
20 JUDGE WARDWELL: Yes and my question was
21 AA-1 and AA-2 were presented and discussed in the SER.
22 I couldn't find anything for AA-3, which is the model
23 that we're now talking about.
24 MR. BACK: The containment.
25 JUDGE WARDWELL: Yes. And so if you want

1 to -- well, why don't you get back to me in regards to
2 where I've missed it in the SER; and if not, why were
3 you not interested in discussing it?
4 MR. BACK: Yes, Your Honor.
5 JUDGE WARDWELL: Is it not a model of
6 interest to you and only to the applicant? It seems
7 to me it would be a model of interest to you. I just
8 want to clarify that.
9 And I will turn to Dr. Kreamer now to
10 solicit any observations that you might have as you --
11 when you reviewed this information.
12 DR. KREAMER: It's my understanding that
13 basically we're talking about average information
14 homogeneous isotropic conditions for well operations.
15 Again with the dichotomy between well operations and
16 contaminant flow, for well operations, this may be
17 sufficient. If water were to leak out of here a
18 little bit, I think we'd just have less efficiency in
19 the uranium withdrawal and captured and that would
20 manifest as just lower concentrations coming up with
21 the pregnant solution.
22 But from a contaminant standpoint, the
23 homogeneities that are not embodied in this picture
24 become really important. If you were to imagine a
25 hypothetical super highway of permeable pathway

1 preferential flow path in this system, what that would
2 mean as far as contaminant flow is that this average
3 view that is really for mining efficiency and not for
4 contaminant evaluation would be not applicable.
5 What it would show is that in mining
6 operations, you might not even notice it until it came
7 to closure. When you came to closure, you could have
8 contaminants that were spread in odd ways and hard to
9 get concentrations down to closure levels.
10 So I think the key here is that it is
11 probably okay for mining operations for a general
12 background. It probably does show containment under
13 homogeneous isotropic conditions, when we all
14 acknowledge that this particular formation and all the
15 parties are agreed that this is a heterogeneous
16 system.
17 This simplification does establish that
18 mining operations probably can proceed with some
19 efficiency. It does not really adequately address
20 contaminant movement off the site because of the lack
21 of characterization of heterogeneities.
22 JUDGE WARDWELL: Thank you.
23 Mr. Lewis, would you like to respond to
24 the statements that Dr. Kreamer made?
25 MR. LEWIS: Well, Your Honor, it's my

1 opinion that for -- and as I previously testified that
2 for a natural system, the production aquifer is
3 actually relatively homogeneous and I think that's
4 borne out by the fact that we have 30 years of
5 operations at the Crow Butte mine that don't show any
6 evidence of uncontrolled high permeability pathways
7 that would create large problems in containing mining
8 solutions. They have a recipe that works over well
9 with a bleed rate between a half and one and a half
10 percent to contain the mining solutions and we know
11 that that works very well.
12 JUDGE WARDWELL: Okay, thank you.
13 Section 3.2.2.2.2 under Extended Facility
14 Shutdown Modeling Effort 5 Analysis of Extended
15 Facility Shutdown on Containment, it is presented in
16 CBR006, a technical report, at Section 3.1.7 at 3-26
17 to 3-27, where supposedly there was modeling for
18 hydraulic containment can be maintained in the event
19 of an extended facility shutdown of that situation.
20 In the analytical flow model, paren, ESI-
21 1999, was used to simulate groundwater flow in the
22 production aquifer at the MEA. Particle tracking
23 techniques were used to illustrate the zone of
24 hydraulic containment, paren, capture zone, end of
25 paren, produced by a hypothetical pumping well or

1 wells placed within the ISR well field. Mine Unit 5
2 at the MEA site was used for illustrative purposes in
3 this analysis.
4 And then the following Basal Chadron
5 Chamberlain Pass Formation parameters were used for
6 transmissivity, it was 2,469, which is listed as the
7 maximum observed from an aquifer pumping test. The
8 hydraulic gradient was used as 0.00048, the maximum
9 observed for baseline monitoring. And both of those
10 values referenced Aqui-Ver 2011 report: an effective
11 porosity of 0.2 and 30 gallons per minute for the
12 pumping rate.
13 I guess my question to you, to start off
14 with, for anyone from Crow Butte but probably Mr.
15 Lewis, is do these values differ from the ones that
16 were used for AA-3 and the groundwater calculations
17 that were presented in CBR006 at 3-25?
18 MR. LEWIS: Looking at these values, Your
19 Honor, I believe the hydraulic gradient is slightly
20 steeper in this particular analysis and that would be,
21 for conservatism, groundwater moving at a higher rate
22 using a steeper gradient. This type of analysis I
23 felt that was appropriate.
24 JUDGE WARDWELL: And that transmissivity
25 has changed but you've mentioned that is the maximum

1 so that is a justification for that effort also. Is
2 that correct?
3 MR. LEWIS: That is correct.
4 JUDGE WARDWELL: Exhibit CBR006, again,
5 the technical report 3.1.7 for the section, 3-26 to 3-
6 27 states that modeling for hydraulic containment can
7 be maintained in the event of an extended facility
8 shutdown. The results shown on CBR008, Figure 3.1-9
9 at 128. And this is referencing the Aqui-Ver report.
10 So if we could pull that up, Joe, I would
11 appreciate it.
12 And this is from the 5/30/13 report. It
13 shows that the zone of hydraulic containment was
14 computed using reverse particle tracking techniques
15 after 30 days of pumping and the zone will expand over
16 time. If multiple mine units are in operation at the
17 time of the hypothetical shutdown, additional wells
18 would be needed, i.e., one or two wells at a total
19 rate of 300 gallons per mine unit to maintain complete
20 containment of multiple mine units.
21 Bear with me just a second here.
22 Yes, this is -- that discussion was what
23 was presented in a technical report. And as I think
24 I mentioned earlier, I don't see any -- this
25 particular figure shows in references Aqui-Ver

1 5/30/2013 report. And yet, has that report been
2 submitted as an exhibit; or if not, where is the
3 analysis and the associated report related to
4 supporting this discussion that took place in the
5 technical report in Section 3.1.7 at 3-26 to 3-27,
6 which I just read?
7 MR. LEWIS: Your Honor, I don't locate the
8 2013 report you've referenced in anything other than
9 the TR we're looking at right here.
10 JUDGE WARDWELL: So I'm sorry. Could you
11 say that again? Are you referring in regards to the
12 typed note on the bottom of Figure 3.1-9, Aqui-Ver,
13 Inc., 5/30/2013 and you are saying what about that
14 now?
15 MR. LEWIS: I don't believe that reference
16 was included in this package.
17 JUDGE WARDWELL: Okay. And so is that a
18 report dealing with this particular figure?
19 MR. LEWIS: I do recall preparing a short
20 letter report that went with this. It seems to --
21 yes, I have a reference to it, a letter report from me
22 to Doug Pavlick and John Schmuck, Crow Butte Resources
23 Regarding --
24 JUDGE WARDWELL: Sorry, I've got to
25 interrupt you again. I missed the first part of that.

1 Could you start again?

2 MR. LEWIS: The reference for that report,

3 detailed reference is Aqui-Ver 2013 letter report from

4 me to Doug Pavlick and John Schmuck, Crow Butte

5 Resources, Crawford, Nebraska Regarding Containment

6 Analysis for the Marsland Expansion Area May 30th.

7 So that is a report, letter report that I

8 wrote. I'm not sure how it avoided getting into the

9 package.

10 JUDGE WARDWELL: Yes, so as far as you

11 know, it's not an exhibit submitted in this hearing.

12 MR. LEWIS: Not that I know of.

13 JUDGE WARDWELL: In your memory, was there

14 anything else said about this report that wasn't

15 already included in just the narrative that was

16 provided in the technical report at the referenced

17 page numbers that I gave earlier?

18 MR. LEWIS: Not such this way, Your Honor.

19 It was a very brief letter report and I believe the

20 essence is in the TR.

21 JUDGE WARDWELL: Thank you.

22 Why don't you describe what we're looking

23 at here on 3.1-9?

24 MR. LEWIS: Your Honor, similar to the

25 agricultural well analysis, this figure shows the

1 groundwater pathlines moving away from a pump well, in
2 this case. It shows the capture zone or the envelope
3 of the containment area, which would be within the
4 pathline area, of a hypothetical well pumping at 30
5 gallons a minute on the down gradient side of proposed
6 Mine Unit 5 to demonstrate that mining solutions could
7 be contained in the event of a shutdown of some nature
8 in emergency that shutdown pumping from the mine unit.
9 JUDGE WARDWELL: And you made a statement
10 that -- yes. Where does this illustrate the issue
11 associated with reaching a conclusion that if you
12 installed -- I can't find it right now -- one or two
13 additional wells to help control this? Where did you
14 reach that conclusion?
15 MR. LEWIS: Well, Your Honor, this model
16 is based on super position principle, meaning that two
17 wells pumping at the same right would simply double
18 the capture zone width. So it follows that, without
19 having to do additional simulations, you could put two
20 wells pumping at half of the pumping rate and get the
21 same basic capture zone.
22 JUDGE WARDWELL: Thank you.
23 Again, did you state that WinFlow was used
24 for this or was it a more simplistic model or a
25 different model?

1 MR. LEWIS: This was used with the
2 WinFlow.
3 JUDGE WARDWELL: The Oglala Tribe, in
4 their rebuttal on Exhibit number 014 at 3 to 4, number
5 9 item states that CBR's conclusions and NRC staff's
6 analysis rely on the presumption that lateral
7 contained -- containment of mining solutions at the
8 MEA has been demonstrated using WinFlow to simulate
9 conditions at the MEA site.
10 The presentation by CBR presents one
11 single realization, the particle distribution map,
12 without completely listing assumptions, pumping rates,
13 injection rates, justification for uniform geologic
14 and hydrologic parameters. And for instance, why is
15 the uniform porosity of 20 percent used? Initial or
16 boundary conditions are model domain. Multiple
17 scenarios are not presented. Further and importantly,
18 uncertainty, error bars, precision and accuracy of the
19 results are not indicated. The single map
20 presentation is cosmetically attractive, which I am
21 sure you are pleased about Mr. Lewis, however, despite
22 its lack of utility.
23 And I will turn to Dr. Kreamer to start
24 with. And are you referring here in a statement in
25 regards to the analysis here that was presented in the

1 technical report of CBR at Section 3.1-7 and the one
2 that we saw before in regards to the Appendix AA-3
3 simulation, both of which are dealing with issues
4 associated with the Basal Chadron?
5 DR. KREAMER: Your Honor, there are
6 similar comments as far as homogeneity isotropic
7 conditions assumed; only one realization that's done
8 here, not multiple realizations.
9 There are some slight differences. It was
10 mentioned about two capture wells and the mathematical
11 principle of super position. What Mr. Lewis did not
12 mention is the distance that these capture wells are
13 apart means that you might not have double the
14 drawdown, depending on if you had half the pumping
15 from two wells, the distance that these were apart
16 would play into your ability to capture things.
17 So for this one realization for homogenous
18 isotropic conditions and despite Mr. Lewis saying that
19 for all intents and purposes he considers it to be
20 homogeneous and isotropic, again, that's for
21 operational purposes. Maybe that's true, maybe it's
22 not but for contaminant hydrology migration, as
23 evidenced at Crow Butte resources and their lack of
24 ability to close or have closure very quickly, for
25 contaminant hydrology that may not be accurate or

appropriate.

And so for this analysis for a simplistic view of things without error bars, without uncertainties put in here, it is good for what it is.

JUDGE WARDWELL: Thank you.

And I guess I'll finish up with Crow Butte. Would you like to address any of the issues raised by Dr. Kreamer?

MR. LEWIS: Your Honor, only to say that I recognize there is uncertainty in the aquifer parameters. That's why we tried to select conservative worst-case steep gradient high transmissivity so that we could be sure that this was protective in making those simulations.

JUDGE WARDWELL: Thank you.

Moving on to 3.2.2.3, the Basal Chadron Chamberlain Pass Formation Aquifer Drawdown, Modeling 6 Drawdown, Impact Assessment Analysis, as presented in the technical report, Crow Butte's Exhibit 017, Appendix GG. It's an AquiTek report 5/11/16, entitled Drawdown Impact Assessment MEA.

And I guess I'd ask CBR. Looking at this report, I was wondering where the details of this model are delineated and whether there's any other -- yes. This was really the first mention of AquiWin32

1 and I was wondering are there any details of this
2 model delineated beyond what you've already explained
3 earlier on?
4 MR. LEWIS: No, Your Honor.
5 JUDGE WARDWELL: And no other sub-programs
6 were used besides the WinFlow module. Is that
7 correct?
8 MR. LEWIS: No, Your Honor.
9 JUDGE WARDWELL: And what's the pumping
10 rate for this analysis in GG?
11 MR. LEWIS: Your Honor, you are referring
12 to CBR017, the impact analysis?
13 JUDGE WARDWELL: Right.
14 MR. LEWIS: There are multiple pumping
15 rates from three different facilities that were
16 assumed in this simulation. For the CBO facility,
17 those are based on historical pumping rates, as well
18 as the projected future mine plan schedule. These
19 rates are summarized in the attachment to this report,
20 the pumping rate schedule.
21 The same is true for the Three Crow
22 Expansion Area, which is east of CBO. We made
23 assumptions using their proposed mine plan and the
24 distribution of pumping at that facility in the
25 future.

1 And for MEA, we used the proposed mine
2 plan, the future scheduled development of the mine
3 units in developing pumping rates for that analysis.
4 JUDGE WARDWELL: Thank you.
5 You mentioned in the Appendix at 5 that
6 model drawdown projections can be considered
7 conservative because they do not include the impact of
8 groundwater recharge on the Basal Chadron Chamberlain
9 Pass Formation Aquifer over a large radius of
10 influence and because consumptive use of the MEA and
11 Three Crow Expansion Area, or TCEA, are based in part
12 on the conservative 30 percent reverse osmosis
13 efficiency during well restoration. In parenthesis,
14 25 percent reverse osmosis efficiency has been
15 routinely achieved at the renewal site facility.
16 And I guess my question is how does a
17 consideration of the Basal Chadron recharge differ
18 from a heterogeneous leaky aquifer system? Wouldn't
19 that be represented by it?
20 MR. LEWIS: Your Honor, if you have a non-
21 leaky aquifer, the drawdown is greater, you produce a
22 conservative estimate of drawdown. So that is what is
23 intended by that statement is simply that for purposes
24 of a drawdown impact assessment, not having a
25 significant amount of recharge increases the amount of

1 drawdown and makes that a more conservative analysis.
2 JUDGE WARDWELL: Then how did you also
3 consider, sir, conservative to have an RO efficiency
4 of 30 rather than 25 percent?
5 MR. LEWIS: Thirty percent, I would say,
6 is a conservative estimate in that it over predicts
7 the amount of the net pumping as a result of
8 restoration. Since 25 percent is routinely achieved
9 at the facility, we know that that 30 would be a
10 conservative estimate for the net pumping rate from
11 restoration at the future facilities.
12 JUDGE WARDWELL: Thank you.
13 CBR016 and Appendix GG, 1-1, the Basal
14 Chadron aquifer values for input parameters for use in
15 each of these mine units are as follows: the MEA has
16 a transmissivity of 1012 square feet per day, the
17 storage coefficient of 7.46 times 10 to the minus 5.
18 The renewal site has a transmissivity of 479 square
19 feet per day as an initial estimate and a storage
20 coefficient of 8.8 times 10 to the minus 5 as an
21 initial estimate. And the Three Crow Expansion Area
22 has a transmissivity of 480 and a storage coefficient
23 of 8.8 times 10 to the minus 5.
24 Can you elaborate a little bit on how you
25 arrived at these derivations of these input parameters

1 for the model?

2 MR. LEWIS: Your Honor, all of these

3 parameters were developed initially from aquifer

4 testing reports for those facilities and their

5 representative values from those tests.

6 JUDGE WARDWELL: Okay, thank you.

7 You do mention in Exhibit 017 at 2 in

8 Appendix GG that transmissivity and storativity values

9 for the renewal site facility were lowered from

10 initial estimates cited above as part of the model

11 calibration process. And I guess I -- could you

12 explain that a little more in depth this calibration

13 process that you used for this modeling? And had you

14 used the same calibration process in the other models

15 that were dealing with the Basal Chadron and not -- I

16 already know about the recalibration you did for the

17 irrigation well but describe in more detail this

18 calibration process that you used for this drawdown

19 and was it incorporated in any of the other modeling

20 that we've used for the Basal Chadron?

