

THE ALBERTA ENERGY REGULATOR

PROCEEDING ID NO. 430

IN THE MATTER OF the Responsible Energy Development Act, SA 2012, c R-17.3 and the Regulations and Rules made thereunder;

AND IN THE MATTER OF an Application to Amend Commercial Scheme Approval No. 11475 for the Kirby In Situ Oil Sands Project, KN08 and KN09 Development (Application No. 1936092)

AER PROCEEDING

VOLUME 4

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February 9, 2024

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1 Proceedings taken at Govier Hall, Calgary, Alberta

2

3 February 9, 2024 Morning Session

4

5 Cindy Chiasson Panel Chair

6 Brian Zaitlin Panel Member

7 Meg Barker Panel Member

8

9 William McClary AER Legal Counsel

10 Shannon Peddlesden AER Legal Counsel

11 Andrew Lung AER Staff

12 Denise Parsons AER Staff

13 Anastasia Stanislavski AER Staff

14 Fahad Hamdan AER Staff

15 Maryam Rahimabadi AER Staff

16 Susan Harbidge AER Staff

17 Maksim Khaferllari AER Staff

18 Felix Chiang AER Staff

19 Scott Botterill AER Staff

20 Baohong Yang AER Staff

21 Elwyn Galloway AER Staff

22

23 J.P. Jamieson For Canadian Natural

24 Resources Limited

25

26

1 M. Riley For ISH Energy Ltd.

2 A. McLeod For ISH Energy Ltd.

3

4 S. Murphy, CSR(A) Official Court Reporter

5 S. Burns, CSR(A), RPR, CRR Official Court Reporter

6

7 (PROCEEDINGS COMMENCED AT 9:04 AM)

8 Opening Remarks

9 COMMISSIONER CHIASSON: Okay. Good morning. And
10 welcome back to Day 4 of our hearing. And so the usual
11 reminder about the video cast and that you may show up
12 on the video cast if you're in the room, and if there's
13 anyone new -- I would assume anyone who has had
14 concerns would have already brought them up to
15 Mr. Lung, but if you have concerns about the potential
16 that you may appear on the video cast, please speak
17 with Mr. Lung.

18 And I know I mentioned this at the first day of
19 the hearing and I realized because I just had to do it
20 before I sat down is please remember -- check that all
21 your electronic devices, phones, computers, et cetera
22 are set to "silent" because I almost made that mistake
23 just this morning. So please -- please make sure of
24 that.

25 Otherwise, I believe -- unless there's anything to
26 start off with this morning, we are continuing on with

1 CNRL cross-examination of ISH's witness panel. So if
2 there's nothing else, then please proceed,
3 Ms. Jamieson.

4 J. Jamieson Cross-examines the ISH Energy Ltd. Witness
5 Panel

6 J. JAMIESON: Thank you. Good morning,
7 Commissioners, and everybody else in the room.

8 We do have a number of questions, an hour, an hour
9 and 15, I believe that's what we were allocated. I
10 suspect we're going to use it all.

11 Q J. JAMIESON: I'm going to start with
12 Mr. Vickerman from -- yeah. You -- you gave a
13 presentation yesterday on the image logs, interpreting
14 image logs. We found that very helpful. Thank you.
15 Appreciate it. And can you just confirm that you only,
16 in the end, interpreted two image logs?

17 A K. VICKERMAN: Yeah, that's correct.

18 Q And as you're -- or are you aware that Canadian Natural
19 had provided 11 image logs to ISH that could have been
20 reviewed? Are you aware of that?

21 A Yeah.

22 Q Were you involved in the selection process of which --
23 of the two -- which of the 11 to review?

24 A Yeah. So we looked at the images that were available,
25 and we picked out the ones that we could see some
26 fracture.

1 Q Okay. So you helped with that?

2 A Yeah.

3 Q Okay.

4 A But it was looking at 11 images in an hour, so it
5 wasn't a --

6 Q Understood.

7 A -- it wasn't a deep delve into them.

8 Q Okay. But you were involved. Okay. Thank you.

9 And now if I understood your evidence correctly
10 yesterday, you said that ideally you would have
11 received the DLIST -- DLIS --

12 A Yeah.

13 Q -- logs to conduct your interpretation. I understand
14 that stands for digital log interchange standard; is
15 that correct?

16 A That's correct.

17 Q Okay. Which you didn't receive -- and we're all aware
18 of that -- and -- but what you did receive was a PDF of
19 a TIFF file; is that correct?

20 A I don't know that it was generated from a TIFF file.
21 It was a PDF, and the part of the PDF that we used was
22 a -- like a TIFF file in that it's a -- an image array.
23 It's -- it didn't have any orientation. It just showed
24 where the pixels were particular colours.

25 Q Okay. Thank you.

26 When you do these interpretations, you're agnostic

1 to the depth of the issue in question, and that's how
2 you approached this one as well?

3 A That's right. You usually pick from bottom up and then
4 review from the top down and then change the scale and
5 do another review through.

6 Q Right. Okay. Now, notwithstanding you didn't receive
7 the format of the image logs that you would have liked
8 ideally, you were still able to provide some
9 interpretation, and you have a level of confidence in
10 that interpretation?

11 A Yeah. The data that we had to work with is -- if you
12 imagine that the -- a DLIS might be a hundred percent
13 confidence when you -- maybe if we had had an image of
14 the static image and the dynamic image that we could
15 have cropped both, that might have been a 95 percent or
16 something like that. And what we had, there will be
17 some intervals that are much lower confidence that
18 could have had more fractures or could have had fewer
19 fractures.

20 Q Okay.

21 A And so, you know, maybe it's a 90 percent confidence.
22 We -- it was still a fairly decent image over those
23 two, and I was confident -- certainly high confidence
24 in some of the features that we saw and moderate --
25 confident enough in -- in the others.

26 Q Thank you.

1 J. JAMIESON: Court reporters, are we
2 speaking loud enough? You're -- thank you.

3 Q J. JAMIESON: In your report in your
4 executive summary there, you generally characterize
5 what you did identify as "sparse" or "low density".
6 Can you confirm that that was your overall conclusion?

7 A That's correct.

8 Q Thank you very much, Mr. Vickerman.

9 These next set of questions are for you,
10 Mr. Barrie, please. And -- was that me?
11 Ms. Wheaton -- is it Ms. Wheaton? No. It's somebody
12 new everyday.

13 COMMISSIONER CHIASSON: Sorry. This is -- this is
14 Ms. Arruda. Sorry.

15 J. JAMIESON: Ms. Arruda.

16 COMMISSIONER CHIASSON: I apologize. I should have
17 introduced her.

18 J. JAMIESON: Thank you. No worries.

19 I know that there was a lot of requests to
20 Mr. Lung, and he wasn't in control at all. That was
21 the witness training we did. Sorry. Okay.

22 So, Ms. Arruda, if I could please have
23 Exhibit 44.10 up on the screen, and it is Figure 1 --
24 oh -- sorry -- PDF page 7, Figure 1.

25 Q J. JAMIESON: And can you please confirm,
26 Mr. Barrie, that you prepared this map?

1 A B. BARRIE: Yes, I can confirm that.

2 Q Thank you.

3 And can you please describe what it shows, and I
4 think in particular the blue lining on the map?

5 A Yes. Can I get the mouse, please? Yeah.

6 Q Oh, that's a good idea.

7 A So this is a map of the mid-B1 mudstone, and the values
8 that you see plotted here are my estimations of the
9 thickness of that unit, which vary on the flanks from
10 42 to 34 and then down to 16 centimetres, et cetera.
11 It gets much thinner until you move to the centre. The
12 area within the blue line is where I've plotted zeros,
13 which is where, in my interpretation, I have mapped
14 that the mid-B1 mudstone is absent, which is adjacent
15 to the area that CNRL has mapped as absent, which is
16 shown in green.

17 Q Very good.

18 And I'm going to ask you -- I'm going to take you
19 to another figure, but can we agree that we'll call,
20 you know, that your blue polygon, and what's inside is
21 your interpretation that there's no mid-B1?

22 A That's correct. There's no mid-B1 mudstone within that
23 blue contour.

24 Q In your -- in your opinion? Okay.

25 A Yes.

26 Q Thank you.

1 J. JAMIESON: So if I could please now,
2 Ms. Arruda, have Exhibit 50.003, Tab 7. And if we
3 could -- thank you. That's the image. If you could
4 expand -- you see the yellow in the middle of the --
5 those wire logs? Yeah. Just a -- just so that it's
6 really readable. Maybe one more expansion. Perfect.
7 Thank you very much.

8 Q J. JAMIESON: Okay. So what we've got
9 here --

10 J. JAMIESON: Actually, I think I missed a
11 step. So if we could keep that one handy, but if you
12 could go to Exhibit 32.03, page 5 of the PDF, Figure 1.
13 Yeah. Perfect. Thank you.

14 Q J. JAMIESON: Yeah. This is the other piece
15 I believe, Mr. Barrie, comes from your report, and you
16 spoke to this yesterday, and if we could just confirm
17 that the core photo displayed is -- is representative
18 of the mid-B1 mudstone?

19 A Yes, that's my interpretation.

20 Q Okay. All right. Can you just describe for us --

21 A Can I --

22 Q Oh.

23 A Sorry for interrupting.

24 Q Sure.

25 A I agree that the interval between the red pins, so the
26 area outlined with the green double arrows, is the

1 mid-B1 mudstone. The rock below it in the image and
2 the rock above it in the image is not the mid-B1
3 mudstone.

4 Q Understood.

5 A Okay.

6 Q Can you just for us describe how you see that
7 lithofacies of the mid-B1?

8 A How do you mean "see"?

9 Q The character of it. Can you describe the character of
10 the mid-B1 from a geology perspective?

11 A Okay. In brief -- typically it's a medium to dark grey
12 mudstone without mud sand. It has fine bioturbation
13 burrows. I think that's it.

14 Q Thank you. No, that's perfect.

15 Do you acknowledge that the mid-B1 is a regional
16 marine flooding mudstone? Is that how you would
17 characterize it?

18 A I agree with the characterization that's been provided
19 by CNRL, and when I look at that interval there, it
20 looks like a marine flooding mudstone, yes.

21 Q Okay. Thank you very much.

22 J. JAMIESON: Now, if we could go back to
23 50.003, Tab 7. And if you wouldn't mind, please,
24 Ms. Arruda, enlarging it the way you did the other
25 time. That's perfect. Thank you very much.

26 Q J. JAMIESON: We've seen this cross-section

1 before -- Mr. Lavigne spoke to it -- and if you -- it
2 represents Canadian Natural's interpretation of -- in
3 the very middle, this is the 100 of the 1-3 well -- and
4 this is the Canadian Natural's view of the world,
5 right. They see this -- their interpretation is that
6 it's just cut out very locally there for a tidal
7 channel. You're familiar, right? You're aware that
8 that's Canadian Natural's view?

9 A I'm aware of that.

10 Q Thank you. Okay.

11 If we could look to the left -- and this was a
12 nuance I had missed, so I'm going to read it out, but
13 the well to the left is a 1-3 as well, but it's the 1AA
14 well, and if you can just look at the dimensions at the
15 top line, it says 215 metres, and that represents that
16 that well is 215 metres away from the other 1-3 well.
17 Do you see that, sir?

18 A Yes, I do.

19 Q Okay. Thank you.

20 So if you could just confirm that in that well, so
21 the 1AA/1-3 well, if you -- maybe you can do it from
22 here, but can you confirm that the mid-B1 mudstone is
23 present in that well?

24 A No.

25 Q What do you see that --

26 A What do you mean what do I see there?

1 Q Well, Canadian Natural sees the mid-B1 in that -- in
2 that well. They're identifying it in the green, or
3 it's between the upper -- the green, so the upper B1
4 regional sequence, there's a layer between that and the
5 lower B1 regional sequence, and they see that as the
6 mid-B1 sequence. Do you concur?

7 A I understand what you're saying about their
8 interpretation, but there's absolutely no way on logs
9 to see the mid-B1 mudstone when --

10 Q That's core?

11 A Particularly on this well log. It has to be thicker to
12 see it. I have seen this core, and so the core in the
13 photo isn't shown here, but, yes, the mid-B1 mudstone
14 is present in core in this well.

15 Q I think -- if I can get a moment.

16 A Yeah.

17 Q I think I'm bungling this question.

18 I know where I went wrong.

19 J. JAMIESON: If you could, Ms. Arruda --
20 like, it's zoomed out. If you could zoom back in the
21 core photo to the left. So we need to correlate the
22 core photo that's there. So to the left -- sorry --
23 the other direction. There. Okay.

24 Q J. JAMIESON: So the red arrow to the green
25 on the log is -- is connected to the mid-B1 from the
26 core photo, and do you see the mid-B1 in the core

1 photo?

2 A Yes, I do. It's circled with the red ellipse.

3 Q Thank you.

4 All right. Let's go to the other side. So the
5 third well on the right-hand side is the 1AC/5-2 well,
6 and, again, there's a red arrow pointing to the -- you
7 know, the regional sequence, and it is correlated with
8 a section of the core that is the mid-B1. Do you see
9 that there on the right corner?

10 A I see that there's a circle pointing to where you're
11 indicating the mid-B1 is present.

12 Q So is your -- do you recognize the mid-B1 in that core
13 photo?

14 A I can't say as I do. I mean, there is a grey shale
15 that's circled there, but I do not recall seeing that
16 core, studying it to be sure. If you want, I can say
17 that it does look like the mid-B1 mudstone, but I'm not
18 sure that it is the mid-B1 mudstone.

19 Q Okay. That's fair. And that's --

20 A Okay.

21 Q -- sufficient for our discussion. If you look to the
22 top third well over, the logs, it says "1AC/5-2", and
23 then, again, in between that well and the middle well,
24 you see the 217 metres. So is it your understanding or
25 do you concur that that well is 217 metres away, the
26 one --

1 A Yes.

2 Q -- that Canadian Natural is showing, the mud B?

3 A Yes.

4 Q Okay. Thank you.

5 Sorry. That was a little bit clumsy, but we got
6 there.

7 A A. LAGISQUET: Excuse me. Can I -- can I
8 please confer with my colleague for a second on this
9 question?

10 Q Sure. Yes.

11 A B. BARRIE: My team leader has asked me to
12 tell the hearing room that I'm not sure that I have
13 looked at that core.

14 Q Understood.

15 A Okay.

16 Q And, yeah, I really was asking you to visually identify
17 or see if you thought that was the mid-B1?

18 A Can I --

19 Q -- from the core photos?

20 A And I know that that's what you were trying to do, but
21 if you look at that same photo, there's -- if I may,
22 just point -- is my mouse active? Yeah. So that's
23 what you're calling the "mid-B1 mudstone". There's
24 also some other mudstones here and there which are not
25 within that interval that you circled that look like
26 they could be mid-B1, but they're not, so it's

1 difficult for me --

2 S. PEDDLESSEN: Mr. Barrie, for the record, if
3 you could just verbally say where you put the mouse, so
4 to --

5 A Okay.

6 S. PEDDLESSEN: -- the far left.

7 A B. BARRIE: So if we are looking at the --

8 A A. LAGISQUET: Can we please zoom in on the
9 core so that he can point to the pointers on the core?
10 That would be easier to record.

11 A B. BARRIE: So I'm -- I'll start by
12 pointing out the ellipse in red, which is what you're
13 asking me to tell you if that's the mid-B1 mudstone.
14 There's also some mudstones below that, which are on
15 the far left side of this photograph panel, which look
16 like medium grey shales that may not -- that -- you
17 know, it's hard for me to be certain what mud that is.
18 And there's also some muddy beds up here that it's hard
19 for me to be certain of.

20 But to help you get on your way, so to speak, I
21 will acknowledge that this could be the mid-B1
22 mudstone.

23 Q J. JAMIESON: Thank you.

24 A Okay.

25 Q Just a follow-up question: Looking inside the red
26 circle, can you visually estimate the percentage of

1 mudstone in that interval?

2 A It's difficult for me to estimate on a core photograph
3 across the room the -- you've asked me the volume of
4 shale or how thick the shale is?

5 Q The volume of shale, yeah. So VMI?

6 A It's difficult to estimate, but for the sake of moving
7 along here, it's high. There's a lot of shale there.

8 Q Okay. That's sufficient?

9 A Okay.

10 Q Thank you very much for cooperating on that.

11 Let's move to, if we could -- oh, I think we
12 should just -- these are just questions based on your
13 evidence -- your direct evidence yesterday.

14 You made a statement -- and we did look it up in
15 the transcript. I'll read it out to you just to
16 refresh your memory. You stated: (as read)

17 We estimate the volume of shale in the
18 so-called confinement strata to be
19 approximately 35 percent. In other words,
20 65 percent of the material in the confining
21 strata is sand, porous, and permeable sand.
22 The volume of shale, the 35 percent, is much
23 lower than other SAGD developments where the
24 volume of shale is typically 60 to 80 percent.

25 You recall that statement, sir?

26 A Yes, I do.

1 Q And based on the cores that we just looked at, is that
2 an accurate statement, or would you adjust it? Just
3 based on -- you just used the word "high", and
4 yesterday you used the word "35 percent", but just
5 based on the images we just looked at, what would
6 you -- how would you characterize the percentage?

7 A Okay. So, first of all, when you were asking me to
8 estimate the volume of shale, I understood you to be
9 asking me about the volume of shale within the red
10 ellipse in the middle of the screen, which is of the
11 mid-B1 mudstone. And I indicated that the volume of
12 shale is high there.

13 My comment yesterday was about the entire package
14 of the confining strata, which includes from the top of
15 the SAGD pay to the base of the Wab B. And if you look
16 in this photo, you can see that there is a high
17 percentage of sand in that interval. All the dark
18 brown colouring here is sand. It's not mudstone.

19 Q Did you conduct any log-based analysis to come to that
20 conclusion?

21 A No, I did not.

22 Q Have you conducted any mapping over other SAGD
23 developments to support that statement?

24 A I have viewed hundreds of maps of that interval over
25 various SAGD projects in this basin.

26 Q Okay. Thank you.

1 J. JAMIESON: If we could -- let's see if
2 we're still in Exhibit 50.003. I believe we are.
3 Tab 5, please, Ms. Arruda. And if you could just zoom
4 out for a moment to the map in the centre, we'll start
5 there.

6 Q J. JAMIESON: Okay. So this map, my
7 understanding of it is the -- Canadian Natural had
8 taken -- had drawn your blue polygon over their isopach
9 map. Do you concur that blue polygon represents
10 your -- your mapping outlining of where you believe the
11 mid-B1 is present?

12 A No.

13 Q No?

14 A It's where it's absent.

15 Q Sorry. Yes. So present on the outside?

16 A Correct.

17 Q Absent in the middle?

18 A Correct.

19 Q We're on the same page. Thank you. All right.

20 So I'm going to -- I'm going to refer to it as
21 "the blue polygon", and I'm going to talk about inside
22 or outside the blue polygon.