21 MR. LEWIS: Your Honor, in performing the

22 initial calculations for the impacts from the Crow

23 Butte operating facility, we recognized that the

24 drawdown was under-predicted; that during the 2011 and

25 forward monitoring period, there had been

1 approximately 20 foot of drawdown that was observed at
2 the Marsland facility as the result of operating the
3 Crow Butte facility.
4 So, the 20 foot of drawdown at Marsland
5 offered some validation or some data for which the
6 model should be calibrated or at least to try to get
7 in the ballpark of that 20 foot of drawdown that had
8 been observed historically, as a result of operating
9 the CBO mine. So the transmissivity was adjusted, as
10 described in this report, in order to better match the
11 observed drawdown historically at Marsland due to
12 operating the Crow Butte facility.
13 JUDGE WARDWELL: Thank you.
14 And I'll turn to Dr. Kreamer to see if you
15 have any comments or observations in regards to this
16 modeling.
17 DR. KREAMER: Certainly. I believe they
18 used WinFlow software. It's an interactive analytical
19 modeling tool and it simulates two-dimensional flow.
20 It uses average parameters. It's analytical in the
21 sense of it's not a numerical model as I define it.
22 And it's fairly simplistic. It can be used for steady
23 state or transient state models.
24 It does have a component that could
25 calculate leaky aquifers and leakage. I'm not sure

1 that the statement that the maximum drawdown would be
2 conservative is conservative if there is leakage from
3 the Brule and the Brule would be diminished. So I'm
4 not sure I'm in agreement with that statement.
5 But generally for operations of the mine,
6 I think that probably this is in the ballpark. I
7 think that for contaminant flow it is inappropriate.
8 JUDGE WARDWELL: Thank you.
9 That concludes Concern 3 so we move on to
10 Concern 4, unless the Chair would like to take a break
11 or, if nothing else, give him his opportunity to read
12 the concern into the record.
13 CHAIR BOLLWERK: Let's do this first to
14 try to be efficient here. I know there's two things
15 outstanding with respect to Concern 3, at least as
16 I've got it.
17 There was a question about Model 3. Are
18 you all still working on that?
19 MR. STRIVER: Yes, Your Honor, regarding
20 calculation of groundwater velocity, CBR006, 3.1.7,
21 page 325, the hydraulic gradient was derived from the
22 maximum gradient on the baseline monitor wells during
23 the initial test, hydraulic pump test.
24 The hydraulic conductivity has the highest
25 transmissivity value of 2470 for the Basal Chadron

divided by the average thickness of 40 feet. And then from there, the effective porosity of 0.20 was used and the calculation was made utilizing those parameters and came up with 0.148 feet per -- excused me -- feet per day.

That's where the calculations were derived from, sir.

CHAIR BOLLWERK: Thank you. Do you have what you need then on that one?

JUDGE WARDWELL: Yes.

CHAIR BOLLWERK: All right, good.

We also had a question I guess for the staff about why was it Figure AA-3 was not discussed as part of the staff analysis. Are you ready to respond to that or do you want to need more time?

MR. LANCASTER: Sure. Yes, I did look at that AA-3 modeling effort concerning the containment there that they did showing inward hydraulic gradient.

Based on the results of the aquifer test, we determined that they could maintain an inward hydraulic gradient, which we have required in a license condition 10.1.6 in Exhibit NRC009.

So we have looked at that. We didn't document it because the aquifer test provides the -- the results of the aquifer test showed -- demonstrate

1 that they can maintain an inward hydraulic gradient.
2 And so it was required as license condition and they
3 agreed to it.
4 Also, as pointed out in our initial
5 testimony, A-15 -- let's see here -- yes, we don't
6 require this kind of an effort. This is an extra
7 effort that they did, this modeling effort concerning
8 relative to excursions and that sort of thing,
9 assessing that sort of scenario looking at controlling
10 excursions.
11 You know with the inward hydraulic
12 gradient, which is based on the pumping test, as is
13 stated in our answer for that, which is A-15 of our
14 initial testimony, we focus on procedures for
15 preventing, detecting, and controlling excursions.
16 And so during ISR operations groundwater restoration,
17 the required inward hydraulic gradient and excursion
18 monitoring procedures provide the primary assurance
19 for control and prevention of excursions.
20 JUDGE WARDWELL: I guess I think I've just
21 got one follow-up. Oh, I'm sorry. Are you still --
22 MR. LANCASTER: Oh, no, go ahead.
23 JUDGE WARDWELL: I just have one follow-up
24 question on that and that is, so it is -- I didn't
25 miss any write-up that you might have had in regards

1 to this in your SER. It was not described in the SER?
2 MR. LANCASTER: I don't believe it is
3 because we rely -- you know this is we rely -- we felt
4 that we had the reasonable assurance based on the
5 results of the aquifer test that they could maintain
6 an inward hydraulic gradient and control excursions.
7 JUDGE WARDWELL: Thank you.
8 MR. LANCASTER: And then -- so.
9 CHAIR BOLLWERK: Are we good on that one?
10 Okay.
11 And I think the other one, which was the
12 difference between 401 and 373, I think you got that
13 when you talked about Model 2. Is that --
14 JUDGE WARDWELL: Yes.
15 CHAIR BOLLWERK: Okay, so you're good?
16 JUDGE WARDWELL: Yes, that's right.
17 CHAIR BOLLWERK: All right. So we've
18 finished with Concern 3, I believe, now. We would
19 normally here take a break to get any questions they
20 might have. Having said that, first of all, I don't
21 know if there are any questions but let me try to be
22 a little more efficient here. Maybe we can kill two
23 birds with one stone, if we need to.
24 Let's turn for a second to OST021, which
25 is a PowerPoint that has been suggested be put into

1 evidence so that -- it's part of a discussion with Dr.
2 Kreamer in response of one of Judge Wardwell's
3 questions about Concern 2. We'll go ahead and mark
4 that for identification. We'll call it -- it's
5 OST021. It's described as Kreamer PowerPoint slides.
6 (Whereupon, the above-referred to
7 document was marked as OST Exhibit No.
8 021 for identification.)
9 CHAIR BOLLWERK: As I said, it was marked
10 for identification. Now my question would be are
11 there any objections?
12 MR. SMITH: Your Honor, this is Tyson
13 Smith for Crow Butte. We do object to admission of
14 this. This reads like testimony that should have been
15 presented either as initial and certainly as rebuttal
16 testimony. It just builds on information that has
17 long been in our application and should have been
18 presented then.
19 And I guess in addition I would add it is
20 unfair to ask us to respond to this in a short period
21 of time without having had a chance to look it over,
22 which is exactly why parties are expected to present
23 their primary case in their direct and rebuttal
24 testimony.
25 CHAIR BOLLWERK: All right. Anything from

1 the staff?

2 MS. SIMON: Your Honor, the staff also

3 objects largely for the same reasons that Mr. Smith

4 just articulated.

5 I would note that this exhibit seems to be

6 the same type of analysis that Dr. Kreamer provided.

7 DR. KREAMER: Could you speak into the

8 microphone?

9 CHAIR BOLLWERK: Can you pull it closer?

10 Do that.

11 MS. SIMON: This seems to be the same type

12 of analysis that Dr. Kreamer provided in the license

13 renewal hearing and, in fact, he provided that license

14 renewal analysis as an exhibit in his initial

15 testimony in this proceeding. So there's really no

16 good reason, as Mr. Smith suggested, why he could not

17 have done so in his initial or rebuttal testimony.

18 I will note the rebuttal testimony was due

19 September 5th, two months ago. And as Mr. Smith also

20 said, the purpose of this hearing is for the Board to

21 obtain clarification on what was already filed and the

22 rules contemplate pre-filings for a reason.

23 And we also agree it is unfair for the

24 staff witnesses to have to respond on the fly orally

25 without preparation.

1 So we do object. And if the Board chooses
2 to admit this exhibit, we would request an opportunity
3 to provide a written response to the contents of the
4 exhibit and Dr. Kreamer's discussion of it when the
5 hearing is over.
6 CHAIR BOLLWERK: All right.
7 Any response from the Oglala Sioux Tribe?
8 MR. BALLANCO: Yes, Your Honor. We
9 anticipate that Dr. Kreamer could describe what is
10 presented in this PowerPoint on the record with his
11 voice. This certainly makes his response to the
12 question that he was asked during this hearing more
13 readily understood and it provides a visual means of
14 communicating what he has been saying the entire time.
15 I wouldn't say that this is new evidence.
16 This is further illustration of the point Dr. Kreamer
17 has been making the entirety of his submission. So,
18 we would move for submission on those grounds.
19 CHAIR BOLLWERK: All right. Anything
20 further either of the parties want to say at this
21 point about that?
22 All right, so the Board is going to take
23 this under consideration right now. And you all now
24 have this opportunity to do your questions for Concern
25 3 while we're talking about this.

1 We'll take this under advisement. It
2 should take us both about ten minutes and then we'll
3 come back and deal with it.
4 (Whereupon, the above-entitled matter went
5 off the record at 10:15 a.m. and resumed at 10:29
6 a.m.)
7 CHAIR BOLLWERK: Let's go back on the
8 record. During the brief break we took, we received
9 some questions with respect to Concern Number 3 from
10 the NRC staff. Crow Butte had none, and the
11 interveners had none. So, we've looked at those
12 briefly, and Judge Wardwell is going to have some
13 questions.
14 JUDGE WARDWELL: I'll start off with Crow
15 Butte. When discussing Figure B1 of Appendix AA-3,
16 and that's Exhibit CBR012, you stated that if
17 operations were shut down, the potentiometric surface
18 contours would return to the pre-mining gradient that
19 is southwest to northeast. Did you mean to say
20 southeast to northwest?
21 MR. LEWIS: For the production aquifer,
22 yes.
23 JUDGE WARDWELL: Okay, thank you. And Dr.
24 Kreamer, do you dispute that CBR has demonstrated the
25 ability to maintain an inward gradient to prevent

1 fluid migration during operations? That's a yes/no
2 question.
3 DR. KREAMER: For mining operations, I
4 think they've demonstrated it. For contaminant
5 movement, they have not.
6 JUDGE WARDWELL: Sorry, I stepped on you.
7 Could you respond again, starting off with a yes or
8 no, and then elaborating?
9 DR. KREAMER: Yes and no. And the yes
10 would be for mining operations. I think they
11 demonstrated that it's efficient enough for them to
12 get adequate withdrawals. For contaminant and
13 movement offsite, I think it's inadequate.
14 JUDGE WARDWELL: Thank you.
15 DR. KREAMER: It's not adequate.
16 JUDGE WARDWELL: And do you believe that
17 contamination from within the production zone can move
18 against the hydraulic gradient?
19 DR. KREAMER: The question supposes that
20 there's one hydraulic gradient, or are there several
21 different directions of flow? In other words, in a
22 heterogeneous media, you can have different pathways
23 and there's not one, just one direction of flow.
24 Generally, no, contaminants don't move
25 against the hydraulic gradient. But if you're

averaging all the hydraulic gradients, you can get movement in different directions.

You can also get mechanical dispersion that will spread things out in a longitudinal direction and a transverse direction.

JUDGE WARDWELL: Well, why isn't that, then, your position that, in fact, they can move against the hydraulic gradient, if you say it can occur with those last two --

DR. KREAMER: Well, it can --

JUDGE WARDWELL: -- processes?

DR. KREAMER: -- move against it, yes. I can give you a quick example, if you want.

JUDGE WARDWELL: I'm sorry, you started answering my question before I got finished asking it, so I didn't hear the first part of your question, the response to that.

DR. KREAMER: Yes, it can move against the hydraulic gradient. Transverse dispersion, transverse mechanical dispersion is an example of that.

JUDGE WARDWELL: Okay, thank you. For the staff, is CBR required to undertake the types of transport analysis Dr. Kreamer has referred to in his testimony?

DR. KREAMER: The end of your question --

1 oh, I'm sorry.

2 MS. STRIZ: No, Your Honor.

3 JUDGE WARDWELL: In your opinion, do you

4 think such analyses are necessary?

5 MS. STRIZ: No, Your Honor.

6 JUDGE WARDWELL: Okay. Thank you.

7 CHAIR BOLLWERK: All right. That, then,

8 concludes our consideration at this point of Concern

9 Number 3. Make sure we retain these post-questions

10 for the record.

11 With respect to the question of the

12 admission of OST021, while the Board, in particular,

13 particularly Judge Wardwell, was impressed with the

14 presentation that was made, we've decided that, based

15 on the situation that exists currently, we're not

16 going to admit the exhibit.

17 We agree with the staff and the applicant,

18 this is the type of information that could have been

19 presented as part of the original filings in the case.

20 And so, at this point, we're going to deny the

21 admission of that exhibit. All right.

22 I think, then, we're ready to move on to

23 Concern Number 4. And Concern 4 contests whether the

24 final environmental assessment contains

25 unsubstantiated assumptions as to the isolation of the

1 aquifers in the ore bearing zones.

2 JUDGE WARDWELL: And, again, 4 is a bit of

3 a coalescing of other testimony, we'll move through it

4 anyhow.

5 In my 4.1, under analysis assumptions, OST

6 Exhibit 003 at 6 says that they allege that, regarding

7 the assumptions for the Theis methodology and the

8 Cooper-Jacob techniques, the first major assumption is

9 that the Basal Chadron aquifer is confined and has

10 apparent infinite extent.

11 The presumption by the authors and the

12 main foundation for the analytical approach is not

13 consistent with the data used in evidence.

14 And I think we've covered the assumptions

15 for the Theis methodology and the Cooper-Jacob

16 techniques in Section 2.1.3.2 and Section 2.1.3 and

17 really do not need to repeat them here.

18 I will turn to Dr. Kreamer and ask him if

19 he has any evidence demonstrating the effect of the --

20 that hasn't already been submitted and discussed, if

21 he has any additional evidence demonstrating that the

22 effect of the assumptions in the Theis methodology and

23 the Cooper-Jacob techniques would have the potential

24 to change the scientific conclusions of the staff's

25 and applicant's TR and EA and SER.

1 DR. KREAMER: Yes, I do.

2 JUDGE WARDWELL: Thank you. Exhibit 003 of
3 the Oglala Tribe at 6, OST, states that the second
4 major assumption is that the Basal Chadron Chamberlain
5 Pass aquifer is homogeneous, isotropic, and of uniform
6 effective thickness over the area influenced by
7 pumping, referencing CBR016 at 15. This foundational
8 requirement is violated and is consistent with the
9 data in evidence.

10 And again, I think we've covered this, in
11 regards to the homogeneity, isotropy, aquifer
12 thickness, and lateral extent of the pump -- in
13 evaluation of the pumping test analysis in Section 2.3
14 and 2.4, and don't need to repeat them here.

15 But again, I will offer Dr. Kreamer a
16 chance, if he has any additional evidence
17 demonstrating these that he would like to present,
18 that would help determine whether or not there's a
19 needed change in the scientific solution of the
20 applicant's and staff's documents.

21 DR. KREAMER: Thank you, Your Honor. In
22 the evidence that was presented in the hydrology
23 pumping test reports, an omission was the Cooper-Jacob
24 straight line analysis on the drawdown tests.

25 The recovery tests were drawn in, but the

1 drawdown tests and the pumping tests were not included
2 in the document.
3 What I would have presented is, I would
4 have presented one figure from CW3, which is 100 feet
5 away from the pumping well, that would have shown a
6 recharge boundary. A very clear, classic recharge
7 boundary.
8 That recharge boundary -- first of all,
9 wells that are that close are considered in a -- one
10 quote would be David Todd, who wrote a textbook, wells
11 that are closer to a pumping well are usually more
12 accurate. And that's one of the closest in the
13 pumping monitoring well array.
14 What I would have shown is, I would have
15 shown that there is over 30 percent difference from
16 what you would expect from the drawdown. You would
17 have 30 percent more water.
18 I would have shown that the pumping well,
19 which was drawn down 23 feet, would have taken only a
20 couple of minutes to be virtually pumped dry. I would
21 have shown that the -- with this new figure, I would
22 have shown that the interpretation clearly shows, by
23 industry, in the report, does not take issue with the
24 fact that this is a valid test.
25 They opine that the reason why you have a

slug of water coming into CW3 in a localized way is because there's an underlying channel into Pierre Shale, which is shown in the report.

JUDGE WARDWELL: Can I interrupt you for a minute? I need to interrupt you for a minute. Where have you provided this in your evidence or testimony?

DR. KREAMER: In my evidence and testimony, I've said that there is obvious leakage, and if a complete Jacob-Cooper analysis was shown, that would illustrate it, I believe, in one of my comments.

JUDGE WARDWELL: Okay. And did you show this in your testimony, the statements that you're just now making, that you say you would have shown or could have shown?

DR. KREAMER: I did not show it, but it's evident in the hydrologic report and the -- what I'm talking about as far as the discontinuities, not only in the base of the formation, but in the top of the formation, were provided in that hydrologic report as well, in Figures 9, 10, and 11.

JUDGE WARDWELL: Okay. Thank you. OST Exhibit 003 at 6 states that transmissivities range from 230 to 1,780, and values of storage coefficient from 1.7 times ten to the minus three to 8.32 times ten to the minus five are not consistent with

1 homogeneous conditions.

2 Homogeneity also means the thickness of

3 the formation is uniform, and it's not. We've already

4 covered this in Section 2.1.7 and 2.4, need not repeat

5 it.

6 And again, if Dr. Kreamer has any other

7 evidence that hasn't been submitted that he thinks

8 demonstrates that in fact the storage coefficients

9 would have a change in the conclusions that would be

10 reached by the applicant and the staff in their

11 documents, he has an opportunity to refer us to that.

12 DR. KREAMER: CW3 shows a storage

13 coefficient which is almost two orders of magnitude

14 different than the rest.

15 Storage coefficient is release of water to

16 a pumping well, and the question is: where did that

17 extra water come from? It's not generally over the

18 whole site, as shown in the other monitoring wells;

19 it's very localized.