23 J. JAMIESON: So if you could zoom out just
24 so that we can catch the core that's on the right side,
25 Ms. Arruda. It's the 1AA/11-2 well. It's on the
26 centre right.

1 Q J. JAMIESON: And I believe, Mr. Barrie, you
2 spoke to this one yesterday.

3 J. JAMIESON: And if you could just zoom out
4 a bit. So it's the well -- let me get the right one.
5 It's third up from the bottom on the right. So, yeah.
6 Right there, please. Yes.

7 Q J. JAMIESON: Do you recall that yesterday?
8 I believe, Ms. Barrie that -- Mr. Barrie, that you
9 identified or acknowledged that in that well, the 11-2,
10 you were seeing mid-B1 in the bottom -- on the bottom
11 row of that log on the left side; correct?

12 A Yes. I was seeing the mid-B1 mudstone in that
13 photograph.

14 Q Good. Thank you.

15 So I want to move to the one just below it --
16 sorry. Before we go there, that well, if you follow
17 the line to your blue polygon, sits just outside the
18 blue polygon?

19 A Correct.

20 Q All right. Thank you.

21 So then if we look to the core just below it and
22 in this one, do you identify or see the mid-B1 mudstone
23 [sic]? It would be the top row to the right-hand side?

24 A This is the same photograph you showed me a few minutes
25 ago, and, again, I can't recall if I've seen this core,
26 and I can't say for certain that is the mid-B1 mudstone

1 or not. However, for the sake of moving along, I will
2 agree that this looks like rock that could be mid-B1
3 mudstone.

4 Q Okay. Thank you.

5 I didn't -- the identifier for that core is under
6 the photo, the core photo on the right-hand side, so
7 that's the 1AC/5-2 well, and you're saying it could be.
8 And if we follow the black line into your blue polygon,
9 do you see that the location of that well is in almost
10 the centre of your blue polygon?

11 A Yes, I see where the arrow points.

12 Q Okay. Thank you very much.

13 If we could now, I'd like go up to the corner left
14 of this figure. Top -- yeah, very top corner on the
15 left-hand side, and that well identifier at the top,
16 sir, is 1AB/5-2. Do you see that?

17 A Yes, I do.

18 Q And, again, Canadian Natural identifies mid-B1
19 mudstone. I believe it's on the right-hand side of
20 that core on the upper level, and do you concur that
21 that too is B1 mudstone?

22 A No.

23 Q You disagree on that one?

24 A I disagree on that one.

25 Q Okay. But just for the argument's sake to complete, if
26 you follow the black line, you would agree with me that

1 the location of the well is in the middle of your blue
2 polygon; correct?

3 A As drawn here, yeah, it looks like the arrow points to
4 the middle of the blue polygon.

5 Q Thank you.

6 Okay. We're going to do the last one; you'll be
7 relieved to find out.

8 J. JAMIESON: If you could, Ms. Arruda, go
9 up to the top right-hand corner, far right. There's
10 another core up at the top, and if we could just zoom
11 out a little bit, and it's the -- the identifier is the
12 1AB/11-2 well.

13 Q J. JAMIESON: Do you see that one, sir?

14 A Yes, I do.

15 Q Okay. And, again, far right-hand side, Canadian
16 Natural identifies mid-B1 mudstone, and would you
17 concur that that, in fact -- just on a visual basis,
18 that appears to be mid-B1 mudstone?

19 A No, I do not concur.

20 Q Okay. Again, let's follow the arrow down. You would
21 concur, though, that the location -- that that well is
22 within your blue polygon; correct?

23 A Yes. If it's plotted correctly.

24 Q Thank you.

25 I believe those are all my questions for you.

26 Thank you, Mr. Barrie.

1 I stand corrected, Mr. Barrie. There is -- there
2 are a few more questions I just want to follow up.

3 Are you a professional geologist, sir, with APEGA?

4 A I am a P.Geo scientist with APEGA.

5 Q P.Geo

6 A Yeah.

7 Q Okay. Thank you.

8 The question is: As a geologist would you agree
9 that picking well tops on wireline logs is a
10 fundamental task expected of a geologist?

11 A Yes.

12 Q And would you also agree that the construction of
13 geological cross-sections of wireline well logs to show
14 structural and stratigraphic relationships of
15 geological formations at and in between existing well
16 control is also a fundamental task expected of a
17 geologist?

18 A Yes.

19 Q Would you agree that making maps from the tops picked
20 from wireline wire logs is a fundamental task expected
21 of a geologist?

22 A Yes.

23 Q Would you agree that structural maps are important to
24 determining the amount of differential compaction
25 within or above a geological sequence?

26 A Yes.

1 Q Thank you.

2 Last question: Would you agree, then, that ISH
3 has not done any of its own fundamental mapping work to
4 demonstrate that the amount of differential compaction
5 at KN08 and 09 is significant?

6 A Can you repeat the question, please?

7 Q I'm going to back up because I think that one is a
8 little unfair without more context. But have you made
9 any structural maps showing the magnitude of
10 differential compaction at KN08 and 09?

11 A No, I have not had the time. I've relied on CNRL's
12 maps, primarily their depth conversion structure maps
13 on the top of the Wabiskaw B.

14 Q And just back to your mapping -- and I'm not sure I
15 fully appreciate the differences, but would you call
16 your blue polygon -- has it been constructed based on
17 the proper or the best practice of geological mapping?

18 A Yes.

19 Q How did you come up with your map, then, sir?

20 A Well, I looked at all of the well logs in the immediate
21 area of the blue polygon. I looked at several of the
22 cores that were available to me at the AER. I looked
23 at all of the core photos that were provided to me by
24 CNRL, and then I contoured it using standard geological
25 contouring practices.

26 Q Last question -- and this is back to the differential

1 compaction, but would you agree that ISH has not done
2 any of its own fundamental mapping work to demonstrate
3 that the amount of differential compaction at KN08 and
4 09 is significant as been asserted in your report?

5 A That's correct. We've relied on CNRL's mapping, as I
6 mentioned a few minutes ago.

7 Q Thank you very much.

8 All right. Thank you. I'm just going to -- if
9 you'll give me a moment, we're going to shift gears
10 here.

11 Ms. Lagisquet -- am I saying your name correctly?

12 A A. LAGISQUET: Lagisquet.

13 Q Lagisquet. Oh, my God. It's so beautiful when you say
14 it, but ...

15 Okay. So I understand -- or can you just confirm
16 for the record that you put together the report filed
17 at Tab 7, Exhibit 32.11?

18 A That's correct.

19 Q Right. And I guess we can tell from your résumé as
20 well as your comments yesterday that you've done a fair
21 bit of -- you've got a fair bit of experience with risk
22 assessment, and I think there's some common general
23 principles that we could agree to, and I'm just
24 wondering if we could test those, just what's involved
25 in -- when you're doing it.

26 So would you agree with me that the initial step

1 would be to identify the hazards or the potential
2 risks?

3 A Yeah, that's correct.

4 Q And then you would identify the barriers or the
5 mitigation, things that would prevent -- maybe it's not
6 mitigation, but barriers, things that would prevent the
7 identified consequence from that risk?

8 A Yes. You identify an event, you try to identify what
9 causes the event, and you also identify what would be
10 the consequence of that event.

11 Q And anything that acts to prevent the consequence,
12 would you characterize as a barrier?

13 A Can you rephrase? I'm sorry. I don't think I
14 understand the question.

15 Q Yeah. So I'm just -- it's really basic, but we've
16 identified hazards. You talked about the consequence,
17 right, but anything that would prevent that might be a
18 barrier in between?

19 A Any mitigation that you identify may allow you to
20 reduce the likelihood associated with a risk. A
21 mitigation doesn't reduce the consequence hardly ever.
22 So yesterday I was a bit confused between my right and
23 my left. I'm sorry. I should have said that you
24 mitigate from right to left; right?

25 Q Yeah.

26 A But only the likelihood changes, not the -- the

1 consequence.

2 Q Understood. I was actually thinking more in terms of
3 barriers, things that prevent. So you had done --
4 identify a risk, but there may be a barrier before it
5 happens. I have would have said mitigation --

6 A The control.

7 Q -- the control, sure.

8 A Okay.

9 Q Let's use that. Okay.

10 So then if we could, please, in your report -- no.
11 It's not your report.

12 J. JAMIESON: Exhibit 44.10, PDF page 15,
13 please. This is in ISH's IR responses. And I believe
14 if you could scale up on the regional scale on the
15 right-hand side, please. Just zoom it out a little bit
16 so that we get it in front.

17 Q J. JAMIESON: I believe you spoke to this
18 figure yesterday; is that correct?

19 A Yes.

20 Q And if you look to the figure on the right, we could
21 describe the hazard as being steam at the bottom of the
22 reservoir; correct?

23 A Yeah. I plotted a steam chamber at -- at the bottom to
24 illustrate, you know, the -- the location of the steam
25 chamber.

26 Q But we can agree the hazard -- the potential hazard is

1 the steam?

2 A The steam and the consequence associated with steaming
3 operations, which are gas exsolved out of bitumen as
4 well as potential other reaction product, like when
5 aquathermolysis happens, you know, the release of H₂S.

6 Q Sure. Understood. But the consequence would be the
7 steam invading the Wabiskaw B; correct, or ...

8 A ISH looks at it from a broader perspective. We are
9 looking at the impact of steam as well as the
10 consequences associated with steaming operations.