20 If you look at the stratigraphy and the

21 top of the formation and the bottom of the formation,

22 they're irregular. Within 1,000 feet, they change as

23 much as 80 feet in elevation (audio interference) that

24 the leakage that is shown at CW3, as evidence in a

25 hard way to see in the Theis drawing that was

1 provided, but was not provided in the Jacob-Cooper,
2 which would have shown it more dramatically.
3 I guess, this leakage was not well
4 discussed in the document, did not account for
5 alternative opinions. There was one -- they opined
6 that it was ancestral stream channel heterogeneity,
7 which in itself sort of invalidates the assumptions of
8 the whole technique of the Theis and the Cooper-Jacob.
9 JUDGE WARDWELL: And where can you lead us
10 to a demonstration that, if in fact what you say is
11 correct, that this would somehow change the
12 conclusions in the applicant's and the staff's
13 documents?
14 DR. KREAMER: If you go to all the major
15 textbooks that describe hydrology and pumping tests,
16 aquifer tests, when they talk about Jacob-Cooper, they
17 show a deviation from a straight line, which is a
18 classic difference.
19 If you -- if industry had done the
20 drawdown test on Jacob-Cooper, you would see this
21 dramatic change, this recharge boundary, which
22 indicates that a whole lot of water showed up that
23 shouldn't have showed up.
24 So, and it's localized, it's not over the
25 whole site, as I think was opined by one of the people

1 from CBR. So, I guess, the concern is, where is this
2 localized water coming from? Why does it vary the
3 Jacob-Cooper straight line analysis --
4 JUDGE WARDWELL: Excuse me --
5 DR. KREAMER: -- for the 30 percent --
6 JUDGE WARDWELL: Excuse me, but my question
7 was, where do you show the demonstration that this has
8 an impact on the conclusions that are reached in those
9 documents, such that they might change?
10 I'm not interested in potentials or maybes
11 or has a possibility of, I'm interested in, where have
12 you taken the steps to show that, in fact, if you
13 incorporate your position, it has an effect on the net
14 result of what we're here to assess?
15 DR. KREAMER: Without -- there's not enough
16 information provided by industry to make those
17 analyses, Your Honor. They --
18 JUDGE WARDWELL: Have you requested that
19 information from them?
20 DR. KREAMER: I'm sorry?
21 JUDGE WARDWELL: Have you requested that
22 information from them during your review process,
23 prior to the preparation for this hearing?
24 DR. KREAMER: If somebody doesn't do
25 fracture analysis, you can't mathematically go through

1 it. If people would just use homogeneous isotropic
2 equations --
3 JUDGE WARDWELL: Is your answer a no, then?
4 DR. KREAMER: Pardon?
5 JUDGE WARDWELL: Is your answer to my
6 question a no, then? I asked you a yes/no question
7 and --
8 DR. KREAMER: The answer to your question
9 is, no, there was not enough data available for me to
10 do extra analyses.
11 JUDGE WARDWELL: Say that sentence again;
12 you were stepped on.
13 DR. KREAMER: I'm sorry, you're not
14 speaking in the microphone; I couldn't hear that last
15 question, Your Honor.
16 JUDGE WARDWELL: Could you say your answer
17 again? Because you were --
18 DR. KREAMER: There was not enough
19 information for me to do those analyses, Your Honor.
20 JUDGE WARDWELL: And my question to you
21 was: did you ask the applicant for the information
22 needed to make your evaluation and analysis?
23 DR. KREAMER: I did not; no, Your Honor.
24 JUDGE WARDWELL: Thank you. Under
25 anisotropy, we have covered this in detail in Section

2.5, need not repeat it.

And again, I'll turn to Dr. Kreamer. Do you have any evidence that you have done that demonstrates that more intense anisotropy would result in a change in the scientific conclusions that the applicant and the staff have made in their documents?

DR. KREAMER: I've looked at the geophysical logs, Your Honor, and there is variation with verticality throughout the formation, the Basal Chadron Chamberlain Pass Formation. So, there's obvious vertical changes and so obvious anisotropy. I did not quantify that, Your Honor.

JUDGE WARDWELL: Okay. Thank you. NRC, and while we have resolved that, I have a few more questions in regards to anisotropy, and I'll start with NRC at their Exhibit 014, Answer 23, at Page 25, where you state, in regards to the use to the Theis approach, staff notes that these methods have been adopted in ASTM standards, and you reference NRC017 as the exhibit number, and in practice, these methods have been applied to heterogeneous anisotropic aquifers.

And my question to NRC is, while the standards describe how to run the test, whether or not you select to use this method, if aquifer conditions

1 are not adequate for the assumption, is within the
2 test?
3 What I'm trying to say is, the standards
4 describe the test, but they don't describe when you
5 should use them or when you should not use them. Is
6 that correct?
7 MS. STRIZ: No, I disagree. They do
8 describe when you should and when you should not use
9 them.
10 JUDGE WARDWELL: And how do they do that?
11 MS. STRIZ: They state that you have to
12 have an understanding of the conceptual model of the
13 site before you begin the pumping test and what you
14 expect to see, and then you conduct the pumping test
15 and see if it deviates from that conceptual model. If
16 it deviates, then you should look at using other
17 methods of analysis to reach your conclusions.
18 JUDGE WARDWELL: Okay. Thank you. At that
19 same page number, you state that, if -- as Dr. Kreamer
20 suggests -- the methods are only applicable if
21 assumptions are strictly adhered to, the methods would
22 never be applicable, because no hydrogeologic system
23 could meet them.
24 At some scale, all geologic systems are
25 heterogeneous and anisotropic, and the application of

1 these basic equations to these systems is done with
2 the understanding of the assumption inherent in their
3 use.
4 My question for -- I'll start off with the
5 Crow Butte. From the type curves, how would you know
6 when the use of the type curves should be abandoned?
7 MR. LEWIS: Your Honor, if there's
8 significant deviation from a type curve, normally, you
9 would look at the physical conditions that might lead
10 to those deviations.
11 With respect to the MEA, in Monitor Well
12 Number 3, which seems to be the focus of this
13 discussion, the flattening of the curve, the deviation
14 there, I'd explain that as the variation in
15 transmissivity to the west and the northwest of the
16 pump well within the radius of influence.
17 That same interpretation was utilized at
18 the Crow Butte facility to explain a similar effect of
19 the flattening of the curve in late time and was
20 accepted by parties.
21 So, in my opinion, you don't need to rely
22 on leakage analysis that, for seven of eight of the
23 monitor wells, there is no appearance of leakage.
24 Seven out of eight of those type curves fit a normal
25 Theis curve for a confined aquifer very well.

1 To suggest we needed to do a leaky
2 analysis on a single well location, when there are
3 other more obvious conceptual reasons for the
4 flattening of that curve is unnecessary.
5 JUDGE WARDWELL: In your first statement,
6 you said the type curves should be abandoned when you
7 see a significant discontinuity from the curve. And
8 that leads to the obvious question of, what is the
9 definition of a significant discontinuity?
10 MR. LEWIS: Your Honor, there is
11 professional judgment involved with that statement.
12 A significant deviation, significant flattening of the
13 curve that is visually obvious. I don't know how to
14 go into a greater quantification of that. It's a
15 professional judgment.
16 JUDGE WARDWELL: Okay. Thank you. Is it
17 feasible to use a portion of the type curve that does
18 match, even though there -- and what faith do you have
19 on the aquifer values from that, when there is good
20 explanation as to why there's unmatched points that
21 exist in other portions of the type curve -- of the
22 data from the type curve?
23 MR. LEWIS: If I understand your question
24 correctly, Your Honor, in general, there would be
25 greater emphasis on the middle to late time data on a

type curve, because it avoids the wellbore storage and inertial effects that are typically present in early time.

That has been demonstrated very well in previous testimony. And in particular, at the MEA, the wellbore storage is very large and pumped well.

Certainly, more than the first 45 minutes of the data would be suspect, given that the early inertial time effects are greater than those that we saw at the CBO site, in which 47 minutes, I believe, was the calculation for inertial effects to have been important. So, there are reasons to focus the analysis on the middle and late time --

JUDGE WARDWELL: Well, let me --

MR. LEWIS: -- portion of the curve.

JUDGE WARDWELL: Let me explain my question to you more, you're going off-kilter a little bit, and I've probably confused you.

But my simple question is, if there are deviations from the type curve, over only portions of the data, is it still permissible by the testing standards and is it common practice to match the type curve to only a portion of the data?

MR. LEWIS: Yes, Your Honor.

JUDGE WARDWELL: Thank you.

1 MS. STRIZ: Your Honor, may I please make
2 an addition to help clarify this?
3 JUDGE WARDWELL: Yes, go ahead.
4 MS. STRIZ: Theis' non-equilibrium
5 solution to what is known as the diffusivity equation,
6 which is the equation that solves for the head in an
7 aquifer, in a radial flow to a well, has to be
8 satisfied.
9 So, when you look at a pumping drawdown
10 curve, you have to pick the portion of the curve that
11 is fully developed radial flow. Fully developed
12 radial flow cannot occur if there are wellbore
13 effects, such as wellbore storage and inertial
14 effects, such as Mr. Lewis just described.
15 I have looked at these drawdown curves, as
16 I explained in my earlier testimony, because they were
17 close to the pumping well.
18 If you recall, I said I was concerned
19 about N3 in particular, because it was two orders of
20 magnitude different in storage coefficient, and I was
21 curious as to why.
22 I used a technique that is used in the
23 petroleum industry to look at the derivative of the
24 drawdown with time. And that particular technique
25 allows you to see the section of the curve that is

1 fully developed radial flow. That is the only place
2 you can fit the Theis curve. As I explained to you,
3 I saw effects --
4 JUDGE WARDWELL: Well, that's fine, I think
5 you've explained it before. This is getting
6 repetitive and --
7 MS. STRIZ: It was late time.
8 JUDGE WARDWELL: -- without --
9 MS. STRIZ: And then, all the order --
10 JUDGE WARDWELL: We're aware of this.
11 MS. STRIZ: -- of magnitude difference is
12 gone.
13 JUDGE WARDWELL: Thank you. Dr. Kreamer,
14 have you ever used the Theis curve fitting method in
15 your career?
16 DR. KREAMER: Pardon?
17 JUDGE WARDWELL: Have you ever used the
18 Theis type curve fitting your career, to evaluate
19 pumping tests?
20 DR. KREAMER: Thousands of times throughout
21 the world.
22 JUDGE WARDWELL: Again, I didn't hear that.
23 It's -- could you repeat that, I couldn't hear.
24 DR. KREAMER: Yes, Your Honor. Thousands
25 of time throughout the world.

1 JUDGE WARDWELL: Okay. Is there anything
2 wrong with fitting type curves for -- in a well that
3 doesn't have the perfect shape of a type curve, is it
4 still permissible to take any credence in the values
5 you get, if in fact you match only a portion of the
6 type curve that fits, whose data fits the type curve
7 shape?
8 DR. KREAMER: It depends on how bad the fit
9 is, Your Honor.
10 JUDGE WARDWELL: And -- okay. So, there
11 are cases where, if it does fit in the middle, there's
12 nothing wrong for doing that in regards to deriving
13 those aquifer parameters, which are the result of this
14 curve fit. Is that not correct?
15 DR. KREAMER: It would be lousy aquifer
16 parameters that you derived, but they would be
17 derivable.
18 JUDGE WARDWELL: Okay. Thank you. Section
19 4.2 of mine evidence, indicating hydrologic
20 confinement of the production zone, OST Exhibit 014,
21 Rebuttal at 3, Number 8, states that CBR argues and
22 NRC staff accepts as established that vertical
23 differences in the water quality indicate confinement
24 of the Basal Chadron Chamberlain Pass Formation.
25 This premise is scientifically unsound for

1 two reasons. The first is that any drawdown leaking
2 water would be expected to change chemical composition
3 and passing through fractures in the heterogeneous
4 claystones overlying the Basal Chadron Chamberlain
5 Pass Formation.
6 And I guess I'll start with CBR. Doesn't
7 the point raised by the Tribe refute any hypothesis
8 that the chemical change in the water quality between
9 the Brule aquifer and the Basal Chadron aquifer is not
10 a sign of containment?
11 MR. LEWIS: I'm sorry, could you rephrase
12 the first part of that question?
13 JUDGE WARDWELL: Probably have to rephrase
14 the whole question, because I sure as heck can't
15 remember what it was as I was trying to word it.
16 The rebuttal testimony says that downward
17 leakage of water would be expected to change the
18 chemical composition in passing through the fractures
19 of the heterogeneous claystones overlying the Basal
20 Chadron Chamberlain Pass Formation. That's the
21 rebuttal testimony.
22 I'm questioning that, with this, if you
23 accept that position, would not that position throw
24 out, as a sign of containment, the variations in
25 chemical compositions between that of the Brule and

1 that of the Basal Chadron, because of the change in
2 the chemical composition that would occur as water
3 flows down 300 feet between the two aquifers?
4 MR. LEWIS: Well, Your Honor, in looking at
5 that information, the chemical quality of the waters
6 is very different. I think that's consistent with the
7 fact that there's a very small amount of downward flow
8 or recharge into the Basal Chadron. I think the water
9 quality is consistent with that concept.
10 JUDGE WARDWELL: Dr. Kreamer, do you
11 believe that this change in the chemical composition
12 would be so severe as to make the compositions between
13 the Brule and the Basal Chadron display the
14 differences that they do in this situation?
15 DR. KREAMER: Absolutely. Would you like
16 a brief explanation, Your Honor?
17 JUDGE WARDWELL: Sure.
18 DR. KREAMER: As you know from your
19 background, the clay has got tremendous surface area
20 and, therefore, water that percolates through clay,
21 quickly or slowly, has the potential to change its
22 water quality dramatically. This has been evidenced
23 throughout the world.
24 Even water flowing through fractures,
25 sometimes fractures are not only just fractures, but

1 sometimes they have coatings from deposited materials.
2 That's where some of uranium mines actually, in my
3 neck of the woods, deposit uranium and other metals,
4 in the cracks and fractures, in reducing zones.
5 And so, there's great potential for water
6 quality to change dramatically going through a
7 formation such as what overlies the Basal Chadron
8 Chamberlain Pass Formation. And so, I disagree,
9 respectfully, with the expert, Mr. Lewis.
10 JUDGE WARDWELL: And do you believe that
11 this would take place, even with a fairly rapid
12 velocity of water flow, because we are only concerned
13 about the rapid water flow situation, in regards to
14 destroying any confinement that is demonstrating that
15 there is a real connection between the Brule and the
16 Basal Chadron?
17 DR. KREAMER: That's a great question, Your
18 Honor. Again, this is Dave Kreamer answering the
19 question. It depends on what you mean by rapid. It
20 depends on the strength of the connection.
21 Obviously, if water was being mainlined
22 between the two, it wouldn't have a contact time to
23 change water quality. However, in this situation,
24 with that configuration, in all likelihood it would
25 have plenty of time.

1 When you look at the leakage rates over
2 the site, the immediate response in leakage could be
3 due to water coming from just above the formation.
4 And in the vicinity of the formation, which has
5 already been altered chemically.
6 JUDGE WARDWELL: Okay. Thank you. I'll go
7 back to Crow Butte. Would it be your opinion that --
8 do you agree that chemical transport -- I'm trying to
9 think if there's a better phrase than "chemical
10 transport," but let's leave it at that. If you've got
11 a better term, fine, my mind's losing me for what I
12 want to say.
13 But do you agree that chemical transport
14 is much more complex than hydraulic transport of
15 fluids in porous media in the groundwater?
16 MR. LEWIS: It is more complex, Your Honor,
17 yes.
18 JUDGE WARDWELL: Good, that's what I wanted
19 to make sure. With that, wouldn't it make sense to
20 put less weight in regards to demonstrations of
21 containment between two aquifers on chemical aspects
22 than you would on hydraulic aspects?
23 MR. LEWIS: Sorry, can you restate your
24 question, Your Honor?
25 JUDGE WARDWELL: Given the complexity with

1 predicting and knowing what chemical transport effects
2 would occur, doesn't that lead one to then conclude
3 that when listing the number of items that you think
4 demonstrate containment at a site, that you would put
5 less weight, if any, on any chemical changes that you
6 observe between the two aquifers?
7 MR. LEWIS: Chemical changes between
8 aquifers, I would probably not give as much weight as
9 other lines of evidence.
10 JUDGE WARDWELL: Okay, that's basically
11 what I was after. I wasn't after what you -- I was
12 after you to make a position, I don't care what you
13 said.
14 MR. LEWIS: Right.
15 JUDGE WARDWELL: I hope you don't mean --
16 MR. LEWIS: That was --
17 JUDGE WARDWELL: -- don't refer that --
18 MR. LEWIS: I was --
19 JUDGE WARDWELL: -- I was after you to say
20 that --
21 MR. LEWIS: That answer was responsive --
22 JUDGE WARDWELL: -- if you don't believe
23 it, don't say it.
24 MR. LEWIS: That answer was responsive to
25 your question.

1 JUDGE WARDWELL: That's right, that's what
2 I meant, that's exactly what I said. You didn't hear
3 that, Chair. Oh, man.
4 Moving on to the second point that Dr.
5 Kreamer made in his rebuttal on Exhibit 014, at 3,
6 Number 8, in regards to the second point, the current
7 water quality, i.e., the current water quality
8 differences noted by CBR are under unstressed
9 conditions, not those associated with production
10 pumping and injection.
11 And I guess I'll start off with Dr.
12 Kreamer. What's the relevance or significance of the
13 stressed versus the unstressed conditions? Could you
14 explain that a little more?
15 DR. KREAMER: Well, if there is leakage,
16 and movement is enhanced, there might be a change in
17 water quality that's not evidenced in a more static
18 system.
19 You have the potential for different redox
20 conditions, that is oxidation-reduction conditions
21 above the formation. As we mentioned before, there's
22 a lot of clays, there's a possibility of preferential
23 absorption that goes on in an unstressed condition.
24 If you stress the condition and you pump
25 and inject, you have a possibility of pulsing water

1 and the water quality differences might be completely
2 different.
3 I think this whole argument has to do with
4 the static conditions, but the point is that under
5 pumping conditions, water quality analysis might
6 reveal a better connection than is obvious by the
7 differences, which don't necessarily rule it out.
8 JUDGE WARDWELL: Okay. Thank you.
9 Appreciate that clarification. The next set of
10 questions deal with the different signs of containment
11 that the applicant maintain are indicative of
12 confinement.
13 And I think I'd like to read them all
14 through first, to make sure I have got all of them and
15 that I've got it paraphrased or selected correctly
16 from the reference document and page numbers that I
17 have taken it from.
18 And then I'm going to turn to Dr. Kreamer
19 and ask him why he feels those aren't correct
20 indications of containment and whether or not he's got
21 similar observations that support his premise that in
22 fact there isn't containment. And I think they're two
23 different things.
24 It doesn't mean, in the second instance,
25 it doesn't mean that you just disbelieve this, it's

that, gee, you've got something -- it doesn't have to be the same type of issue in this containment -- and maybe we can just do that second one after you get through your comments on why these particular indications that they're counting on for containment aren't correct.

And then, after we get done that, I'll ask you what other observations you have, or a summary of your observations that support your position, which I believe is that there is not sufficient containment.

And by that, I don't mean, oh, we've got anisotropy, we've got this and that may lead to this, or whatever. I would like the same types of demonstrations that -- distinct items that they have presented that display it.

If you have any others that you haven't already, or even those that you have talked about, that point to the fact that you have uncontained or direct communication between the Brule and the Basal Chadron, to the point that, again, mining could not move forward and the conclusions that were reached by the applicant and the staff in the documents would change.

So, that's where we're going with all of this, as kind of a preview. If there's any other way

you would like me to do it, just let me know, but let's start in with this. And again, I think I'm just going to read through them now and then, go back up through them one by one.

I have used NRC's documents as references, just because they summarized them in a nice fashion in a couple spots, so I stole them right out of there, is what I think I did. But it's been a while since I've done this.

And -- but I think I'd like to start, because they're Crow Butte's, I believe all of them are, and they're derived from Crow Butte's work and their application and the NRC didn't make them up, they took them from your application, so I think you should be the ones responding to them. So, anyhow. The first set of them, I reference NRC Document 001, Answer 21, at Pages 28 to 31.

The first one is site-specific --- and now my mind's not working -- x-ray diffraction, I couldn't remember what XRD stood for, x-ray diffraction analyses, particle grain size distribution analyses, and geophysical logging, confirming the presence of a thick (between 360 and 450 feet) laterally continuous, upper confining layer, consisting of low permeability mudstone and claystone (with a falling head parameter

1 testing measure hydraulic conductivity of 1.3 times
2 ten to the minus seven centimeters per second) and a
3 thick (more than 750 feet) regionally extensive lower
4 confining layer, composed of very low permeability
5 black marine shale, demonstrating that the hydraulic
6 resistance to vertical flow is expected to be high,
7 due to the significant thickness of the upper and
8 lower confining zones within the MEA.
9 The next bullet item that I have is that
10 the results of the May 2011 aquifer pumping test
11 demonstrate no discernable drawdown in the overlying
12 Brule Formation observation wells.
13 The third bullet item is that the large
14 differences in the observed hydraulic head (330 to 500
15 feet) between the Brule Formation and the Basal
16 Chadron Formation is there and would not occur if the
17 overlying strata were not effective.
18 Fourth, that the potentiometric surfaces,
19 that is the water pressure levels, measured within the
20 Brule aquifer are several hundred feet higher than
21 those measured in the Basal Chadron Chamberlain Pass
22 Formation aquifer, Section 3.2.3.
23 As a result, any amount of groundwater
24 movement through the confining units would be downward
25 from the Brule aquifer into the Basal Chadron

1 Chamberlain Pass Formation aquifer, thus the confining
2 units that indicate strong vertically downward
3 gradients and minimal risk of natural occurring
4 impacts to the overlying Brule Formation.
5 The next one is, based on a comparison of
6 the major ions and cations, significant horizontal
7 differences exist in geochemical groundwater
8 characteristics between the Basal Chadron and the
9 Brule Formation.
10 And then, the last one, that based on the
11 age dating of isotopes, as discussed in Section
12 3.3.2.1 at 3-28 of the staff's EA, the Arikaree
13 aquifer (which is 150,000 to 250,000 years old), the
14 Brule aquifer (which is 250,000 to 300,000 years old),
15 and the Basal Chadron Chamberlain Pass Formation
16 aquifer (which is 300,000 to 500,000 years old) have
17 large groundwater age differences.
18 The next two items were from NRC014,
19 Answer 15, at Page 15. That pressure effects -- the
20 first one is, pressure effects from pumping at a
21 relatively low rate (27 gallons per minute) were
22 observed at long distances over short periods, which
23 would only occur with confinement of the aquifer.
24 The last one was, that the calculated
25 storativity values range from 1.7 times ten to the

minus three to 8.3 times ten to the minus five, with an average of 2.56 times ten to the minus four, which corresponds to storativity values for a confined aquifer that range between five times ten to the minus five and five times ten to the minus three, referencing NRC015 Todd 1980 at PDF3-4.

CHAIR BOLLWERK: Did you give a reference for the first six? You mentioned that it came from a staff document, but I don't -- did you read the --

JUDGE WARDWELL: Yes, 001, Answer 21, at 28 to 31 --

CHAIR BOLLWERK: Okay.

JUDGE WARDWELL: -- for the first batch. And then, the Rebuttal Testimony 14 at A15 to F15, for the other two.

CHAIR BOLLWERK: All right. Thanks.

JUDGE WARDWELL: Why don't I start with the staff and say, have I missed any that you are aware of that should be added to that?

MR. BACK: I think you've captured them all, Your Honor.

JUDGE WARDWELL: And, CBR? Crow Butte?

MR. STRIVER: I'm sorry, Your Honor, could you repeat the question?

JUDGE WARDWELL: Yes, have I missed any?

1 MR. STRIVER: No, you have not. But I
2 could make one addition. Within the overlying
3 confining unit, there are two widely, widespread
4 blanketed volcanic ash beds that also have very low
5 permeability, the Upper and Lower Whitney Ash, that
6 are contained within the Lower Brule, that are
7 additional vertical permeability barriers.
8 MR. LEWIS: Your Honor --
9 JUDGE WARDWELL: You have so stated --
10 MR. LEWIS: -- I would like to make --
11 JUDGE WARDWELL: -- I will not cover those
12 in these, as summarized by the staff, however.
13 MR. LEWIS: Your Honor, I would like to
14 make an addition to that list.
15 The hydrologic impact assessment that was
16 performed demonstrates a very low amount of leakage
17 where recharge could exist over that large radius of
18 influence of the operating facility, a total discharge
19 from the aquifer of less than 300 gallons a minute
20 from pumped wells. If we have a leaky aquifer, that
21 type of situation can exist.
22 During the impact modeling that I
23 performed, I did attempt to fit a leaky aquifer
24 solution to the historic drawdown at the operating
25 facility and could not achieve any drawdown at the

Marsland Facility using any of the type curves from a leaky aquifer.

JUDGE WARDWELL: Okay. Thank you for sharing that. I will not plan on adding that to, at least to the list of ones I would like to cover. I think both those points are within the testimony and not necessarily separate items, or for other reasons, not planning on discussing those.

So, Dr. Kreamer, I'd like to start with the site-specific x-ray diffraction analyses, particle grain size distribution analyses, the geophysical logging, the presence of a very thick laterally continuous upper confining layer that's consisting of low permeability mudstones and claystones, and a thick lower confining layer of the marine shale, demonstrating that the hydraulic resistance for vertical flow is expected to be high and due to the significant thicknesses of the upper and lower confining layers within the MEA. And how do you dispute that as one sign of containment?

DR. KREAMER: I'm happy to respond. Thank you. Your cup that's next to you is probably holding water, I assume it's water, and it's probably got low permeability. But if we put a crack in it, I think your computer might get wet.

1 No fracture analysis was done. And the
2 important thing here is that what is unstated is
3 there's circular reasoning going on.
4 The system is assumed to be layer cake,
5 homogeneous, isotropic media. That's the operating
6 conceptual model that Dr. Striz talked about. With
7 that bias, with that operating assumption, other
8 things follow.
9 It follows that, if it's layer cake,
10 without fracture analysis, if you look at low
11 permeabilities in a big zone, they'll block water.
12 But the operating assumption is, you have homogeneous
13 layer cake layers, which are not demonstrated at the
14 site.
15 And in writing, we disagreed with, all
16 parties disagreed with it in writing when we described
17 these aquifers. They were not homogeneous. And so,
18 I guess, those two points, one, in the absence of
19 fracture analysis -- I'll say one more thing, let me
20 add a third.
21 JUDGE WARDWELL: No, I don't think -- no,
22 I'm going to interrupt you, I think. Because --
23 DR. KREAMER: Okay.
24 JUDGE WARDWELL: -- you start spanning all
25 of the other ones also, because then you disregard all

1 the other signs in this process. Under this
2 particular --
3 DR. KREAMER: I think I --
4 JUDGE WARDWELL: -- bullet item --
5 DR. KREAMER: I think --
6 JUDGE WARDWELL: Excuse me. Under this
7 particular bullet item number, what I would look for,
8 your first sentence was valid, in regards that you
9 think there's fracturing there.
10 But now, I would like to see, what is your
11 evidence that there -- you say there may be
12 fracturing. Where is your evidence that you use to
13 convince yourself that in fact the fracturing is there
14 sufficient, such that containment is not demonstrated?
15 And with --
16 DR. KREAMER: Great question.
17 JUDGE WARDWELL: -- and that's what I'd
18 like to know. What do you use for your evidence that
19 tells you the fracturing is there to the degree that
20 containment, sufficient containment is not achieved?
21 DR. KREAMER: I'm happy to respond to that,
22 Your Honor.
23 JUDGE WARDWELL: Please do.
24 DR. KREAMER: It seems like the most
25 leakage that was evidenced in the pumping tests very

1 clearly was CW3. If you look at the --

2 JUDGE WARDWELL: Okay. I don't think we

3 need any more, because we're not rehashing the

4 testimony. I think we've been through that well. I

5 understand your position, I don't need any more than

6 that. Now, you've given me that point in regards to

7 your --

8 DR. KREAMER: No, Your Honor.

9 JUDGE WARDWELL: -- what you're pointing

10 to. Do you --

11 DR. KREAMER: No, Your Honor.

12 JUDGE WARDWELL: -- have any others --

13 DR. KREAMER: I was going to make a further

14 point.

15 JUDGE WARDWELL: -- that you'd like to say?

16 Say again?

17 DR. KREAMER: What I was going to say is --

18 JUDGE WARDWELL: Let me interrupt --

19 DR. KREAMER: -- the way that the --

20 JUDGE WARDWELL: I'm sorry. I'm going to

21 interrupt you again. I'm going to interrupt you again

22 and I apologize.

23 DR. KREAMER: I was talking over you, I

24 apologize.

25 JUDGE WARDWELL: I want to put a little

1 more boundaries on what we're dealing with here. This
2 is mostly a synopsis to refresh our memories of
3 everything we've been over these last three days, so
4 I don't want a regurgitation of everything we've been
5 over.
6 And that's one of the reasons why I'm not
7 going to add on what Crow Butte wanted to add on for
8 additional ones. We've talked about that to a certain
9 degree, it's there, we've got it in the record. This
10 --
11 DR. KREAMER: I want --
12 JUDGE WARDWELL: -- the goal --
13 DR. KREAMER: No, no, there's something
14 that's --
15 JUDGE WARDWELL: -- of this --
16 DR. KREAMER: -- not in the record, Your
17 Honor.
18 JUDGE WARDWELL: If I --
19 DR. KREAMER: There's something that's not
20 in the record --
21 JUDGE WARDWELL: If I might continue --
22 DR. KREAMER: -- that I was going to say.
23 JUDGE WARDWELL: If I might continue --
24 DR. KREAMER: What I was going to talk
25 about is structural geology and stratigraphy. And in

1 the area of CW3, there is a dip in the Pierre Shale,
2 below that location, and above, in the top of the
3 Basal Chadron.
4 Now, the opinion that this is evidence of
5 an ancestral stream channel is against the idea that
6 there's a dip also above. In other words, this
7 formation has a lowered elevation, below and above,
8 the location here.
9 It's got variations in the location of the
10 top and the bottom of the Chadron Formation, the Basal
11 Chadron. This is not something we've discussed
12 before, this is new information.
13 And so, if you have an ancestral stream
14 channel in the Pierre Shale years ago and it fills up
15 with sediment, you would expect the top of that to be
16 flat. Do you follow what I mean?
17 The top of the Chadron, when it became
18 sandstone, would be flat. But we don't see that, we
19 see a dip in the top of the Basal Chadron, and that
20 indicates possible fracturing. That's all I wanted to
21 say.
22 JUDGE WARDWELL: Okay. Could you --
23 because you started talking when I was talking, I did
24 not catch your reference for where you saw this dip.
25 I also do not want to start bringing up new

1 information, I don't -- why didn't you bring this up
2 before?
3 But we will investigate, and we'll talk
4 about this now, but give me the cite where you're
5 showing that this has showed up, so that I can have
6 the other parties respond to this. And that's what
7 we're going to have to go through.
8 That's not the purpose of these questions
9 from now on, though. Any information should have been
10 brought up before, so we could have covered it when we
11 were talking about that topic and you had the
12 opportunity to do that.
13 DR. KREAMER: I was trying --
14 JUDGE WARDWELL: But tell me what is the
15 reference that you're using that showed this dip, and
16 then repeat what you were saying, so we can look at
17 the diagram while you're describing it.
18 DR. KREAMER: Certainly. This is in the
19 hydrologic report, I can give you the number of the
20 hydrologic report, it is, hang on a second, the
21 evidence number is Exhibit CBR016, Appendix F, the
22 Marsland Pumping Final Test. I'm talking about
23 Figures, basically Figures 10 and 11.
24 JUDGE WARDWELL: And can we call those up,
25 please, Joe? As we move forward, while he's --

1 DR. KREAMER: In answer to your question as
2 to why I didn't bring it up before, Your Honor, it's
3 -- I was trying to do that and I was unable to
4 articulate it entirely by the length of the question
5 period I had before.
6 And I had apologize, I was trying to say
7 that when I was describing what was happening at CW3.
8 May I ask one other question, Your Honor?
9 I guess, Dr. Striz talked about an
10 inertial analysis, I did not see that in the
11 documentation, and I was not able to look at that.
12 And if a reference to that inertial analysis can be
13 made and where it's in the documentation, I would
14 appreciate it.
15 JUDGE WARDWELL: While Joe is working on
16 that, Dr. Striz, would you like to respond to Dr.
17 Kreamer?
18 MS. STRIZ: I discussed this on the second
19 day of testimony and described to you that I was
20 concerned that there was a different storativity near
21 the wellbore and that I had conducted this analysis on
22 my own and have --
23 JUDGE WARDWELL: Okay. So --
24 MS. STRIZ: -- not provided it --
25 JUDGE WARDWELL: -- he can refer to that --

1 MS. STRIZ: He can refer --
2 JUDGE WARDWELL: -- the transcript from --
3 MS. STRIZ: -- to the testimony --
4 JUDGE WARDWELL: -- that testimony --
5 MS. STRIZ: -- and my recent testimony.
6 JUDGE WARDWELL: -- to resolve his
7 question. Thank you.
8 DR. KREAMER: Was that in the written
9 documentation, Dr. Striz?
10 JUDGE WARDWELL: Moving on to, what figure
11 numbers were these, Dr. Kreamer, that you were looking
12 at?
13 DR. KREAMER: 10 and 11.
14 JUDGE WARDWELL: So, here's 10.
15 DR. KREAMER: Yes, that's a good one to
16 start with; 10 is a good one to start with, Your
17 Honor.
18 JUDGE WARDWELL: Well, tell us about it,
19 now you've got to go through this again. What's your
20 position on this? That you think shows there's
21 connection between the Brule and the Chamberlain Pass
22 Formation?
23 DR. KREAMER: Again, if that could be blown
24 up in the middle, it would be easier to see. It's a
25 little bit small. But in the center of that document,

1 right there, is the pumping well and CW3.

2 This is a map of the top of the Pierre

3 Shale, I believe. And this shows the elevation above

4 sea level. It would help to blow that up even more so

5 the contours are visible to everyone. Okay, that's

6 good. That's good, that's very good right there. All

7 right.

8 In the opinion, in the document I just

9 referred to, it's opined that the high hydraulic

10 conductivity in the leakage that is shown in CW3,

11 which is near the center of that particular picture,

12 is due to an ancestral stream channel. The --

13 JUDGE WARDWELL: I don't -- I'm sorry, I

14 can't see CW3.

15 MR. STRIVER: Your Honor, that's Monitor 3.

16 JUDGE WARDWELL: Sorry.

17 MR. STRIVER: I'm sorry to interrupt, Your

18 Honor. That CW3 is Monitor 3.

19 JUDGE WARDWELL: Oh, okay. Where's the CW

20 come, is that -- CW, is that what you used?