11 Q Okay. How could we describe the -- even if -- even if
12 we were to accept this sort of torturous path that
13 you've depicted in purple there, can we describe -- or
14 would you concur that those different formations
15 potentially act as barriers or, in your terms, control?
16 So there's some controls there, some barriers between
17 the potential risk or threat and the consequence;
18 correct?

19 A Provided those barriers are present, I would say yes.
20 I think the question here is whether or not those
21 barriers are present at the regional scale.

22 Q Understood. But we can agree that your evidence isn't
23 that they're completely gone; right? There are some
24 potential barriers or potential, in your words,
25 "controls", between the potential hazard -- this is
26 really fundamental stuff, so I'm not trying to confuse

1 you -- the hazard and the consequence up in the Wab B
2 pool?

3 A I mean, if the question is, is it likely that steam
4 would condense before it goes to the Wab B, there could
5 be. And I don't know if I understand your question, so
6 you may have to dummy it down even more for me.

7 Q That's fair. We're going to move on. It was just the
8 application of some really basic principles, but we
9 will move on.

10 In this figure, which is -- I understand that to
11 be ISH's concept of risk -- there are six different
12 barriers or discontinues that those are 2 to 6 metres
13 apart vertically, and laterally they are anywhere from
14 about 100 metres apart to 500 metres. So would you
15 agree on that scale? Are you familiar enough with
16 the -- the data filed on the record?

17 A Yes.

18 Q Thank you.

19 And would you agree that in order for a steam to
20 rise up, you know, even a couple of metres and then
21 progress laterally for hundreds of metres, potentially,
22 that could take a very long time since gravity is a
23 much weaker driving force and the bitumen will drain
24 very slowly with the shallow drainage angle; you'd
25 agree?

26 A Yeah.

1 Q Thank you.

2 And would you agree that by analogy the risk may
3 only arise if the discontinuities or the, you know,
4 gaps or whatever we want to call it -- but potential
5 pathways in these six barriers all align very closely
6 to create a much less torturous path than shown here?

7 A Yeah. Generally speaking, yes. Again, what I would
8 like to clarify -- and it might be, you know, a slight
9 reframing -- is we are looking at discontinuities
10 when -- you know, on the -- in a different perspective,
11 you're looking at the presence of barriers, right. So
12 that's what we have to put in perspective, and that's
13 the whole questions that we've been asking --

14 Q Understood. Understood.

15 A -- over the last few days.

16 Q And I know we're using different words or language.
17 I'm trying to get on the same page with you.

18 A Yeah.

19 Q But we agree that you -- you need a pathway in order
20 for the hazard to create the consequence --

21 A Correct.

22 Q -- that you've identified?

23 Okay. Let's leave it there.

24 Table 50.00 -- sorry -- Exhibit 50.002, and that's
25 PDF page 43, Table 4, and this is a summary of the gas
26 pool values as provided by -- well, the first column

1 was provided by ISH, correct, in Table 4 in terms of
2 the value of the gas?

3 A Right.

4 Q And you used those values, did you, in your risk
5 assessment process?

6 A Yes.

7 Q Thank you.

8 Can you confirm that the -- sorry -- that the
9 numbers reflect -- in that table reflect the values for
10 the gas pools and it actually represents the value --
11 the total value of two different gas caps, not just
12 ISH's ownership interest, which is 46.25 percent in
13 both? I'm going to break that down. So those numbers
14 reflect --

15 A It's a hundred percent.

16 Q -- two gas pools. Two gas pools a hundred percent?

17 A Correct.

18 Q What are those two gas pools?

19 A The shut-in Kirby Upper Mannville II and Wabiskaw A.

20 Q Wabiskaw A. Thank you.

21 Again, Column 1, the one that ISH produced, that
22 assumes the gas production starts as of January 1st,
23 2024; correct?

24 A Correct.

25 Q And the risk that you identify, of course, assumes
26 there's leakage of steam from the McMurray into the

1 Wabiskaw, the pathway that we identified earlier?

2 That's a basic assumption that you're making to get to
3 that consequence?

4 A I believe that I mentioned reaction products in my risk
5 assessment.

6 Q And by that you mean the dynamic of aquathermolysis?

7 A Not only. I mean, gas will be exsolved as a result of
8 SAGD operations.

9 Q Do you agree for the purposes of the risk assessment
10 that some discounted value of the gas should be used?

11 A No.

12 Q No. But you are --

13 A Let --

14 Q -- acknowledging you used a hundred percent of the gas
15 from two gas pools?

16 A Let me confer with my colleague.

17 Do you mind repeating the question, please?

18 Q Yeah. Well, I asked you first: Do you agree that for
19 the purposes of the risk assessment that some
20 discounted value of the gas should be used; you said
21 no?

22 A No.

23 Q And then I asked you: Would you agree that 20 years is
24 a reasonable estimated life expectancy for the SAGD
25 drain -- drainage boxes?

26 A Yeah, that's correct.

1 Q Yes. Okay. So 20 years you feel is reasonable, but
2 your clear answer on discounting was no, and why would
3 that be?

4 A Let me validate with my colleague.

5 What ISH provided here is the value of the gas
6 reserves, and we don't believe that we need to discount
7 the value of the gas reserves.

8 Q Thank you.

9 Let's just do some --

10 A J. CHODZICKI: I could elaborate on that.

11 Q Go ahead.

12 A So the discount -- any time you have a cash-flow
13 stream, you pick a discount rate. The discount rate
14 assumed for the cash-flow stream of a declining gas
15 reserve volume is 10 percent. The effective date is
16 the 24th of January. If you push it into the future,
17 you always get a lower NPV. We're looking at what
18 could we do if we were to start this production up
19 right away? That then says, This is what we think the
20 value is.

21 Now, CNRL also stated yesterday that the life of a
22 SAGD pad is between 10 to 20 years, and there is
23 uncertainty in the life of a SAGD pad. As a result, we
24 look at the gas that's just what is it worth to us at
25 this current time.

26 Q Thank you very much. We actually have some follow-up

1 questions to that, Mr. Chodzicki, so we'll come back to
2 that. Thank you.

3 I just want to complete on your risk assessment
4 work, Ms. Lagisquet. And these two next questions are
5 really just from a logic perspective, really. Would
6 you agree that it would be more appropriate to at least
7 reflect numbers that reflected the 46.25 percent of
8 ISH's in the pool as opposed to the 100 percent?

9 A A. LAGISQUET: Well, if the pool is
10 contaminated, I can't guarantee that you're only going
11 to contaminate the one-half that CNRL doesn't own;
12 right? So the pool is contaminated or is not
13 contaminated; right? So applying the working interest
14 to this evaluation I don't think makes a lot of sense.
15 It's -- it's more binary question is that: Is it
16 contaminated, or is it not contaminated? Do you have
17 controls, or do you not?

18 Q Understood. But the only -- you would -- you would
19 have to concur with me that the only piece that's
20 relevant would be the damage to ISH's interest in the
21 pool; correct? You're not looking out for Canadian
22 Natural's gas interest?

23 A But -- but, again, if it's contaminated for ISH, it's
24 contaminated for CNRL.

25 Q Yes. Understood. But I would've thought your risk
26 assessment -- the scope of it would've been focused on

1 ISH's interest. Are you saying that's not the case?
2 The scope of your report focused just on the gas pool,
3 and you didn't divide it -- you didn't -- these numbers
4 don't reflect the value of ISH's gas. That's the
5 confusion?

6 A Correct. It's a hundred percent as it's said in the --
7 in the title.

8 Q Thank you.

9 J. JAMIESON: If we could bring up
10 Exhibit 32.02, Figure 21.

11 A I would say before we move on -- on from that, if we
12 agree that the value as of January 1st, 2024, even
13 applying the working interest would be over a million
14 dollars, right, and when you go back to the risk
15 assessment and you look at the consequence, the
16 financial consequence, the range is 100K to a million
17 and then a million to 10 million. So even if I apply
18 the working interest, it doesn't change the inherent
19 risk.

20 Q Understood. Thank you. That's helpful.

21 J. JAMIESON: All right. Please,
22 Ms. Arruda, it's Exhibit 32.02, PDF page 39, and
23 Figure 21. And if you could just -- yeah. That's
24 great. We can just read that title.

25 Q J. JAMIESON: So, Ms. Arruda [sic], are you
26 familiar with this map? It's the Wabiskaw B net gas

1 pay map. It was prepared by Canadian Natural, but the
2 purpose of it was to show the two pools.

3 A A. LAGISQUET: Yeah, I -- I recognize -- I
4 recognize the map.

5 Q Okay. And so, you know, I think there's been a little
6 bit of talk of possible communication between the
7 pools, but the question really is if you had some
8 contamination, you know, to the far west in one of the
9 pools, you know, is it reasonable to assume
10 contamination at a hundred percent of the other gas
11 pool?

12 A J. CHODZICKI: Yeah. I can discuss that
13 part. The -- obviously contamination would occur over
14 a period of time. The concentrations of CO₂ and H₂S in
15 the McMurray SAGD projects, if they are to leak into
16 the Wabiskaw B, could be a -- a problem -- a big
17 problem. However, the spread of that would have to be
18 determined with future modelling. And the fact that
19 there is some risk that the pool Wabiskaw B zone could
20 be contaminated implies that there has to be a degree
21 of caution because the other issue is with safety of
22 the wellheads. If you have H₂S in a pool and you're
23 set up to be a sweet producer, if there's any kind of
24 leaks, you'd have a safety risk on surface. So that is
25 an additional risk in addition to the contamination of
26 this gas. The exact time at which the gas will

1 contaminate is difficult to determine for sure.