21 MR. STRIVER: Yes, CW is for the Pumping

22 Well 1A, Monitor 3 is apparently CW3.

23 JUDGE WARDWELL: Do you mean Monitoring 3?

24 Where did you get the CW3 from, Dr. Kreamer?

25 DR. KREAMER: I got it from the charts that

1 are presented elsewise. The 1A is listed as CWP.
2 JUDGE WARDWELL: Right, because that's the
3 pump well, but the others aren't. Anyhow, you mean
4 Monitor 3?
5 DR. KREAMER: I mean Monitor 3, yes, Your
6 Honor. In this particular picture, it's Monitor 3.
7 JUDGE WARDWELL: Okay.
8 DR. KREAMER: In the graphs and charts that
9 go with this, it's CW3.
10 JUDGE WARDWELL: Okay. So, turn to Monitor
11 3, Joe. So, we're going to go down to the charts of
12 Monitor 3? You better back up the -- no, not --
13 sorry, Joe.
14 You've got to, what I meant was, you've
15 got to back off the exaggeration and get it so it's --
16 you were just looking at -- when you're down here,
17 Joe, if you just come over here to the third one to
18 the right, it'll give it the full size.
19 And we want to start with that, so then
20 zoom in. And then, when we get done with the diagram,
21 zoom back out to that, by just poking that. And I
22 think that will move faster.
23 Now, if we could go down, to come up with
24 Monitor 3, I believe is what you're after, Dr.
25 Kreamer? No, don't do any exaggeration, scroll down.

1 There you go. You're now after the response in that
2 well. Is that correct, Dr. Kreamer?
3 DR. KREAMER: I'm sorry, your mouth was
4 away from the microphone, and I didn't hear it.
5 JUDGE WARDWELL: What do you want to see
6 now? What figure do you want to call up?
7 DR. KREAMER: Figure 10, sir, the one we
8 were on. Figure 10 and Figure 11.
9 JUDGE WARDWELL: What do you want to say
10 around that? We were there, I thought you wanted to
11 move to something else. But go ahead.
12 DR. KREAMER: Okay. What this figure shows
13 is, around Monitoring Well 3, which is where the
14 leakage is, there's a lowering of the contact below
15 the formation of interest.
16 That is the contact between the underlying
17 Pierre Shale and the overlying Basal Chadron
18 Chamberlain Pass Formation. The reason that was given
19 in the hydrologic report as to --
20 JUDGE WARDWELL: Wait a minute --
21 DR. KREAMER: -- as to what --
22 JUDGE WARDWELL: Excuse me --
23 DR. KREAMER: -- as a possible --
24 JUDGE WARDWELL: Excuse me, this is not
25 working. You said --

1 DR. KREAMER: I'm sorry?

2 JUDGE WARDWELL: -- a statement about --

3 the first sentence out of your mouth, I don't see that

4 on here. You said something about there's -- I can't

5 even remember what you said, but say your first

6 sentence again.

7 DR. KREAMER: These are elevations above

8 ground surface, Your Honor. And so, it shows the

9 contact between the Pierre Shale and the overlying

10 Chadron, Basal Chadron.

11 JUDGE WARDWELL: Okay. And what is your

12 point --

13 DR. KREAMER: And so, the --

14 JUDGE WARDWELL: What is your point in

15 regards to Monitor 3? What is your point in

16 regards to Monitor 3?

17 DR. KREAMER: I'm sorry. I talked over

18 you, I'm sorry.

19 JUDGE WARDWELL: What is your point of

20 Monitor 3?

21 DR. KREAMER: The point is that faults

22 could be indicated by the depression in the Pierre

23 Shale --

24 JUDGE WARDWELL: Stop.

25 DR. KREAMER: -- as echoed --

1 JUDGE WARDWELL: By the depressions, you
2 mean the fact that it's in a contour zone area that's
3 lower than the surrounding. Is that a fair assessment?
4 DR. KREAMER: Yes, sir.
5 JUDGE WARDWELL: Continue.
6 DR. KREAMER: All right. It was opined
7 that this was an ancestral stream channel, and that's
8 why there's high hydraulic conductivity by the
9 hydrologic report that we're talking about.
10 If we now go to Figure 11 and look at that
11 same area, we'll now look at the contact between the
12 top of the Basal Chadron and the overlying aquitard.
13 Now, that -- I'm sorry, I might have the wrong one
14 there. No, that's the -- I've got the wrong number
15 there, let's try 9. Sorry, 9. Thank you.
16 So, this is a map of the top of the Basal
17 Chadron, where it contacts above. If you notice,
18 there's that same trough, that same depression,
19 running through this site, particularly localized near
20 the wells of concern, where there might be leakage.
21 Now, if this was an ancestral stream
22 channel in the Pierre Shale, subsequent sedimentation
23 would build up and flatten above it. And so when you
24 got to this map, it should be pretty flat.
25 But what we see is a depression both in

1 the underlying basement formation and the overlying
2 formation, indicating that everything went down. If
3 everything went down, that's one indication that
4 there's possible fractures in this area that are the
5 reason why we see added leakage in this area. That is
6 my point, Your Honor.
7 JUDGE WARDWELL: Okay, thank you. Crow
8 Butte, would you like to respond to the comparison of
9 these two structural contour maps at this location?
10 MR. STRIVER: Yes, Your Honor. Figure 10
11 is a structural contour map to the top of the
12 elevation of the Pierre Shale. It's an erosional
13 surface where this ancestral stream channel was
14 meandering through this area over a width of several
15 miles, according to all geologic information.
16 When the channels come through, they
17 scour, they meander, and there are stacked series of
18 sands. We have stacked channel sands that occur all
19 through the ancestral valley.
20 So, what we're seeing in Figure 9 -- okay,
21 I'm sorry, we'll stick with Figure 10. That is a low,
22 an erosional low, as a result of erosional -- it's an
23 erosional surface.
24 You'll see it further to the south, you'll
25 see it in -- and so, that's the base part of the main

1 channel that was coming through here at the time of
2 deposition.
3 If we look at Figure 9, you'll see, to the
4 left, right around Monitor 3, that northwest trending
5 contour line, this is the top of the Basal Chadron,
6 that's another channel sand. That's part of a stacked
7 channel sand, most likely, in my opinion.
8 Anything that we would see regarding the
9 fracture system or any sort of -- we would see a
10 linear offset through the Pierre. This is a low, it's
11 an erosional surface, very common on the exposed,
12 Pierre Shale that was exposed for quite a long period
13 of time, in my opinion.
14 JUDGE WARDWELL: Are there any other cross-
15 sections or items that we could look at that would
16 help illustrate whether or not this is a, as I
17 understand Dr. Kreamer saying, an abrupt change in the
18 location of the -- or I should say, the elevation of
19 the Pierre Shale and the top of the Basal Chadron?
20 MR. STRIVER: Yes, Your Honor. We have
21 cross-sections through the pump test area that are
22 included in this report. You can -- if we can have a
23 few minutes to take a look?
24 JUDGE WARDWELL: Sure. A few minutes or a
25 few seconds, just -- do we want to just scroll through

1 them here? If they're in this report, we can scroll
2 through them here, can't we? To see where the one is
3 -- well, the one that has Monitor 3 in it. Can we not?
4 MR. STRIVER: Yes, Your Honor. We need a
5 minute to look at where the cross-sections are
6 developed and to see where -- we just need a minute --
7 JUDGE WARDWELL: Okay.
8 MR. STRIVER: -- if you can bear with us.
9 Okay, Your Honor.
10 DR. KREAMER: Your Honor, if I may say
11 something while they're looking?
12 JUDGE WARDWELL: No, I think they're all
13 set to go.
14 MR. STRIVER: In Figure, of the same
15 report, Figure 6, Cross-Section DD-Prime.
16 JUDGE WARDWELL: Is this the one?
17 MR. STRIVER: Correct.
18 JUDGE WARDWELL: Okay. Now, Joe, can we
19 zoom in? Hit one, just hit it once though. And now,
20 move it up a little bit, pull it up. If you run your
21 -- can you -- if you run your arrow over it, will it
22 allow you to grab it?
23 Or you might be able to turn your arrow
24 into a grabber. Yes, there you go. There. Is this
25 -- did we jump ahead now, or is the cross-section you

1 wanted? We're looking at DD-Prime now.

2 MR. STRIVER: Yes. Yes, Your Honor. DD-

3 Prime is in close proximity to Monitor Well 3. Around

4 in the central part, between N706 and N1372,

5 geophysical logs, in that --

6 JUDGE WARDWELL: Okay.

7 MR. STRIVER: You'll see the base of the

8 Basal Chadron on top of the Pierre. You'll see some

9 variation of the thickness of the Basal Chadron, with

10 the channel sands. And scouring typically occurs at

11 the base of a fluvial system.

12 And no significant offset in the center

13 part, where -- we also have another cross-section in

14 the TR we can refer to, that goes in this similar

15 area.

16 In the Technical Report, CBR006, Cross-

17 Section DD-Prime, that's Figure 2.6-3D, it runs a

18 cross-section of three wells, three geophysical logs

19 of drill holes in that general vicinity also.

20 JUDGE WARDWELL: Okay. Thank you. Dr.

21 Kreamer --

22 DR. KREAMER: Yes.

23 JUDGE WARDWELL: -- can you point us to any

24 cross-section you would rather see that demonstrates

25 your point?

1 DR. KREAMER: Yes, Your Honor.

2 JUDGE WARDWELL: And --

3 DR. KREAMER: If we could go back to the

4 previous figure?

5 JUDGE WARDWELL: No, I want a cross-

6 section. I want to look at a cross -- I've seen your

7 other figure, I don't need that any more. I need to

8 look at -- I want to look at a cross-section of that.

9 And if you don't, that's fine. If either

10 you don't have it or it doesn't happen to pass through

11 that, I understand that. It may not.

12 DR. KREAMER: This cross-section is not

13 through the area of concern exactly.

14 JUDGE WARDWELL: And that's why I'm asking

15 you: do you have one that you want us to look at? And

16 if you don't, I understand why you don't, you haven't

17 looked that up. But I just -- if you did, we could go

18 to it. If not --

19 DR. KREAMER: Well, the previous figure

20 shows where they actually drilled to get these cross-

21 sections. And if you look at the previous figure,

22 you'll see that they're clustered down that center

23 line.

24 And so the changes that would occur

25 laterally on either side of this are not recorded,

1 just because of the lack of bore holes that are in the
2 east-west direction.
3 So, the previous slide showed where the
4 bore holes actually were. It shows how strong this
5 information you're seeing here is.
6 And it also, the comment that -- you see
7 lineaments and things like that, the nature of where
8 they sampled, you would be able to see a lineament if
9 it was there, without a fracture analysis. And that's
10 very, very obvious if you go to the previous figure.
11 JUDGE WARDWELL: Okay. But that's --
12 DR. KREAMER: You'll see that all the
13 borings are clustered down the center line of the
14 property that runs southeast to northwest.
15 JUDGE WARDWELL: So, when we read the
16 transcript of what you've just said, we'll just -- the
17 previous figures you're referring to are the ones of
18 the structural contour maps of the top of the Pierre
19 Shale and the structural contour maps of the top of
20 the Basal Chadron that we were looking at, right?
21 DR. KREAMER: That is correct, Your Honor.
22 JUDGE WARDWELL: Right, Figures 9 and 10?
23 Figure 9 and 10. Is that correct?
24 DR. KREAMER: Yes, sir.
25 JUDGE WARDWELL: Okay. That shows us where

1 we need to go when we look this over, as we evaluate
2 everything that's said here now. So, does this finish
3 up your comments in regards to Monitoring 3?
4 DR. KREAMER: It's the additional
5 information that I wanted to communicate, yes, Your
6 Honor.
7 JUDGE WARDWELL: Do you have any other
8 additional information before we go back to the
9 summary of things?
10 DR. KREAMER: I beg your pardon, sir?
11 JUDGE WARDWELL: Do you have any other
12 additional items that you wanted to bring up related
13 to confinement that you hadn't brought up, like this
14 surprise that you just did bring up, so that we can
15 cover them now, before we go back to what I consider
16 to be a summary of everything that we discussed these
17 last two and a half days and running through that?
18 And so, I want to get through those first. So, do you
19 have some other --
20 DR. KREAMER: I did talk about abrupt --
21 JUDGE WARDWELL: Do you have other pieces
22 --
23 DR. KREAMER: Your Honor, I did talk about
24 abrupt changes yesterday. The answer to your question
25 is, no, I do not have anything else at this time.

1 JUDGE WARDWELL: Okay, thank you. Now
2 might be a good time for lunch. They could check to
3 make sure I haven't left anything else out of the
4 summary. We could start again with the summary right
5 after lunch.
6 CHAIR BOLLWERK: Okay. So, I've got a
7 quarter to 12:00, why don't we go ahead and take our
8 lunch break right now, we'll come back at a quarter to
9 1:00. And, again, what do you want to make sure that
10 they've done?
11 JUDGE WARDWELL: Well, it'll give them
12 another chance to catch up on what I said and to make
13 sure there aren't any huge gaps of ones that have been
14 summarized before, in regards to containment. And Dr.
15 Wireman can look those over and see if he's got any --
16 CHAIR BOLLWERK: Dr. Kreamer?
17 JUDGE WARDWELL: Dr. Kreamer, I got both
18 those wrong, didn't I? I got the last name and the
19 first name, I knew I could get both wrong.
20 (Laughter.)
21 JUDGE WARDWELL: It will give Dr. Kreamer
22 some time to reflect on what he has presented here
23 over the last two and a half days, in regards to just
24 us going through this bullet list of items that are
25 indications of -- summaries of what I think is most of

1 the testimony here, showing those points that support
2 containment and he can bring up his.
3 And probably, that's the fastest, is if,
4 when we go through this, I will ask you, Dr. Kreamer,
5 why you don't believe that particular bullet item is
6 correct.
7 Then when we get all done with that, just
8 period, what is -- why isn't that correct? And then,
9 if you have any other points that you want to bring up
10 in regards to supporting, evidence supporting your
11 position, that it would make a difference in the
12 containment, we'll wrap those up at the end of that.
13 CHAIR BOLLWERK: And let's just make sure
14 everybody has any questions about your list, everybody
15 clear on what the list is? That would be --
16 JUDGE WARDWELL: Yes, it's the list of
17 those bullet items that I just read off that were
18 summaries of the signs of confinement that Crow Butte
19 is relying on to demonstrate that the MEA can be
20 operated as a ISR facility, and able to control their
21 mining fluids.
22 CHAIR BOLLWERK: Dr. LaGarry? All right.
23 Anybody have any questions about the list? Make sure
24 --
25 JUDGE WARDWELL: Of where we're going.

1 CHAIR BOLLWERK: -- Crow Butte? No?
2 Staff? Dr. Kreamer, knows what the list is? Okay.
3 DR. KREAMER: I'm good.
4 CHAIR BOLLWERK: All right, very good. So,
5 why don't we go ahead and take our lunch break?
6 JUDGE WARDWELL: And then, for just one
7 other piece of information. Then, I've got some
8 questions for Dr. LaGarry after we get through that,
9 dealing with the -- your OST20, the Hallum and others,
10 in 2018. And then I'll be done.
11 CHAIR BOLLWERK: All right. Very good.
12 So, a quarter to 1:00, we'll be back in session.
13 Thank you, everyone.
14 (Whereupon, the above-entitled matter went
15 off the record at 11:49 a.m. and resumed at 12:51
16 p.m.)
17 CHAIR BOLLWERK: All right. Let's go back
18 on the record, please.
19 All right. We've had our lunch break, and
20 we're now I think in the final lap here probably. So
21 the plan for this afternoon would be to finish up with
22 Judge Wardwell's questions on concern number 4.
23 Then we'll obviously afford the parties an
24 opportunity to give us any questions they might want
25 us to ask about that particular concern. At that

1 point, we should be done basically with the
2 evidentiary presentations. I know you had a couple of
3 questions you wanted to ask as well.
4 Once we've done that, then we'll deal with some
5 administrative matters, and then we should be
6 finished. So I'm hoping 3:00-ish at the latest maybe?
7 I don't know. We'll have to see how this goes. So
8 we're certainly going to finish this afternoon. No
9 question about that.
10 All right. Anything the parties want to
11 bring to our attention before we start? No? Are we
12 good?
13 All right. Then we'll turn it back over
14 to Judge Wardwell.
15 JUDGE WARDWELL: Except we don't have --
16 we don't have a witness; do we?
17 CHAIR BOLLWERK: Are we missing one? Oh.
18 That would be important. Sorry. Is he here?
19 JUDGE WARDWELL: There he is.
20 CHAIR BOLLWERK: There he is. Good. All
21 right. Is he connected up? He's okay?
22 JUDGE WARDWELL: He's still connected.
23 DR. KREAMER: I can still hear you.
24 CHAIR BOLLWERK: Okay. Good.
25 JUDGE WARDWELL: Good. Okay. Moving