2 Q Understood. And thank you very much.

3 And just back to Ms. Lagisquet. If you were to
4 only evaluate the consequence in terms of the one pool,
5 the Kirby Upper Mannville II, what does that do to your
6 risk assessment? So your consequence is -- is --
7 excludes the other pool.

8 A A. LAGISQUET: Yeah. As I mentioned earlier
9 when you showed me Table 4 of the other exhibit, if we
10 agree that the value as of January 1st of 2024, I
11 think, for the Kirby Upper Mannville II was in the
12 order of 3.8 million. Even if you apply the working
13 interest, you're still above a million. So it doesn't
14 change my risk assessment.

15 Q I'm asking you to do both at this point. I'm asking
16 you to focus on ISH's interest in one pool, the Kirby
17 Upper Mannville --

18 A Yeah.

19 Q -- II --

20 A That's -- that's what I --

21 Q -- does that -- okay. But -- well, I can't do that
22 math. But does that not -- does that get us under the
23 million dollars?

24 A No, it doesn't.

25 Q It doesn't. Okay. Thank you.

26 At the very end of your executive summary -- so

1 this is Exhibit 32.11, PDF page 4, and it's lines 84
2 and 85. Yeah.

3 So I'll just read these out just because I can --
4 it might be hard to read. You state: (as read)

5 The author acknowledges that the cost of
6 incremental monitoring should be commensurate
7 with the risk and that additional information
8 may be required to analyze and evaluate the
9 risks to ISH's gas assets.

10 In your assessment, you're stating that all the risks
11 are financial only; they're not safety or environmental
12 risks. So given that qualification, if the consequence
13 of a risk is financial only and the specific risk has a
14 10 percent chance of occurring, how much is it
15 reasonable to spend to mitigate that risk?

16 A Again, a risk assessment is -- is a dynamic process;
17 right? And I appreciate the asymmetry in data between
18 ISH and CNRL for us to be able to evaluate the risk.

19 So, again, this is a time 'T' assessment provided.
20 More information is available, it could change the risk
21 profile; right? And that's the whole point of a risk
22 assessment; right? It's to -- it's to measure our
23 ability to either prevent or reduce the -- the risk to
24 an acceptable level.

25 Q Understood. Thank you.

26 A Right? And I framed my assessment based on the

1 information that I had.

2 Q Understood. Yeah. I'm just asking you to revisit your
3 evaluation given this additional information, given the
4 information I'm putting to you. But we can move on.

5 Exhibit 32.11, please, and this is PDF page 33,
6 Figure 19.

7 And we'd just like to better understand your case
8 for Risk 2. If -- could we zoom out just so you could
9 perhaps -- if you could identify your wording for
10 Risk 2, please.

11 A Yeah. So I'm saying: (as read)

12 Due to the close stratigraphic proximity of
13 the Wabiskaw D to McMurray formation and the
14 presence of discontinuities in the
15 confinement strata intervals in areas of
16 KN09, there is a risk of subsurface steam
17 loss of confinement within the McMurray
18 formation during SAGD start-up resulting in
19 loss of economic value for the ISH due to the
20 contamination of the GOB shut-in gas pool as
21 a result of reaction products, mobilization
22 in the formations below.

23 I put a likelihood of 4, which this could happen once
24 in ten years.

25 Q Once in ten years. Thank you.

26 A Yeah. And a consequence between a million and

1 10 million, assuming the entire pool is no longer
2 producible.

3 I'm also qualifying at the bottom of the table
4 that as Dr. Boone, you know, identified, I don't think
5 the -- the risk is necessarily at the time of start-up,
6 but I'm trying to frame the potential long-term
7 consequence of the start-up that could create those
8 additional pathways for reaction products to move from
9 the McMurray to the Wabiskaw B formation.

10 Q Understood.

11 And just -- I just want to clarify. You just
12 stated "the entire pool", but for Risk Number 2, you
13 actually were identifying consequence to both pools;
14 correct?

15 A It wouldn't have changed the inherent risk. So, again,
16 it's a matter of how we value the shut-in gas assets.

17 Q Understood. Thank you.

18 Exhibit 50.002, please. And this is PDF page 5.
19 And this is under d. There's two sub-bullets here, and
20 I just wanted to confirm your familiarity with the
21 temporary MOP of 6,600 kPa -- you're aware of that --
22 in that Canadian Natural's commitment to that is a
23 maximum continuous time of 24 hours?

24 A Yeah, I see that in the second bullet point.

25 Q Okay.

26 A First. Sorry.

1 Q Excuse me one moment, please.

2 Ms. Lagisquet --

3 A Lagisquet.

4 Q Lagisquet. Sorry.

5 Okay. So Dr. Boone, in his direct evidence,
6 presented evidence that the mudstones in the confining
7 strata are ductile and not brittle, the way that
8 Dr. Chalaturnyk asserted. So if we follow Dr. Boone's
9 analysis, any induced fractures are very likely to be
10 sealed after they are -- after they close. So in --
11 just -- I just want to cover off this short-term risk.
12 So if we just have a short period of steam injection at
13 high pressure, is that a fraction of the condensed
14 steam that flows into the Wabiskaw B gas zone such that
15 it would -- such that the impairment of the entire
16 value of the gas cap would be highly unlikely?

17 A I would answer that, generally speaking -- and I don't
18 have Dr. Chalaturnyk with me --

19 Q Yeah.

20 A -- today to kind of validate the behaviour, and I think
21 there's still disagreement on the ductile versus
22 brittle behaviour, so my answer is completely
23 hypothetical, but I understand what you're saying in,
24 you know, it could minimize the risk, like the
25 near-term risk, right? I'm still talking -- and that's
26 the challenge. We're still talking about different

1 things where I focus on the full life cycle when I
2 analyze the risk versus, you know, a time zero to a
3 hundred days of start-up. So I'm looking at the
4 long-term consequences of a start-up going wrong and
5 being undetected.

6 Q And being what? Sorry.

7 A Undetected.

8 Q Undetected.

9 So the start-up going wrong being undetected and
10 some potential long-term consequence from that. Okay.
11 Thank you?

12 A Correct.

13 Q All right. Thank you very much for those responses.

14 I think we have one more line. If you can just
15 give us a moment, please. Okay. Thank you.

16 So Mr. -- let me make sure I get your name right.
17 I will do my best, Chodzicki?

18 A J. CHODZICKI: Yes.

19 Q Thank you very much.

20 Okay. So we do have one last line, and I think
21 you are the right witness. It sounds like you're the
22 one that might know.

23 J. JAMIESON: If we could turn up, please --
24 this is a response. It's an IR response, so it's
25 Exhibit 44.002, and it's pages 62 and 63.

26 A Okay.

1 Q J. JAMIESON: We'll just wait till it gets
2 up on the screen.

3 J. JAMIESON: If you could just expand it a
4 little bit. I think -- I'm looking for paragraph 62
5 and 63. Does that show up on there? Oh, page 62, 63.
6 Sorry.

7 Q J. JAMIESON: This is where Canadian Natural
8 asked a number of questions about the gas -- the value
9 of the gas pool. So I don't think we have to refer to
10 anything specific, but just generally. So a moment
11 ago, Mr. Chodzicki, I thought I heard you confirm that
12 you value the gas on a reserve basis?

13 A Yes.

14 Q And do you currently assign proven or probable reserves
15 to the Kirby Upper Mannville II pool?

16 A Again, as a private company, we do our own internal
17 evaluation that we would call this proven developed
18 non-producing.

19 Q Sorry. Proven, not developed --

20 A Proven developed not producing.

21 Q "Proven developed not producing." Okay. Thank you.

22 And just -- we're just focused on the Kirby Upper
23 Mannville II pool, so if you could just confirm that
24 value? I believe it's in -- I don't know if -- on
25 page 63 should be your response there.

26 A Yeah. That paragraph there, that -- so the total was

1 5.7 million and Upper Mannville II pool was valued at
2 3.685 million, and so that -- that 3,685,000 is the
3 value that would have been allocated to the Kirby Upper
4 Mannville II pool.

5 Q Thank you.

6 And is this a discounted value?

7 A That would be discounted at 10 percent.

8 Q Do you --

9 A 10 percent discount rate.

10 Q Right. But you confirm that the Kirby Upper Mannville 2
11 pool or II pool is shut in due to the GOB decision?

12 A Yes, it is.

13 Q In the reserves evaluation, in which year are the Kirby
14 Upper Mannville II wells returned to the production --
15 returned to production?

16 A Well, this was a calculation done to show that, What do
17 we think the value is if we were to start this pool up
18 tomorrow?

19 Q And why -- can you just help us understand why, in your
20 view, "tomorrow" is a reasonable presumption, given
21 that -- that it's clearly shut in?

22 A Well, let me confer.

23 So our opinion was that -- and, you know, we've
24 shown there's very minimal capital outlay to reactivate
25 this pool, and we could turn it on at any time if we
26 had the permission to. So it doesn't matter. The

1 value still exists; it's just a matter of when we would
2 reactivate the pool, but there is still a value to the
3 gas reserves in the pool.

4 Q And when would you expect to receive that permission?

5 A That, again, would be subject to regulatory, but we
6 haven't gone down that path, but, still, for the
7 purposes of this evaluation to show that there's a risk
8 to the value of the gas reserves, we say that the value
9 when we choose to reactivate it would be this, then
10 discounted into the future at 10 percent discount.

11 Q Mr. Chodzicki, yesterday ISH's legal counsel,
12 Mr. McLeod, he was asking Ms. Lagisquet a set of
13 questions about what she thought the 2.5 million of
14 incremental costs potentially from the mitigation added
15 to the KN08, 09 project was minimal, and in the end he
16 characterized it as "just a drop in the bucket", which
17 she agreed to. Do you recall that exchange?

18 A I think I do, yes.

19 Q And I believe she was making that comparison in
20 relation to the total development costs of the project.
21 So how would you compare 2.5 million to the value of
22 the reserves of the Kirby Upper Mannville II pool?

23 A Oh, I think the discussion yesterday was that
24 considering the total value of a SAGD project, of which
25 this monitoring would still give information about
26 caprock movement and -- and things like that, that

1 could still benefit the long-term understanding of a
2 SAGD project that some of the costs of this monitoring
3 should not be considered just to be implied, to be
4 forced entirely upon the Kirby Upper Mannville II pool,
5 that there is a need for monitoring in SAGD projects.
6 I think that's where we were going with that yesterday.

7 Q Understood. But is it -- is it ISH's position that
8 that -- the gas pool should be -- or that mitigations
9 at all cost -- at any cost should be put in place to
10 preserve the gas pool?

11 A A. LAGISQUET: I think, again, it's about
12 preserving ISH's ability to produce that gas in the
13 future, whenever they are authorized to reopen that gas
14 pool; right?

15 Q At any -- this -- my line of questions, in fairness,
16 has to do with cost-benefit analysis. So I'm taking it
17 to an extreme to make a point. At any cost, is that
18 ISH's view?

19 A Well, if we -- if we want to take it to an extreme, I
20 think, you know, given the pressure that we have
21 currently in our industry to identify, you know, low
22 capital, low GHG projects, I think it's in everybody's
23 best interest to ensure that these gas pools are
24 preserved for the long-term, you know, affordability of
25 energy for Albertans.

26 Q I'll just confer and see if there are any final

1 questions.

2 I believe those are all our questions. Thank you
3 very much, ISH panel.

4 J. JAMIESON: And thank you, Commissioners.
5 We are complete on that, you'll be glad to know.

6 COMMISSIONER CHIASSON: Thank you, Ms. Jamieson.

7 We'll take our morning break now. There will be
8 questions from the AER for the witness panel, so just
9 the reminder not to confer over the break. And so we
10 will be back at 10:30.

11 W. MCCLARY: Commissioner Chiasson, if we
12 could maybe just extend that to 20 minutes for a break
13 or -- or perhaps a bit more just to allow for a proper
14 break and a little bit of conference on our end.

15 COMMISSIONER CHIASSON: Okay. Let's -- okay. Let's
16 come back at 10:40, then.

17 W. MCCLARY: Thank you.

18 COMMISSIONER CHIASSON: So that gives us 25 minutes.
19 Thank you, all.

20 (ADJOURNMENT)

21 COMMISSIONER CHIASSON: All right. Thank you,
22 everyone. We will proceed with questions from the AER,
23 and I believe Mr. McClary is starting off.

24 W. MCCLARY: Thank you, Commissioner,
25 Chiasson.

26 The Alberta Energy Regulator Legal Counsel Questions

1 the ISH Energy Ltd. Witness Panel

2 Q W. MCCLARY: Now, when I'm asking these
3 questions to the witness panel, please feel free to
4 confer as you see fit based on the question presented,
5 and just let me know probably who's best suited to
6 respond as we go through.

7 Again, Will McClary here, legal counsel for the
8 Alberta Energy Regulator. Got a few questions which
9 are intended to help us clarify some of the evidence
10 that we've seen and to provide context if necessary for
11 decision-making purposes, et cetera.

12 The first one is really a true clarification
13 question, and it came up in the evidence presented just
14 before the break here. There was discussion of a value
15 of the reserves of -- I believe it was \$3.685 million.
16 And when we're looking at that, the question is just
17 whether that's the -- the whole value of the reserves
18 or if it's an assessment of the working interest. So
19 should that value, you know, be multiplied by some
20 percentage, or is it, you know, ISH's working interest
21 that's been presented there?

22 A J. CHODZICKI: I'll take that question.
23 You're correct. That is the hundred percent value of
24 what we see. And the logic behind that at the time was
25 we saw it that ISH was acting as the operator on behalf
26 of our working interest partner in that Upper Mannville

1 II pool. And the number you referred to is the amount
2 we would prorate back to the Upper Mannville II pool as
3 a result of a -- like, a production kind of rate
4 forecast we gave for what those wells could produce.

5 Q Great. And it sounds like you want to provide context
6 on that number. Is there any further context you want
7 to provide with respect to those numbers?

8 A There is this one table that we submitted in our IRs.
9 Let me take a look. It -- so IRs back to CNRL would
10 have been the 44.002 exhibit, I believe. I think
11 that's ...

12 Q Are you looking at -- is it PDF page 62? Is that what
13 we're looking for?

14 A I think that's where I'm headed to. Right. That's --
15 that's the one. Correct. Thanks.

16 So what was done, we basically looked at the rate
17 at the time of shut-in, and then we looked at the
18 pressure change to what it is currently. We gave a
19 projected rate. We then said, Based on these pools
20 potentially being in communication, although not
21 verified, if we had a certain volume of gas determined
22 by material balance, how would we prorate the
23 proportionate amounts of gas reserves back to each of
24 those pools? So that would've been these rates, total
25 volumes declined out, given an NPV -- net -- net
26 present value forecast discount at 10 percent. That's

1 how it would have been obtained.

2 Q Great. Thanks.

3 Now, moving on to some geochemistry. So we heard
4 yesterday -- and I believe the quote was along the
5 lines of the -- that Dr. Fowler could not comment on
6 the lateral extent that could be interpreted from the
7 data. And if I could please pull up Exhibit 43.002 at
8 page 234.

9 And this is from Fustic 2013, for context, which I
10 see Dr. Fowler nodding along. We noticed that you're
11 recognized in the acknowledgments of both Fustic 2011
12 and 2013 so should be familiar with this, but if we
13 could get that exhibit up, please. Thank you.

14 And the quote that I'm looking at starts with:
15 (as read)

16 Anomalies in well vertical compositional
17 gradients.

18 It's under the heading "Implications for Reservoir
19 Development". I think it's up on the top of the
20 right-hand column. Oh. Yeah. There. So if we could
21 zoom in, it's the -- the first new paragraph on the
22 right side. Yeah. (as read)

23 Anomalies in well vertical compositional
24 gradients may be used for distinguishing
25 between barriers and baffles. For example,
26 subtle deviations in the compositional

1 gradients evident in Samples 5 and 6 in
2 Well 6, Figures 23 and 24, indicate a baffle
3 that slows but does not stop the mixing of
4 fluids inferring that steam advances will
5 behave the same way.

6 And then this is the part that I'm -- I'm interested
7 in, Dr. Fowler. It says: (as read)

8 Greatly changed compositions between
9 Samples 8 and 10, for example, in Well 6
10 suggest that no communication existed between
11 the two reservoir units inferring that the
12 mudstone between them is laterally extensive,
13 thus geochemical data from the integrated
14 baseline studies can be used as a powerful
15 tool for distinguishing between barriers and
16 baffles.

17 And it's cited to Bennett et al and Fustic et al 2011.

18 So I think you can understand that there's a bit
19 of tension between those two statements, but I'm
20 confident that you'll be able to provide an explanation
21 as to how we can contextualize those two statements.

22 A M. FOWLER: Okay. As Mr. Barland said,
23 the data we see is from one well. We -- you know, you
24 assume that there is some lateral extent, but it's the
25 lateral extent of that particular reservoir
26 compartment. How big that reservoir compartment is

1 laterally, you know, I don't think the geochemistry can
2 tell you. It's -- you know, if you looked from a
3 conventional reservoir as -- which people have done
4 reservoir compartmentalization studies way before they
5 came into heavy oil -- they can be quite small when
6 we've gone back and looked, or they can be quite
7 extensive. But you can't tell that obviously from the
8 geochemistry data unless you have geochemistry data
9 from two different wells where you can compare and say
10 these two well -- these wells are in communication.

11 Q And I think, if I understood your evidence correctly,
12 that because different -- different strata I think had
13 been identified in relation to the barriers and
14 baffles, then the lateral extent that could -- the
15 extent of whatever lateral extent could be inferred
16 from the GCMS data, you would hope to see that kind of
17 confirmed in other wells in the same zones? Is that a
18 correct understanding of what --

19 A Can you --

20 Q -- what your position was?

21 A -- just clarify the question a little bit? Sorry.

22 Q So I -- I guess the evidence that I believe you put
23 before us yesterday was along the lines of while you
24 observed different reservoir compartments and a strong
25 barrier in each of the six wells for which
26 geomechemical data was provided, which I think it

1 should say geochemical data was provided, similar to
2 what Mr. Barland stated on Tuesday -- and this is you
3 speaking: (as read)

4 I cannot comment on the lateral extent. As
5 different intervals are providing a barrier
6 in different wells, this suggests that
7 individual barriers are not laterally
8 continuous over the whole area of the
9 proposed development, that whatever this
10 means, there are possible gaps between the
11 different barriers that would enable steam
12 reaction products to escape into shallower
13 areas.

14 Now, considering what Fustic has said about the 2011
15 paper and how the geochemical data can suggest lateral
16 extent of a baffle or a barrier, is there tension
17 between those two statements? Is there -- can we infer
18 a lateral extent based on geochemical data, or is there
19 a limit to the lateral extent that can be inferred and
20 ideally -- I know that you'll probably hate this
21 question -- but ideally with units and distances?