1 along on this list, the next -- the second bullet item
2 -- well, as the results of the May 2011 aquifer
3 pumping test demonstrate no discernible drawdown in
4 the overlying Brule formation observation wells. And
5 I think we've pretty much covered that in detail
6 during the hearing, such that we don't -- I don't
7 think there is any more feedback needed in that.
8 I would be interested, Dr. Kreamer, in
9 your comments in regards to the third bullet item, the
10 large differences in the observed hydraulic head --
11 that's 330 to 500 feet between the Brule formation and
12 the Basal Chadron Chamberlain Pass Formation -- which
13 in the applicant's opinion would not be there if the
14 overlying strata were not effective, i.e. fractured.
15 Do you have any response you'd like --
16 DR. KREAMER: Sure.
17 JUDGE WARDWELL: -- to say in regards to
18 that?
19 DR. KREAMER: Yes, I'd be happy to do
20 that. Can you hear me all right?
21 JUDGE WARDWELL: Yes, I can.
22 DR. KREAMER: All right. Thank you, Your
23 Honor. The last statement in the NRC document that I
24 have in front of me says that the situation you just
25 described, piezometric surface significantly higher

1 than the top elevation of the aquifer, can only occur
2 in a confined aquifer with overlying strata that are
3 effective confining units. That's not true.
4 I live in a valley, in the Las Vegas
5 Valley, that's got a shallow aquifer and a deep
6 aquifer. The deep aquifer has a piezometric surface
7 which is well above the top of that particular
8 aquifer, and it has been noted many times that it's a
9 leaky aquifer. I could cite other examples, but my
10 home one is as -- that statement is false.
11 And so I am in professional disagreement
12 with that, and I can cite other examples if you would
13 like.
14 JUDGE WARDWELL: Okay. Thank you. The
15 next bullet item talks about really the strong
16 downward gradients that are observed between the Brule
17 and the Chamberlain Pass Formations. And that as a
18 result of this downward flow, there is minimal risk of
19 naturally occurring impacts to the overlying Brule
20 Formation. What is your reaction to that?
21 DR. KREAMER: Let's deal with the term
22 "naturally occurring impacts." One impact would be a
23 diminishment of water in the -- in the Brule. That
24 would be a consequence of the situation you just
25 talked about. The Brule flows southeast, as you know,

1 to lakes, rivers, streams, habitats, and people.
2 And I think that part of the job here is
3 to assess whether diminishment of water in the Brule
4 is possible, and to the extent and --
5 CHAIR BOLLWERK: Joe, I think he has
6 dropped out again.
7 Hold on one second, Dr. Kreamer.
8 Dr. Kreamer, if you can hear us, your audio has
9 dropped out. We're trying to fix it.
10 (Pause.)
11 DR. KREAMER: Can you hear me? Hello?
12 JUDGE WARDWELL: Yeah. Now we can hear
13 you.
14 DR. KREAMER: Oh, you can hear me now.
15 JUDGE WARDWELL: Yeah.
16 DR. KREAMER: Did you hear my response, or
17 should I do it again?
18 JUDGE WARDWELL: You'd better do it again.
19 DR. KREAMER: Okay. The fact that there
20 is a gradient, a vertical gradient downward
21 hydraulically means that there is a possibility of
22 diminishment of the Brule aquifer, whether it be over
23 a short period of time or over several decades.
24 Either way, diminishment of that aquifer could affect
25 its flow, which is southeast toward lakes, rivers,

1 habitats, and people. I think it's incumbent upon
2 this group to make sure that that's ensured as well.
3 As far as contaminant movement, it does
4 bode well for vertically upward -- lack of vertically
5 upward contaminant movement. That does not speak to
6 the horizontal movement.
7 JUDGE WARDWELL: Okay. Thank you. The
8 next one talks about the major anions and cations. I
9 think we've talked about the chemical difference
10 between that already earlier today. The last one
11 deals with the dating of the isotopes, and I wondered
12 what your reaction is in regards to those not showing
13 confinement by demonstrating significantly different
14 ages in their constituents.
15 DR. KREAMER: I've done a lot of
16 groundwater dating, and it's refreshing here to see
17 that there are error bars here. It's one of the first
18 pieces of information here that actually has pluses
19 and minuses associated that are so well spelled out.
20 You can notice that the error bars touch.
21 The one age of the Brule aquifer water is the same as
22 the age of the Basal Chadron Chamberlain Pass aquifer,
23 and so these aquifers could be in communication
24 according to this information.
25 When you consider the error bars,

1 personally having done a lot of groundwater dating, I
2 think these error bars, with the methods that they
3 use, are rather constraint. I think that there is a
4 great possibility that these error bars could be
5 bigger than that.
6 And, lastly, I want to point out that when
7 you talk about groundwater age, you're not talking
8 about one age. That's not used anymore. That's
9 old-fashioned. People don't refer to that anymore.
10 What you're talking about is the average residence
11 time when you see these, remembering that you can have
12 a recharge that is nearby where you sample and
13 recharge that's far away from where you sample. What
14 you really measure when you measure age is an
15 integrated sample. The term we use now is not the age
16 of the water but the relative travel time or not --
17 not an absolute one-size-fits-all number.
18 So the fact that these two both touch at
19 300,000 years indicates possible communication between
20 them with the error bars given. And with large error
21 bars it would indicate even more of a possibility of
22 communication.
23 JUDGE WARDWELL: Thank you. Moving on to
24 the two items that were listed under NRC 014,
25 answer 15 at 15, the first one says, "Pressure effects

1 from pumping at a relatively low flow rate of 27
2 gallons per minute were observed at long distance over
3 short time periods," which would only occur with a
4 confined -- confinement of the aquifer. Would you
5 like to express some comments on that, Dr. Kreamer?
6 DR. KREAMER: I think we've gone through
7 how one of the aquifer tests definitely shows leakage,
8 and so the leakage can be localized and still have
9 that effect quantitatively at distance. So you can
10 have that sort of effective distance but still have
11 leakage, and especially if it's localized leakage.
12 That could be very common, to have one area where
13 water is pouring through and other areas which are
14 rather confined and hold water back pretty well. You
15 have that effect.
16 So I don't think that that's definitive
17 evidence at all, Your Honor.
18 JUDGE WARDWELL: Thank you. And the next
19 bullet item says, "The calculated storativity values
20 fall right within the range that would be indicative
21 of a confined aquifer," referencing Todd in 1980. Any
22 comments on that?
23 DR. KREAMER: Well, again, you notice
24 there's two orders of magnitude difference in storage
25 coefficient. There is one storage coefficient, again,

where the leakage occurs which is really high, and the question is: where is all of that extra water coming from?

I think that certainly in other parts of the aquifer with this average test, we have already talked about how you have to take into account the heterogeneities.

That conclusion, if it wasn't for a heterogeneous system, I would say it would be an accurate one. It is consistent with a confined aquifer. But, again, the basic assumption -- the pre-conceived a priori assumption that this is a relatively homogeneous isotropic aquifer I think is a false one, and everything else that flows from that -- that a priori assumption is suspect.

JUDGE WARDWELL: Thank you, Dr. Kreamer. One last question on this -- in this area. It seems to me that you're using extreme situations that may be plausible or may not in regards to your comments on most of these items.

For instance, on the isotopes you said, "Well, it's really the same age because they match at the extremes." And in regards to the downward gradients you say, "Well, we have a leak in this one area," and so that's the end of the world for that.

1 And the same thing with the storativity
2 values, but yet you have to rely on those extreme
3 examples to wipe out each individual one of these.
4 And isn't that really rare, that, yeah, maybe or two
5 of yours are correct, but how -- it would be very
6 unusual, wouldn't it, not to have all of your
7 situations exist, which is what you would have to see
8 to dispute the confinement that Crow Butte is relying
9 on.
10 DR. KREAMER: That's a great question,
11 Your Honor. And I need to answer in the context of
12 why I'm testifying and my background. I've done a lot
13 of contaminant hydrology, and a single fracture can
14 totally destroy a community, it can totally poison
15 people, it can totally wreak havoc.
16 There is not an extreme example. There is
17 a solid example of leakage in the data that has been
18 ruled out, ignored. Part of that has been I guess by
19 some sort of analysis that was done that was not on
20 the record that was referred to by Dr. Striz, some
21 inertial analysis.
22 I was not able to review that analysis, so
23 I don't know how strong that is. But I think that
24 there is definite strong evidence of exceptions.
25 And your point is that for many mining

1 operations, I believe, exceptions don't matter. They
2 are not important. But from a contaminant hydrology
3 standpoint, they are crucial. They are absolutely
4 game changers. The idea that there might be a high
5 permeability trough that runs down the middle of the
6 site, as indicated by the borings, I think is
7 significant.
8 And the fact that there is no fracture
9 analysis when you look at all of the -- when you look
10 at the borings that we looked at and tried to see a
11 change in them, you have to remember that those
12 borings were mostly in the trough. They were all in
13 the trough, and they didn't show any -- any sides of
14 the trough, really, that would show a fracture
15 analysis. So a robust thing that is normally done
16 with contaminant hydrology, including numerical
17 modeling, in my sense of the word numerical modeling,
18 has not been done here, and should be in my opinion.
19 So I think that for operational purposes
20 I think you are absolutely right. I think the
21 analysis that has been done is fine, and satisfies the
22 mining interests that -- whether they can pump the
23 water in, pump the water out.
24 As far as contaminant transport,
25 vulnerability, and the potential for the community, I

1 think not.

2 JUDGE WARDWELL: Okay. Thank you.

3 Moving on to Section 4.3, challenges to

4 the hydrogeologic confinement of the Basal Chadron

5 Chamberlain Pass Formation, OST Exhibit 016, LaGarry

6 rebuttal, at 2 to 3, response to A.27 and 28, you

7 offered items reproduced from your Exhibit 020, Hallum

8 and others, in 2018.

9 Are you -- do you remember that document

10 and that publication?

11 DR. LaGARRY: I have it here in front of

12 me, Your Honor.

13 JUDGE WARDWELL: And, in fact, aren't we

14 actually looking at it as -- I mean, looking at the

15 cover of it as we sit here?

16 DR. LaGARRY: With some note scribbles on

17 it, yes, sir.

18 JUDGE WARDWELL: Did you offer that as

19 merely a reference for us to review and add to the

20 plethora of information we have in regards to this --

21 the characterization of the geology that we're dealing

22 with in this as we evaluate this important project?

23 Or, in fact, do you yourself adopt the seven

24 statements that are presented in this document as your

25 own?

1 Do you understand the difference between
2 the two potential scenarios? And there is no right or
3 wrong. I just wondered, how do you -- how do you view
4 that report? Because my questions will depend on how
5 you review that report.
6 DR. LaGARRY: Let me explain how I view
7 this report, Your Honor. Looking at this report, in
8 some of the figures towards the back, I am looking on
9 -- we don't necessarily have to bring it up unless you
10 -- unless you feel like we really need to. But in
11 Figures 6 and 7 of the report, there are scans of
12 geological maps that form the basis of the data used.
13 These seven maps are seven of the 80 that
14 I mention in my opinion. In my opinion, the original
15 opinion, I talked about the area of this -- the MEA
16 area as being particularly vulnerable. Sir.
17 JUDGE WARDWELL: I think I will -- as
18 you're talking, I think I'd rather look at those as
19 you're talking, so --
20 DR. LaGARRY: Oh, that would be awesome.
21 JUDGE WARDWELL: So give him a second to
22 call that up.
23 DR. LaGARRY: That would be awesome.
24 Thank you.
25 JUDGE WARDWELL: And which figure number

1 were you -- figures numbers were you --

2 DR. LaGARRY: Right now, I'm looking at

3 Figure 6. It's on page 23 of 74. Go down -- go down.

4 Yeah. And you'll want to rotate it. Ah, shazam.

5 JUDGE WARDWELL: Okay. Good.

6 DR. LaGARRY: Okay.

7 JUDGE WARDWELL: And tell us where we're

8 at here.

9 DR. LaGARRY: Well, this is along the

10 Niobrara River.

11 JUDGE WARDWELL: Okay. Good.

12 DR. LaGARRY: The Marsland Expansion Area

13 is just right of center.

14 JUDGE WARDWELL: Right of center. Okay.

15 DR. LaGARRY: Okay.

16 JUDGE WARDWELL: So about where the

17 greenish is, between the green and the -- and the

18 teal. Sure.

19 DR. LaGARRY: Without some reference

20 points directly in the figure, it's hard to orient,

21 but I just did that a minute ago and that was my

22 conclusion. Maybe the -- maybe the teal one or maybe

23 close to the green one.

24 JUDGE WARDWELL: Okay. Yeah.

25 DR. LaGARRY: All right.

1 JUDGE WARDWELL: Got you.

2 DR. LaGARRY: Okay. So these are the
3 maps, some of the maps that I made in the 1990s. And
4 we have talked about them a couple of times in this
5 hearing with respect to my background and what
6 qualifies me to talk about this stuff. Okay? And
7 these are done by pedestrian survey, and the
8 geological lines, maps, pics, all of that, that's my
9 and my junior co-author's work.

10 Okay. So at that time I wrote the opinion
11 some years ago, this work hadn't progressed farther
12 than what I had done in 2006 when the mapping program
13 ended. So the mapping program ended, the state survey
14 and the USGS had the maps, and then things happened in
15 my absence.

16 One of the things that happened in my
17 absence is that the Nebraska -- the Nebraska
18 Geological Survey continued to work on this region and
19 this issue, compile this data, and reach those seven
20 bullet conclusions.

21 Prior to their having done this, when I
22 originally wrote the opinion, some of these
23 considerations in those seven bullets were concerns
24 that I had had at the time of the mapping. At the
25 time of the mapping, my co-author and I had recognized

that in this particular area of the Niobrara River, where the aquifers are exposed and that there is alluvium over it, there was direct communication between the aquifers and it worried me. And that's why I talked about the vulnerability in that -- in that original opinion. That was the basis of those concerns was this map geology.

In the intervening years, those concerns were picked up, not from me or I hadn't communicated them because I hadn't communicated with these people for the years before writing that opinion, but independently from me they came to some of the same conclusions. So when I found this paper, which came out just this past April, I immediately recognized that they had used my data, they had compiled it, other people had looked at it, and they had come to the same conclusions that I had come to.

So some of their bullets I do own, and I will tell you which ones.

JUDGE WARDWELL: Okay. Let's go through one at a time because I'll probably have questions on each one. If you just tell me one, and then I'll ask you some questions on it. And any of those that you are adopting as your own, I'll ask you a couple of questions on them.

1 DR. LaGARRY: That would be awesome.

2 JUDGE WARDWELL: Great. I don't know

3 about awesome, but it would be pretty swell.

4 DR. LaGARRY: Yeah. Yeah. That's a hip

5 term, too, as I understand it.

6 JUDGE WARDWELL: From a different

7 generation, though, don't you think, Dr. LaGarry? I

8 include you in that other generation.

9 DR. LaGARRY: Yeah. But, I mean, the

10 intent is the same.

11 Okay. Bullet number 1, "White River Group

12 outcrops along the valley margins create the

13 impression and subsequent misconception that the reach

14 lacks hydraulic connection between surface water and

15 groundwater. This is not the case locally."

16 I agree with that. That's one that I

17 would own.

18 JUDGE WARDWELL: And so the question I

19 have for you, what -- do you have any idea of what the

20 bounds of your reference to "locally," means? Can you

21 define that?

22 DR. LaGARRY: It would be those seven

23 quadrangles that they talk about. I mean, the areas

24 of greatest concern here on these maps are two areas,

25 a small western one and a large eastern one, outlined

1 in dark, heavy ink. And these are -- these are the
2 places where the groundwater and surface water are in
3 direct communication, which means the fate of one
4 changes the fate of the other, and vice versa. Okay.
5 So an impact to one is an impact to both. Okay?
6 And so that is something that we also
7 concluded, long before all of this was going on, but
8 it hadn't reached publication or anything like that.
9 JUDGE WARDWELL: So as I hear you respond
10 to that locally, certainly means the MEA falls within
11 that definition of "locally."
12 DR. LaGARRY: Yes, it does. They -- by
13 "locally," they mean those seven quadrangles.
14 JUDGE WARDWELL: And I think I've asked
15 you this before, but I'm not sure it's specific for
16 the White River Group. But anyhow, do you have any
17 evidence in regards to outcrops of the White River
18 Group within the MEA, or do you have -- you haven't --
19 do you have any knowledge whatsoever of any outcrops
20 within the MEA?
21 DR. LaGARRY: There are outcrops in the
22 MEA, not White River Group outcrops in the MEA.
23 JUDGE WARDWELL: Thank you. Your next
24 bullet item.
25 DR. LaGARRY: Bullet number 2, "There is

1 sufficient near-surface alluvium to conduct water
2 between the stream and groundwater wells." The second
3 part of that, "Transmissivity is limited by the
4 relative thinness." And I can't claim anything having
5 to do with transmissivity. But since I mapped the
6 near surface alluvium, in contact with the porous
7 permeable bedrock, I can't own the first part of that
8 bullet, the part -- the part about alluvium.
9 JUDGE WARDWELL: So you can't own that --
10 the sufficient near-surface alluvium to conduct water
11 between the stream and the aquifer wells.
12 DR. LaGARRY: That. Yes, sir. Since I
13 mapped that alluvium.
14 JUDGE WARDWELL: And I think I asked you
15 this before, and we -- and you were a little surprised
16 at it. But I believe there -- all parties stipulated
17 to the opposite, that the alluvium is not a usable
18 aquifer. Or is that a different stipulation than what
19 this first part of two is applying?
20 DR. LaGARRY: Whether it's a usable
21 aquifer or not has no bearing on whether it can
22 conduct water. I mean, it may not be a usable aquifer
23 yet still conduct water. So it does conduct water.
24 Whether or not it's a useful aquifer is outside my
25 expertise. I'm not a groundwater geologist.