22 A I -- I don't think I would give -- I could give you a
23 lateral extent of a barrier. It's -- it's -- you know,
24 we look at the geochemistry data. We're not looking at
25 the whole geological context.

26 Q So then does that suggest, then, disagreement with the

1 conclusion in Fustic 2013, that there -- that you can
2 use the geochemical data to --

3 A I -- no. I mean, it works. But I think, as
4 Mr. Barland said on Tuesday or Wednesday, the Fustic
5 papers were early papers, and they were looking purely
6 within the reservoir. They weren't looking for kind
7 of -- you know, within compartments. So you're, like,
8 separating out, like, within the McMurray and you got
9 clear reservoir compartments because those -- those
10 Fustic et al. papers were an extension of what we used
11 to do in -- before for our conventional reservoirs.

12 In the last 10 years, 12 years, we have a lot more
13 experience on the heavy oil reservoirs, and there's not
14 been many papers published, peer review. It's -- it's
15 like giving short courses. You're always stuck because
16 you can't cite anything. But the one thing we do know,
17 there's a lot of variation.

18 Q Thanks.

19 Now, is there anything in the GCMS data that you
20 reviewed to suggest that there is an absence of
21 confining strata over the project area?

22 A There's a barrier in each of the wells, a strong
23 barrier.

24 Q So I'll take that, then, as a "no" to that question.
25 So there's nothing you found that would suggest that
26 the confining strata don't act to confine as CNRL has

1 suggested they would?

2 A Can you just --

3 A A. LAGISQUET: Can I maybe add a little bit
4 to that, please?

5 Q Certainly. I guess the question that I posed to
6 Mr. Barland earlier was whether GCMS data could be used
7 to interpret the absence of a barrier or a baffle, and
8 I believe his response to that question was along the
9 lines of, yes, it can. Do you agree or disagree with
10 that assessment?

11 A M. FOWLER: I would agree with that.

12 Q So was there anything in the data you reviewed that
13 would suggest there is an absence of confining strata
14 between the two relevant zones here?

15 A On a point basis, there's -- there was a -- there's
16 confinement --

17 Q Thanks.

18 A -- I would say, strata in each well.

19 Q Thank you.

20 And, Ms. Lagisquet, if you want to add to that,
21 feel free.

22 A A. LAGISQUET: Yeah. We're looking at data
23 from a core, right, so roughly the size of my cup here,
24 and trying to extrapolate what that means on hundreds
25 of metres. And what we've heard is that GCMS data is
26 not able to do that; right? It can tell you if it sees

1 a barrier at the core level, but hundreds of metres
2 away from that, it can't tell if the barrier is still
3 going to be there. The way you constrain it is based
4 on operational data. You know, once your steam chamber
5 is starting to develop, can you tell, you know --
6 backcast in a sense -- and say whether or not GCMS data
7 was predictive?

8 A M. FOWLER: I mean, just the barrier will
9 be that lateral container reservoir compartment. You
10 know, you can have vertical reservoir compartments, but
11 there's also -- obviously it's 3D. You -- you --
12 you -- it's going to have -- that reservoir compartment
13 is going to have some lateral continuity where the GCMS
14 data will be valid for. How far that -- how big
15 that -- the reservoir compartment is laterally I cannot
16 tell you from a geochemical data. You need the geology
17 or whatever to do that.

18 Q Thanks. I think that -- that assists because I think
19 the issue that we had was trying to square the
20 statement in Fustic 2013 about it being useful for
21 lateral extent. But it sounds like your evidence there
22 would be that the usefulness of the lateral extent is
23 not quantifiable and, you know, hasn't been further
24 investigated since 2013.

25 A Yeah. I mean, as I said, that was -- it was fully
26 unconventional. In the old days, in conventional

1 reservoirs, you would be looking for the lateral
2 continuity rather than the vertical continuity a little
3 bit more, in conventional reservoirs. And there you
4 would have more wells, or you would kind of define
5 that -- that compartment. Here, you know, if -- where
6 we -- you know, where you see differences, then, yeah,
7 might suggest it's a different compartment.

8 Q Thanks. I think we've got enough there.

9 If we could please move on and pull up
10 Exhibit 32.02, PDF page 12, Figure 2.

11 And, Mr. Barrie, I'll be, I think, directing this
12 generally towards you, but if anyone else wants to pop
13 in, please feel free.

14 So in the direct evidence, I believe we heard from
15 you that the vertical permeability of the Wabiskaw C is
16 quite high due to the presence of vertically oriented
17 sand-filled burrows; is that correct?

18 A That is correct.

19 Q And then I believe reference was made to this
20 photograph that we've got up, and maybe if we could
21 please zoom in a little bit on the log in the middle of
22 the page at Figure 2 titled "Wabiskaw C Top". And you
23 referred to this image; right?

24 A That's correct.

25 Q So your conclusion with respect to vertical
26 permeability in the Wabiskaw C, was that -- is that

1 based on your opinion and an interpretation, or was
2 there any effort made to obtain vertical permeability
3 measurements using means available like laboratory
4 samples, et cetera?

5 A B. BARRIE: We did not connect -- conduct
6 any laboratory testing on this rock. I would say my
7 opinion is based on two things: One, my verbal -- or
8 my visual examination of the core and, secondly, the
9 fact that CNRL did not use this unit as a confining
10 strata in their application for KN06.

11 Q Is there anywhere in the materials, I guess -- like, in
12 the materials filed for this proceeding that you could
13 point to in support of your conclusion with respect to
14 the vertical permeability?

15 A Could you repeat the question, please.

16 Q So I guess for the purpose of a hearing, typically a
17 panel is confined to the evidence that's before it, so
18 is there anywhere in the evidence before us that you
19 could point to as evidence in support of your
20 assessment of the vertical permeability of the
21 Wabiskaw C?

22 A Yes.

23 Q Can you take us there, please?

24 A Yes. I would like to point to the visual evidence in
25 this photograph, which shows very well-developed
26 vertical burrows possessing oil-stained sand with very

1 high porosity and permeability, and this rock generally
2 has a very high percentage of porous permeable sand in
3 it.

4 Q Thanks.

5 Now, in light of that, is that -- is that -- is
6 there anything else you would take us to in terms of
7 the materials that we have?

8 A No.

9 Q Thanks.

10 In light of that assessment, we'd like it if you
11 could comment a little further on the nature of the
12 permeability pathways that you've just identified, you
13 know, connection, extent, composition, what they're
14 filled with, et cetera.

15 A Okay. I thought I just did that. The permeable
16 pathways are indicated by the burrows here and
17 interconnected pores between the sand grains that are
18 visible in this photograph. I would like to add that
19 it is my strong opinion that this rock has been
20 intentionally fractured by a process called
21 "differential compaction", which creates vertical
22 permeability pathways within the rock that are not
23 shown in this photograph.

24 Q Are you able to speak to any analogous geologies with
25 respect to vertical permeability created by these types
26 of burrows?

1 A No, not within the context of a one-minute answer. I
2 would need to take you and show you some core and some
3 analyses and so on. So for the purpose of this answer,
4 we only have this photograph.

5 Q Then in -- in conducting your analysis of this core,
6 did you seek out any analogous geology to -- to justify
7 your conclusion about the vertical permeability of the
8 Wabiskaw C?

9 A I relied on my 42 years' experience as a geologist
10 working in this basin and having looked at thousands
11 and thousands of core here and throughout North America
12 that assisted my opinion.

13 Q Thanks.

14 I think I'd like to move on, unless there's more?

15 A Oh, I -- I could add to that.

16 Q Yeah.

17 A Okay. If we look at Exhibit 50.003. You want to go to
18 page 41 and 42. Down near the bottom we see the last
19 paragraph: (as read)

20 The SSG does not believe that the Wabiskaw C
21 interval acts as a regional seal in the area.
22 On the next page -- this is from the original -- the
23 study was back in two thousand and -- 2005. On the
24 next page, page 42, it's mentioned the Wabiskaw --
25 (as read)

26 Based on the inconsistent -- inconsistent

1 cementation of the Wabiskaw C interval and
2 the potential for it to be absent, the
3 Wabiskaw C interval cannot be relied upon as
4 a regional seal.

5 That was part of the original justification to say that
6 for the shut-in of the -- the gas over bitumen shut-in
7 at the time. So that -- I mean, that's some of the --
8 there's a comment there on the 1-11 well. You see a
9 bullet point there: (as read)

10 Highly bioturbated and bitumen-stained but
11 not cemented.

12 So very variable geology here, and ...

13 Q Thanks.

14 Now, again, to whoever on the panel, but
15 Mr. Barrie generally, is there any evidence before us
16 to suggest that these vertical burrows that are
17 identified in that core photograph that we were looking
18 at earlier extend throughout the Wabiskaw C interval or
19 are present elsewhere, have been observed elsewhere?

20 A Yes.

21 Q Can you take us to that?

22 A It would take us some time for me to go through each of
23 the core photos that I've looked at that were provided
24 by CNRL, but, generally speaking, without -- throughout
25 the Wabiskaw C sand interval, it looks like that
26 photograph I just showed you. So it's present

1 everywhere.

2 A A. LAGISQUET: Can I maybe add something --

3 Q W. MCCLARY: Certainly.

4 A -- because the page is already there.

5 So if you look at the fourth bullet point:

6 (as read)

7 Photos of cored wells to the south of the
8 Upper Mannville II pool show that where the
9 Wabiskaw C interval is thicker, it consists
10 of highly bioturbated and bitumen-stained
11 sands and muds.