1 JUDGE WARDWELL: Thank you.

2 DR. LaGARRY: I can speak to the

3 composition of the gravel and where it is.

4 Okay. I can't talk -- I can't own the

5 third bullet. That's a transmissivity question. Part

6 of the fourth bullet, irrigation wells, are

7 hydrologically connected to the high plains aquifer

8 and/or alluvial fill in the Niobrara River. That --

9 to me, I will own that, but to me it seems moot.

10 You know, if there is -- if there is a

11 well in there and they irrigate, there has got to be

12 sufficient water to do that. So that -- to me, that

13 seems intuitively obvious.

14 The fifth bullet. I cannot -- I cannot

15 own that one, since at the time I made no original

16 conclusions about aquifers.

17 The sixth bullet, at larger scales, it

18 becomes apparent that the reach is in contact with

19 sediments capable of conducting water, and that the

20 ability to conduct water will be available by the

21 fitness of the conductive sediments and the physical

22 configuration of said sediments.

23 The composition of those sediments and

24 their physical configuration is my work, so I own that

25 bullet.

1 JUDGE WARDWELL: A couple of questions on
2 this.
3 DR. LaGARRY: Please.
4 JUDGE WARDWELL: It talks about the reach.
5 At larger scales, it becomes apparent that the reach
6 is in contact with -- is in contact with sediments
7 capable of conducting water. Do you know -- while you
8 didn't want to own item number 3, do you believe it's
9 the same reach that is talked about under item 3 where
10 they say, "Transmissivity in the reach is spatially
11 variable"? Any -- even if it's just a logical
12 assumption that you would make that it's the same
13 reach that they are talking about.
14 DR. LaGARRY: It is the same reach, but
15 I'm reluctant to get engaged in talking about
16 transmissivity because I would do more harm than good.
17 JUDGE WARDWELL: I just want to make sure.
18 So that when we still at that as information for us,
19 because you submitted it as evidence --
20 DR. LaGARRY: Yeah.
21 JUDGE WARDWELL: -- we can still look at
22 item number 3 and know that it's the same -- we'll go
23 -- we'll review it under the assumption that it's the
24 same reach in both those bullet -- both of those --
25 DR. LaGARRY: Yeah. The reach that

1 they're talking about is the river valley on those
2 seven quadrangles.
3 JUDGE WARDWELL: Got you.
4 DR. LaGARRY: So it's an arbitrary
5 designation that they have defined by what they
6 showed. Yeah.
7 The final bullet, "At points, such as
8 individual" -- maybe it's the final. It's the final
9 one on that page. It is the final one. "At points
10 such as individual irrigation well locations,
11 uncertainties regarding the nature of hydraulic
12 connection," I can't own that bullet because I will
13 not commit to details of hydrological connections in
14 particular places. That's a job for somebody with
15 better groundwater skills than me.
16 However, since we did -- we did map that
17 stuff, my actual participation and complicity in that
18 final bullet is subsumed under at least two of the
19 ones I have already mentioned. So I don't own the
20 final bullet.
21 So this -- when I was talking about
22 vulnerability, it seemed obvious to me at the time,
23 because I had mapped the rocks, noticed that there are
24 these porous rocks in communication, water could pass
25 freely between them. I thought, oh, no, this is

1 terrible. If something happens to one, something --
2 but it -- you know, at the time I was writing the
3 opinion for this -- this proceeding, it occurred to me
4 that I had seen that and I wanted to get that in that
5 opinion. And so I -- I drew that vulnerable thing and
6 I brought attention to that.
7 I was gratified to find in my most recent
8 search for the rebuttals that this turned up. It was
9 finally available -- it was available on the internet,
10 and that it put in a published format my unpublished
11 conclusions from years before, with independent
12 corroboration.
13 JUDGE WARDWELL: Thank you, Dr. LaGarry.
14 DR. LaGARRY: Thank you, sir.
15 JUDGE WARDWELL: I'll turn to Crow Butte
16 and ask them, do you believe you have responded --
17 reviewed and responded to these points as part of your
18 application or as part of the -- your preparing and
19 providing testimony for this hearing, and they are
20 part of and were evaluated as part of in reaching a
21 conclusion from your position that the confinement of
22 the Basal Chadron Chamberlain Pass Formation exists by
23 -- by other -- by your studies that you've done to
24 confirm that in your own mind?
25 MR. STRIVER: Yes, Your Honor. I believe

1 we have addressed these points.

2 JUDGE WARDWELL: And do you have any other

3 comments that you'd like to make on what Dr. LaGarry

4 has stated?

5 MR. STRIVER: No, Your Honor.

6 JUDGE WARDWELL: And I'll turn to NRC to

7 ask them those same two questions.

8 MR. BACK: Yes, Your Honor. We actually

9 in the EA do use a reference about the connectivity

10 between the groundwater and the surface water

11 resources. Next to the river, we actually agree with

12 all of these points. As you move up towards the site,

13 however, the alluvium tends to more recharge the

14 underlying units.

15 And we would also like to point out that

16 in this study, on page 5, I'll just read it to you,

17 "This study does not include analysis or discussion of

18 the Chadron aquifer, and its associated Chamberlain

19 Pass Formation is known as a minor aquifer that is

20 hydraulically distinct from the high plains aquifer in

21 the study area."

22 So these authors have concluded that there

23 is not a hydraulic connection between the Basal

24 Chadron and the overlying system.

25 JUDGE WARDWELL: Okay. Thank you.

1 Dr. LaGarry, would you agree that these
2 authors have made that conclusion in writing the
3 report? Or do you have another interpretation of
4 that?
5 DR. LaGARRY: No, Your Honor. However,
6 that's not the point. That's not the reason why I
7 included this. It was not my intent to use this paper
8 to demonstrate connection between the Chamberlain Pass
9 and anything.
10 This -- my intent in using this came about
11 -- remember, we reviewed my opinion before, and we
12 talked about underground leaks of pipes and casings
13 and surface spills. This paper bears on that, and not
14 -- not the question of the -- whether the Chamberlain
15 Pass is connected to anything or not.
16 The Chamberlain Pass isn't exposed and in
17 contact with the Niobrara River at all, unless the
18 Niobrara River fault is there and it penetrates the
19 Chamberlain Pass, like Swinehart and others have said.
20 But barring that, this is -- this is
21 principally for the purpose of pointing out the
22 vulnerability to underground pipe leaks, surface
23 spills, and poor casing.
24 JUDGE WARDWELL: Thank you very much for
25 your testimony.

1 DR. LaGARRY: You're welcome.

2 JUDGE WARDWELL: That's it.

3 CHAIR BOLLWERK: All right. Then I think

4 you had some questions, Judge Hirons.

5 JUDGE HIRONS: I have a couple of

6 questions for Dr. LaGarry. Do you believe that

7 subsurface exploration is required or necessary to

8 properly characterize the faults, and so forth?

9 DR. LaGARRY: Sir, I'm a field

10 stratigrapher and geologic mapper. My sub-discipline

11 and specialization centers on surface exposures.

12 Documents and protocols governing the formal mapping

13 and classification of rock stratigraphic units focuses

14 on observable surficial geology, and subsurface

15 geology is considered supplemental.

16 In my professional practice, I look at

17 surface rocks with the implicit operating assumption

18 that things that we see in the surface are also

19 present in the subsurface, just hidden from view. So

20 my work begins with what is exposed at the surface,

21 and then I project into the subsurface.

22 I have used subsurface data to clarify

23 surface problems, not the other way around. So my

24 emphasis has always been on the surface, projecting to

25 the subsurface.

1 And now to directly answer your question,
2 depending on the nature of the investigation, the
3 answer can be yes, but not always yes.
4 JUDGE HIRONS: Okay. Thank you. Let's
5 see. In May of 2017, you gave a presentation at the
6 Oglala Lakota College regarding the geology of Dawes
7 County and the Black Hills area. And you focused on
8 some of the hazards that any sort of mining might
9 include -- wind, dust, et cetera. Can you elaborate
10 on the applicability of those issues to the number --
11 the four elements of contention 2?
12 DR. LaGARRY: Maybe. I don't have the
13 details of contention 2 sitting here.
14 JUDGE HIRONS: Well, just in general I
15 think I'm looking for.
16 DR. LaGARRY: In general, well, dust is a
17 big issue around here. And where uraniferous rocks
18 are exposed at the surface, they contribute to the
19 what's called fugitive dust. Fugitive dust is the
20 free dust that just blows around on the landscape.
21 And with the publicity of dust storms and
22 the Dust Bowl, the 1930s, I mean, I've been out on
23 days where the atmosphere is brown and so full of silt
24 and dust. And some amount of that is -- carries
25 radionuclides. It blows off the easily deflated White

1 River Group rocks. Most erosion and badlands
2 formation is a consequence of deflation and picking
3 the stuff up by the wind.
4 So, yeah, specifically in context, those
5 comments in that presentation that you cited came
6 about because the Army National Guard was considering
7 having pre-Iraq invasion maneuvers north of the town
8 of Red Shirt on the Pine Ridge Reservation on a big
9 flat area that is made up of Chamberlain Pass
10 Formation.
11 And any activities there, including
12 driving, dust blooms from driving, excavation, would
13 have produced a tremendous amount of dust that would
14 have been carried by the prevailing winds to the
15 southeast across the reservation.
16 So I was pointing out to the participants
17 in that presentation, to the audience, that the
18 fugitive dust was a huge issue. It needed to be any
19 -- any creating of the fugitive dust needed to be
20 curtailed until we could get some samples and study
21 some samples of airborne particulates to see how much
22 of that was fugitive dust carrying radionuclides.
23 Unfortunately, due to personnel changes at
24 Oglala Lakota College at that time, we are unable to
25 complete that study. Our fugitive dust guy, who we

1 got grant money to buy a fugitive dust collector,
2 retired and wasn't replaced, so the fugitive dust
3 study never went anywhere.
4 But people are concerned about fugitive
5 dust, not just because of radionuclides but because
6 there is minerals called zeolites that are known
7 carcinogens that are also carried aloft as fugitive
8 dust.
9 Many dirt roads across the reservation
10 have this -- these zeolite minerals that are
11 carcinogenic. And not in South Dakota, but in North
12 Dakota, it has created problems for the Highway
13 Department because its workers are breathing zeolites
14 in their fugitive dust.
15 But beyond that, I haven't carried those
16 studies any farther to get quantitative amounts of
17 potentially dangerous radionuclides.
18 JUDGE HIRONS: Well, from watching your
19 presentation, I came away with the conclusion you said
20 that it's just a terrible environment to work in.
21 DR. LaGARRY: It's a terrible environment
22 to work in. That's true.
23 JUDGE HIRONS: Okay. Thank you.
24 CHAIR BOLLWERK: All right. Judge
25 Wardwell, do you have anything else?

1 JUDGE WARDWELL: No.

2 CHAIR BOLLWERK: I do not have any

3 questions at this point.

4 Let's, then, take a break. It will give

5 you all an opportunity -- it's about almost 1:30, say

6 quarter to 2:00 -- to come up with any questions you

7 might have about concern number 4 that we've just

8 dealt with. And we'll be back then to take those

9 questions and look at them and we'll ask what -- those

10 that are appropriate.

11 So about 15 minutes if you don't mind.

12 Thank you.

13 (Whereupon, the foregoing matter went off

14 the record at 1:28 p.m. and resumed at 1:48 p.m.)

15 CHAIR BOLLWERK: Can we come to order?

16 We'll go back on the record, please.

17 We just completed a break where we got

18 some proposed questions from the Tribe. I understand

19 there are no questions relative to concern 4. I take

20 it there are no questions from the staff and none from

21 the applicant.

22 So we will take these and look them over,

23 and we'll be back in probably about 10 minutes.

24 Take another break. Thank you.

25 (Whereupon, the foregoing matter went off

1 the record at 1:48 p.m. and resumed at 1:54 p.m.)
2 CHAIR BOLLWERK: All right. Let's go back
3 on the record, please.
4 All right. We've taken a brief break and
5 looked at the questions provided to us by the Oglala
6 Sioux Tribe, which proposed questions. And guess
7 what? Judge Wardwell has a few last questions to ask.
8 JUDGE WARDWELL: Thank you. I think I
9 will go to CBR, Crow Butte, to start with. And my
10 first question are -- in your review of both the
11 structural contour maps and any cross-sections, are
12 not the troughs and the contact between the top of the
13 Pierre Shale and the top of the Basal Chadron
14 Chamberlain Pass Formation coincident? That what you
15 see in one you end up seeing in the other at a given
16 location, like Monitor 3 as we were looking at?
17 MR. STRIVER: And the question is whether
18 it's coincident, if there's a trough?
19 JUDGE WARDWELL: Yeah. Do you see -- the
20 coincident is the same as saying that when you see it
21 in the one, you see it in the other also, in regards
22 to the trough. When you see a trough in the Pierre
23 Shale, you're going to see it on the top. Is --
24 MR. STRIVER: I would have to --
25 JUDGE WARDWELL: Do you agree with that?

1 MR. STRIVER: I would have to look at the
2 -- Your Honor, let's see, if you have a trough.
3 JUDGE WARDWELL: Well, let me back up. If
4 you remember, we looked at the two structural contour
5 maps as guided by Dr. Kreamer. And he was pointing
6 out that it was -- there was -- there was a dip and
7 around the area of Monitoring 3 -- Monitor 3 and the
8 Pierre Shale.
9 His point was the same thing is happening
10 at the top of the -- which would be the structural
11 contour map of the top of the Basal Chadron. Same dip
12 and trough is seen on both layer interfaces.
13 MR. STRIVER: Yes, I do observe the same.
14 JUDGE WARDWELL: And are not the layers --
15 are not those interfaces created many years apart?
16 You don't have to look at a map for that.
17 MR. STRIVER: Yes, they are. Yes.
18 JUDGE WARDWELL: Sure they are.
19 MR. STRIVER: Certainly, they are. And as
20 far as the trough and the -- in the higher area, they
21 are not -- they don't exactly match up, but, yeah, I
22 do see that.
23 JUDGE WARDWELL: Yeah. And they are
24 formed hundreds, thousands, millions of years apart,
25 a long time apart.

1 MR. STRIVER: I don't know -- I don't know
2 the time difference, but, yeah, there is a -- there is
3 a significant amount of time.
4 JUDGE WARDWELL: But they're not at the
5 same time.
6 MR. STRIVER: Correct.
7 JUDGE WARDWELL: And why are the troughs
8 in contact between the top of the Pierre Shale and the
9 top of the Basal Chadron Chamberlain Pass Formation
10 coincident in that orientation as -- as an example of
11 -- as shown by Monitor 3 when, in fact, the layers
12 were formed many years apart? That's the question.
13 And you don't have to look at anything
14 to --
15 MR. STRIVER: Yeah. I understand. So,
16 but in general, I mean, we have a northwest trending
17 and it's coming from the northwest down towards the
18 southeast paleo channel. And these structural contour
19 maps, you have the base where you have scouring going
20 on, and at the top. However, that was finally
21 deposited.
22 Why we would have that -- I mean, that's
23 -- I mean, I don't think that's an uncommon
24 occurrence.
25 JUDGE WARDWELL: Wouldn't the -- to a

1 certain degree -- well, I'll leave that as -- it's
2 good enough. Okay. Thank you.
3 For Dr. Kreamer, are you with us orally?
4 I see you visually. Are you with us orally?
5 DR. KREAMER: Can you hear me?
6 JUDGE WARDWELL: Yes.
7 DR. KREAMER: Can you hear me?
8 JUDGE WARDWELL: Yes. Can you hear me?
9 DR. KREAMER: My audio is on, yes.
10 JUDGE WARDWELL: Okay. Dr. Kreamer, is
11 there supporting data that demonstrates that the
12 validity of the data and the pump tests graph, C3, and
13 that show leakage -- and, if so, what is that
14 information that creates that validity?
15 DR. KREAMER: Certainly, Your Honor. Yes,
16 there is. The information is several-fold. The
17 first, that the classic curve for leakage that's shown
18 in CBR 029, on page 13 of Kruseman and De Ridder, is
19 almost a perfect match with that shown in the Marsland
20 pumping report. That would be CBR 016. That would be
21 graph C3, page 82, in Appendix C.
22 Those are both Theis curves, log-log
23 curves, and the recharge boundary that you see in one,
24 which illustrates the classic recharge boundary in a
25 textbook fashion, is almost identical to the one that

is observed in the actual data we're seeing.

The second thing is actually numbers, and I know that there are some probably engineers in the crowd who like numbers. One of the concerns with C3 is it's too close to the pumping well, and the well dewatering effects might affect the drawdown.

And so a few calculations there show that that's probably de minimis. The pumping well, 600 feet deep, 150 feet below static water level, the bottom of that well, the casing is four inches in diameter. And in the maximum pumping test, they had 23 feet of drawdown.

If you're speaking, the camera is not on you, Judge Wardwell, so I can't see if you're trying to interrupt me. So just keep trying. You're good so far. Okay.

So what that means is if you do pi r-squared times the depth of the well, the amount of water that was dewatered would be about 7.9 cubic feet or 59 gallons. At a pumping rate of 27.08 gallons per minute, it would take 2.17 minutes to dewater if no water was coming in.

Now, water of course is coming in. That would be measured by the decline in the well. They, fortunately, in the pumping well did measure the water

levels. In 2.45 minutes, or less than two and a half minutes, the well was 86 percent dewatered by the data. In 22 minutes, it was 90 percent dewatered. And the real data that is under consideration as to whether it's worthy or not, or good, doesn't start until after 60 minutes. So the dewatering effects are probably de minimis.

The last quantitative thing is another way to measure whether the data is good or not is with what's called a U-factor in the Cooper-Jacob analysis. And the U-factor takes into consideration what time the data begins to -- the data at the beginning is always bad, and it gets better and better and better as time goes on.

For 90 percent accuracy, better than 90 percent accuracy, less than 10 percent error in the U-factor, that is still under 100 minutes time. And so most of the data that we see at that well is good data as the analysis by the people who wrote the report CBR 016 said, they did the analysis, they considered -- geology considered. I do as well, and it's classic charged leakage that is shown at this particular well.

I did not have access to Dr. Smith's inertial analysis. I'm sorry, I didn't see that in

1 the written record or I would have analyzed that as
2 well.
3 Thank you.
4 JUDGE WARDWELL: Thank you, Dr. Kreamer.
5 A follow-up question on that, if I might. Are you
6 cognizant of the irony in the fact that you seem to
7 besmirch the Theis approach and the Cooper-Jacob
8 approach over this last two and a half days, and yet
9 most of our discussions that we have had when we
10 started looking at data have always been referred back
11 to those diagrams.
12 And, in fact, you use it a great deal to
13 support your position in C3. And I was just wondering
14 if you were aware of the irony of that.
15 DR. KREAMER: That's a good point, Your
16 Honor, and I must admit that --
17 JUDGE WARDWELL: That's a yes or no
18 question.
19 DR. KREAMER: -- I'm not doing this -- my
20 motivation for testimony here is not really for --
21 it's not like I don't have other things I could be
22 doing. It's not like -- it's not like I expect a big
23 reward for this, but I do believe that there are some
24 paradigms that are being used here that really need to
25 be changed over time. I really believe that as a

1 professional.

2 And the answer to that is, I don't have

3 unlimited time. I would have run a numerical model on

4 the data if I had had time. I would have done a much

5 more complete analysis and not used just Theis or

6 Jacob-Cooper, but I -- I, quite frankly, didn't have

7 time to do that, and so I had to rely on the data

8 there, which does show deviation.

9 It does show leakage. And so even with

10 those -- those assumptions that are invalid, it does

11 show that there is a potential problem, and that hooks

12 up with the structural geology as well.

13 JUDGE WARDWELL: Thank you.

14 MS. STRIZ: Your Honor, excuse me. Could

15 I please address his incorrect use of the U-factor?

16 JUDGE WARDWELL: I am asking the

17 questions.

18 MS. STRIZ: In an analysis --

19 JUDGE WARDWELL: I'll take down your

20 advisement, but --

21 MS. STRIZ: Thank you, Your Honor.

22 JUDGE WARDWELL: -- I'm turning to you

23 now, and you have to have trust in the system.

24 MS. STRIZ: Okay.

25 JUDGE WARDWELL: For NRC, why are the

1 troughs and the contact between the top of the Pierre
2 Shale and the top of the Basal Chadron coincident in
3 orientation and location when the layers were formed
4 millions of years or thousands or lots of different
5 years apart?
6 MR. BACK: Your Honor, we would have to do
7 a detailed analysis, because, you know, we're looking
8 at cross-sections. We can look at the elevations.
9 But to just simply base that conclusion on one area,
10 which is what we have looked at, to make that
11 conclusion across the entire site, I mean, we know the
12 environment.
13 It's a depositional environment. For it
14 to be coincident everywhere and suggest that it's
15 because of faulting, there is no other evidence for
16 that. So we would just have to look at it and -- if
17 people are trying to draw a conclusion, that's -- the
18 entire site got faulted, you know, for this lifting.
19 We -- it just is contradictory to everything else we
20 have looked at.
21 JUDGE WARDWELL: Thank you.
22 For NRC, is there inertial analysis that
23 you conducted that, Dr. Striz, appeared on the record?
24 MS. STRIZ: No. Except that I described
25 it yesterday when you questioned me about if I had

1 conducted an analysis to look at what I thought might
2 be occurring at that well.
3 JUDGE WARDWELL: Okay. Thank you. Do you
4 have any comments about the U-factor that Dr. Kreamer
5 was talking about?
6 MS. STRIZ: Yes. He used it incorrectly.
7 The Theis solution is the well function, WU, which is
8 approximated by an infinite series, several terms. I
9 can provide that to the Board.
10 The Cooper-Jacob approximation deals only
11 with large values of R or T -- small values of R,
12 large values of T, that allow you to truncate all of
13 the terms in that series except for the first one, so
14 that you can use a linear approximation.
15 So that restriction has nothing to do with
16 well bore or inertial effects. It has only to do with
17 where it is appropriate to use the truncated
18 approximation to the well function. So it does not
19 have anything to do with well-based storage or other
20 effects.
21 DR. KREAMER: May I respond?
22 JUDGE WARDWELL: Yes, you may, Dr.
23 Kreamer.
24 DR. KREAMER: I completely agree with Dr.
25 Striz, but I think she misunderstood me. I was giving

1 -- and she described it very well. I'm writing
2 another edition of a book right now on applied
3 hydrogeology with Fetter, and that's exactly how I
4 would describe it. So she did a very good job in
5 describing U.
6 I didn't mean that U was a function of
7 well bore water or initial analysis. I did not mean
8 to imply that. I meant it as another line of
9 evidence, different than that. And on page 65 in
10 Kruseman and De Ridder, which I have already given you
11 the evidentiary -- the -- I guess that's CBR 029. On
12 page 65 of that, they clearly state that the U-factor
13 has less than 10 percent error within the range of the
14 data we're seeing at that particular well. That's
15 just another way to confirm that the well data is well
16 good and robust.
17 So I didn't mean to imply, and I'm sorry
18 if it was confused, that it was something other than
19 a way of -- well function. I'm well aware of that,
20 and I -- I appreciate the additional clarification.
21 Let me just say one other thing. This may
22 be the last time that I ever -- I get to say anything
23 in this hearing. I just want to express that even
24 though I have differences of paradigm and things like
25 this with the other experts, I have enormous respect

for Dr. Striz, Dr. David Back, the whole NRC staff, Mr. Lewis, and the CBR staff. I think they are excellent professionals. And even though we disagree on approaches and the way to go, I want to say that I'm proud to have you as colleagues.

JUDGE WARDWELL: Thank you, Mr. Kreamer. And I gather with that statement you don't care much for the Board, though.

(Laughter.)

JUDGE WARDWELL: You need more response.

Mute him. Mute him, Joe. Don't let him talk.

(Laughter.)

JUDGE WARDWELL: That's all I have. All right.

DR. KREAMER: I'm sorry.

(Laughter.)

CHAIR BOLLWERK: All right. Well, on that note, I think we are just about to -- do you have any further questions or comments?

JUDGE HIRONS: No, I don't.

CHAIR BOLLWERK: All right. You don't have anything about anything else?

All right. So, at that point, I think we're about ready to wrap things up here. First of

1 all, on behalf of the Board, I want to thank all the
2 witnesses, Mr. Back, Mr. Lancaster, Dr. Striz, Mr.
3 Trefethen, for the staff; for Crow Butte, Mr. Lewis,
4 Mr. Nelson, Mr. Pavlick, and Mr. Striver; and for the
5 Oglala Sioux Tribe, Dr. Kreamer and Dr. LaGarry, and
6 of course Mr. Wireman is not here today -- we thanked
7 him yesterday -- for the very candid -- the candid
8 testimony you provided us, and for your service to the
9 Board.
10 I know in talking with the other judges on
11 the case we very much appreciated the information you
12 have given us, and your straightforward approach to
13 the questions you have been asked. So you have I
14 think all done yourselves proud in terms of your
15 appearance before the Board.
16 JUDGE WARDWELL: And I would like to just
17 echo that and emphasize that we wouldn't be here at
18 2:00 adjourning if it wasn't for the succinctness and
19 the brevity of which you responded, and also the --
20 you know, the real concern that I think all of us have
21 for this project to assure that we're reaching what is
22 the best estimate of how it might perform.
23 And we wouldn't have gotten it through
24 this if it wasn't for your cooperation in assuring
25 that we get the information but yet do it in as

1 efficient manner as we possibly can. And it just
2 shows the quality of which you experts are. It's one
3 of the highest quality group of witnesses that I have
4 been privileged to both be on that side and be on this
5 side to observe. So I thank you all for your -- for
6 your efforts as we waded through this, and appreciate
7 it much.
8 CHAIR BOLLWERK: And the fact we lost
9 nearly two hours the first day, and we're still
10 getting done a little early the third day I think just
11 simply echoes that. So, again, we do very much
12 appreciate everyone's efforts here.
13 And I would say the same thing for
14 counsel. You have all been very professional
15 throughout the proceeding, and we appreciate your
16 efforts as well.
17 So at this point, the witnesses are
18 excused, although it's probably not a good idea to get
19 up and leave right in the middle of what -- we're
20 going to be about another five minutes, but it won't
21 take us that long.
22 Let me just say a couple of things about
23 procedure that we need to talk about. Let me get to
24 the right page here. Okay. So we need to talk about
25 a few things. Joint transcript corrections. We had

1 issued an order about this previously. Just let me
2 emphasize a couple of things.
3 Let's go ahead and try to have joint
4 transcript corrections, and the word "joint" is
5 important there, by Monday, November 19, 2018. And we
6 will put out an order early next week memorializing
7 these dates, to the degree they are not already in
8 something written down. So joint transcript
9 corrections.
10 Please remember we anticipate -- our court
11 reporter has indicated you should be receiving the
12 first day's transcript on Monday, then Tuesday, then
13 Wednesday. So hopefully by the middle of next week
14 you'll have everything. My hope is that you can take
15 a read through it.
16 Again, we are not trying to edit it to
17 make everybody sound good. Nobody is going to sound
18 good in this transcript. The important part is to
19 make it accurate. If there is a "not" that is
20 missing, obviously, you ought to bring that to our
21 attention. If for some reason you can't agree about
22 a particular transcript correction, let us know and
23 we'll take -- we'll deal with that issue.
24 And, again, my hope is to get you -- if we
25 could get those by the 19th, get you an order that

1 puts out the final exhibit list and also has all of
2 the transcript corrections well in advance of the time
3 when your proposed findings are due. We would also
4 obviously close the record at that point when we go
5 ahead and issue the final exhibit list and also those
6 joint transcript corrections.
7 In terms of proposed findings of fact,
8 November -- I'm sorry, Monday, December 3rd, that's
9 due under the general schedule we've had out for a
10 number of months. The response to the findings of
11 fact, Friday, January 4th, and then as the general
12 schedule indicates, our decision on or before Tuesday,
13 February 19, 2019.
14 Let me say one thing, though, about
15 evidentiary material that I need to correct in the
16 record or get the record corrected. There were two
17 OST exhibits, Oglala Sioux Tribe exhibits, 18 and 20.
18 And as Dr. LaGarry was talking about 18 yesterday --
19 and this is on me, so I'll take it -- I'll take the
20 bad for it -- there are links in that transcript.
21 Those links cannot be active.
22 So you have a choice with that particular
23 exhibit. If you do nothing further -- and I will --
24 we're going to give you an opportunity to do
25 something, if you want to -- those links are going to

1 be made inactive. We cannot have evidentiary material
2 that is sitting out on the internet. It has to be
3 locked down. People can go in and change it or the
4 links can disappear. That's not a good situation.
5 You sort of invited people to look at what
6 is behind those links. I have no idea if that's
7 important to you or not. Obviously, what you provided
8 us was because that was there. So you need to take a
9 look at that.
10 We will give you until a week from
11 Tuesday, because I think a week from Monday is a
12 federal holiday. If you want to have those linked --
13 that linked material in the evidentiary record, what
14 you would need to do is file a revised exhibit that
15 includes a PDF copy attached to the existing exhibit
16 of any of those links that you want in there.
17 And the same thing goes for OST 20. I
18 would have to say that OST 20, there is a couple of
19 references to like the USGS report. I suspect you are
20 not concerned about that, and it's probably not
21 necessary to revise that one. Take a look at OST 18
22 and see if there is anything you want in there. I'm
23 not -- we're not trying to compel you to do anything
24 with it, but we either need to know a week from
25 Tuesday, do you plan to change the exhibits at all,

1 and if you do, you're going to have to file a revised
2 exhibit, particularly for OST 18. All right?
3 And, again, this is just something to lock
4 down the record. Yes.
5 MR. BALLANCO: Your Honor, just to make
6 sure I understand. You're talking about a week from
7 last Tuesday?
8 CHAIR BOLLWERK: I'm talking about --
9 where did I write that date down?
10 MR. BALLANCO: A week from next Tuesday.
11 CHAIR BOLLWERK: No. Tuesday,
12 November 13th. I'm sorry, I did have it written down
13 here.
14 MR. BALLANCO: Thank you.
15 CHAIR BOLLWERK: Tuesday, November 13th.
16 I apologize. So that's one week from next Tuesday.
17 All right?
18 So that would be another date to bear in
19 mind. And, again, we'll -- I'll issue an order early
20 next week that memorializes these dates, if there is
21 any questions about them.
22 At this point, I want to thank some folks
23 that have been integral in this proceeding, our law
24 clerks, Sarah Ladin and Joe McManus, who basically
25 keep us running on time and moving forward; Joe

1 Deucher, our Panel IT specialist.

2 I know you all were somewhat concerned,
3 the staff and the applicant, about doing a remote
4 hearing. It has not been perfect; I'll be the first
5 one to admit that. I think it has been adequate.
6 We'll find out when we see what the court reporter has
7 for us. He has been telling us that he has been
8 getting a good audio signal all along, no matter what
9 problems we have been having in here. So maybe the
10 transcript will be the proof in the pudding as it
11 were.

12 I should say we have learned some lessons
13 from this. We need to be careful in facilities that
14 have Wi-Fi with only two bars. We thought it was
15 going to be four. That's what the map showed, but it
16 wasn't true. That has happened before. We need to be
17 careful about that.

18 But this really, I have to say, based on
19 my experience over the last 15, 20 years, this is
20 really the way that things are going. The Commission
21 is already looking at this potentially for the high-
22 level waste case in terms of using this sort of remote
23 connectivity, and the Panel is, frankly, too.
24 Basically, we can actually reach more people often by
25 having our hearings back in Washington or somewhere

1 where we bring people in remotely, and it saves
2 everybody cost and money, so -- time and money.
3 So it's something that is being
4 considered, although the Panel -- the agency's general
5 policy still is, particularly for evidentiary
6 hearings, to have them near the facility. So that's
7 something that is kind of in flux right now, but I'd
8 just mention that.
9 And we have some lessons to learn,
10 although we have been doing this for quite a while as
11 well.
12 So, again, to the degree that the audio
13 and the video at some points wasn't quite up to snuff,
14 I apologize to you. We're sorry that didn't work out.
15 But I think on the whole we're going to have an
16 adequate record that everyone will be able to deal
17 with.
18 So, Joe McManus -- excuse me, Joe Deucher,
19 our IT specialist, I want to thank Chris Lamb from NRC
20 Security, as well as Sheriff Karl Dailey and the Dawes
21 County Sheriff's Office for the officers that we had
22 here. They came in very handy on Monday -- Tuesday,
23 excuse me. We were very glad to have them, and they
24 did a great job for us.
25 And, again, I'd express my thanks to Mr.

1 Ballanco and Mr. Frankel for their intervention in
2 that situation as well, and as well as the Tribal
3 Council, which we did appreciate. It allowed us to
4 complete the hearing, which I think is to the benefit
5 of the Tribe, rather than us having to go home without
6 having the evidentiary record that we have today.
7 So, also, for the limited appearances, I
8 wanted to thank Shellie Johns and Melody Carnahan of
9 Chadron State College and for the proceeding that we
10 have been holding here for the use of this facility.
11 Hold on one second here. I'm flipping between pages.
12 Jennifer Dean, the Deputy City Clerk, and
13 Jane Dailey, the City Clerk and Treasurer who helped
14 us arrange for the space in the Crawford Community
15 Building.
16 The seats were a little hard, but I think
17 the facility was certainly adequate, and I think it
18 has worked out fairly well. So, again, we appreciate
19 their efforts.
20 I also want to thank James Salandro, who
21 has been our court reporter. I think he has done a
22 good job for us. And we will find out I guess next
23 Monday when the transcript comes in, but I have little
24 doubt -- hopefully, we will be making corrections, not
25 -- all of them will be joint, rather than having any

1 disputes about anything in the transcript. I'm pretty
2 confident of that.
3 So at this point, Judge Wardwell, anything
4 you want to say?
5 JUDGE WARDWELL: No.
6 CHAIR BOLLWERK: All right. Judge Hirons?
7 JUDGE HIRONS: No.
8 CHAIR BOLLWERK: All right. Again, our
9 sincere appreciation to all of you for spending the
10 last three days with us, as well as some of you who
11 were with us over the weekend. I think it has been a
12 good hearing. We have gotten a lot of good
13 information.
14 The onus is now on us, based on your
15 proposed findings of fact, conclusions of law, and the
16 evidentiary record that we have put together, to make
17 a decision relative to Contention 2, and that we will
18 do that by the middle of February.
19 I hope everyone has a safe trip home to
20 the degree you're traveling out of the area. And at
21 this point, we stand adjourned. Thank you.
22 (Whereupon, the above-entitled matter went
23 off the record at 2:21 p.m.)
24
25