12 So I think that would be valid at the regional level
13 because this was a regional study.

14 Q Thanks.

15 Now, in relation to the -- the vertical -- what
16 are we calling them again? The vertical ...

17 A B. BARRIE: Burrows.

18 Q Burrows. Thank you.

19 They're filled with sand; right? That's my
20 understanding of the evidence.

21 A Yes.

22 Q Thanks.

23 Where does that sand originate from?

24 A Well, the sand would have been deposited by some
25 process on the sea floor, storms, dunes migrating
26 around on the sea floor, and at some point, organisms

1 were allowed to churn through the rock and redistribute
2 the sand so that you can't observe original -- or
3 primary sedimentary structures that may have once been
4 there.

5 Some of these sand bodies could have been
6 deposited fairly rapidly, essentially burrowing --
7 burying the organism, and some of these structures we
8 see are so-called "escape structures" where an organism
9 was buried and escaped through the sand overlying it
10 and left the traces that we see in the photograph that
11 we just looked at.

12 Q Thanks.

13 Can you explain to me what is meant by the term
14 "torturous"?

15 A I would like to confer on that, please.

16 Q Thanks. Go ahead.

17 A Could you please clarify the context of the question.

18 Q In respect of the log that we were observing earlier --

19 A Do you mean core photograph?

20 Q The core -- yeah. Sorry. The core photograph. Would
21 it be fair to describe -- or would it -- is there any
22 evidence to suggest that a network of those burrows
23 would be or would not be torturous or torturously
24 connected? Like, is there any evidence in our record
25 that would allow us to create an assessment about those
26 burrows and whether they're torturously connected?

1 A I don't have any data on that.

2 Q So would that be to say that there's no data to suggest
3 in either direction whether a network formed by those
4 burrows and pathways between them would be torturous or
5 would not be torturous?

6 A There is no data available.

7 Q Okay. Thanks.

8 Now, the next set of questions is going to relate
9 to stratigraphic context of the fractures, et cetera,
10 identified in the HEF logs, so just a heads-up -- and,
11 Mr. Vickerman, feel free to confer if necessary. Are
12 you able to explain your process for how you go about
13 determining whether a fracture that's observed in a
14 borehole image log is open -- or an open hole -- or an
15 open fracture, rather, is naturally occurring or
16 drilling-induced?

17 A K. VICKERMAN: Yes. The drilling-induced
18 fractures have a particular geometry in the borehole.
19 They tend to reflect so that they exist parallel to the
20 borehole, at least for certain parts of it, and that
21 gets really complicated as the deviation increases and
22 then depending on the direction that the hole is
23 drilled in.

24 So if the hole is drilled, for instance, towards
25 the maximum horizontal stress direction, then any
26 induced fracture would tend to be a vertical sheet

1 fracture that looks like a vertical line on the -- on
2 the plot.

3 Whereas if you have some angle -- if you're
4 drilling now across that -- that maximum horizontal
5 stress direction -- and I'm using my hands to -- to
6 have an inclined borehole and a vertically oriented
7 fracture, the fracture would want to come in parallel
8 to that stress direction plane, that vertically
9 oriented stress direction plane, but then as it gets
10 into the borehole would reflect parallel to the
11 borehole for a part of it and then reflect out the top
12 so that the features tend to be nonplanar.

13 And if you remember the sigmoidal bedding that we
14 talked about yesterday, it would have that sort of
15 shape where it -- where it comes in, it has a
16 curvature, it goes parallel to the borehole, and then
17 reflects out. So that's how they would appear in -- in
18 the image logs that -- that I looked at because they
19 were both deviated. We didn't see that in those logs.
20 They were -- the features that I identified were
21 planar, and they also had either a cusp or a trough to
22 them.

23 And if -- if you have a feature that now crosses,
24 say, 30, 40 percent of the borehole, it's now away from
25 that maximum horizontal stress direction side of the
26 borehole and now in the opposite side where the induced

1 fracture wouldn't -- wouldn't exist.

2 So it has to do with -- there's -- there's a
3 narrow range on the -- on the inside of the cylinder of
4 the borehole that those kinds of features land and --
5 and to do with their shape.

6 Q Thank you.

7 Now, in terms of the analysis, is it -- sorry. Is
8 there some further --

9 A We're good.

10 Q Okay. In terms of the analysis you conducted on the --
11 I believe it was two wells, right, that -- that you
12 looked at the --

13 A That's right.

14 Q -- borehole image --

15 A That's correct.

16 Q -- logs for?

17 A Yeah.

18 Q They were the 9-33 and the 11-34 wells; right?

19 A Yes.

20 Q So for the 11-34 well, did you observe any
21 drilling-induced fractures?

22 A We didn't report any, no. I -- and I should -- I
23 should add the 9-33 was the original name of the well,
24 and I think it was subsequently named to 5-34.

25 Q Noted.

26 A Yeah.

1 Q I think for your purposes when we're looking at the
2 exhibit that it's still titled "9-33", but if --

3 A Yeah.

4 Q -- if there's confusion later, I will very much
5 appreciate that clarification.

6 A That's correct. It's the same well. It's -- we just
7 had the old headers. We -- so I used that in my -- my
8 titling.

9 Q Thank you.

10 Now, to confirm, you said for the 11-4 well you
11 conducted the analysis that you just described, and
12 there weren't any drilling-induced fractures?

13 A There weren't any that we identified.

14 Q Thanks.

15 A Yeah.

16 Q And then is that the same for the 9-33 well, or are
17 there drilling-induced fractures in the 9-33 well?

18 A If you look in my report, there's a Stereonet for
19 the -- oh, actually, I should --

20 Q We could pull it up, I think.

21 A Yeah. Let's -- let's do that.

22 Q I believe it's Exhibit 32.08, PDF 47 or 23. I'm not
23 sure. Oh, here. And -- sorry -- were you looking for
24 the log or the --

25 A Okay. So page -- page 20 on the PDF. I say no
26 drilling-induced fracture, so that's for the -- the

1 first well, which would be the 11-34. The similar
2 diagram in my report from the second well is
3 page number 44.

4 Q Page 44. Thank you.

5 A And I -- I guess I misspoke. So the -- we did pick
6 three different drilling-induced fractures in that
7 image log.

8 Q Now, in terms of -- just to contextualize that. I'm
9 not trying to, like, get you or anything, but as a
10 percentage of the fractures identified, is -- how many
11 is three? Like, what -- what percent of the fractures
12 overall is three fractures?

13 A So there were 16 open fractures. So, I mean, 3
14 drilling-induced and 16 open. I should say when I pick
15 a drilling-induced fracture it may be more of a
16 representative pick rather than picking every single
17 feature. So if we see a trend of those sigmoidal
18 borehole parallel things coming through, we might pick
19 at a larger scale. I might look at 5 or 10 metres at a
20 time and do a pick that goes through the borehole
21 parallel part of it because that tells you the strike
22 direction of that -- that maximum horizontal stress
23 direction.

24 Q Thanks.

25 Now, speaking more generally about the fractures
26 that were identified, can you indicate -- or can ISH --

1 and I think that this is probably something that you'll
2 want to get the panel's support on -- the witness
3 panel, I should say. We just want some clarity on the
4 stratigraphic intervals in which the fractures, both
5 healed and open in this case, that HEF identified in
6 both wells occurred.

7 So maybe the easiest way would be to go, like,
8 well by well just to confirm the stratigraphic
9 intervals in which the fractures, and, again, either
10 healed or open, were identified.

11 A Yeah. So maybe go to page 46 on this.

12 Can we scroll down a little bit on this log?

13 Q Certainly.

14 A Okay.

15 Q Maybe a depth would probably be the most helpful for
16 the record and for our assistance.

17 A Agreed. So if -- if -- if we look down from the top,
18 the -- the -- the dark part of the image that marks the
19 very top of the log down to 503 metres would be the --
20 the Clearwater. The Wab C, I think, starts at 519 or
21 thereabouts on this log. You might push it a little
22 bit down based on the image of where that contact might
23 be more at 520.

24 And then the -- just from looking at the image
25 here, you see that there are some shales that are
26 coming in at approximately five -- 560 or so. That

1 would be the -- probably the base of the non-reservoir
2 McMurray, and so it would be between that 560 and 519.

3 Q Thanks.

4 Now, how much confidence do we have in those
5 assessments, and what are they based off of?

6 A The -- the assessment of the tops?

7 Q Yeah.

8 A The picks as you were -- as it were.

9 A J. CHODZICKI: Oh. We're looking at the
10 Tab 3, Exhibit 43 point -- 043.197, Tab 3, core photos
11 and image log catalogue as provided by CNRL in -- I
12 believe that was in their file submission. I'm not
13 sure if it was an IR reply, but -- so we're -- we're
14 assuming CNRL's -- of -- identification from their
15 spreadsheet from the Tab 3.

16 Q Thanks.

17 So just to clarify the process that -- that's
18 being used here -- oh, that's helpful. I didn't even
19 think we could do that -- you're relying on the picks
20 that CNRL has provided for the same well and then
21 applying those to the -- the log that we were just
22 looking at?

23 A Well, we actually didn't apply it to any log.

24 Q Or --

25 A Kris's analysis is completely independent, and -- so
26 now we're just on the fly here taking the spreadsheet

1 and saying, There's evidence of fracturing in different
2 parts of the confinement strata when we look at the
3 whole intervals from 519 down to 539 or 540 or lower
4 still.

5 Q One moment. I'm just going to confer.

6 So if I were to ask you the same question for the
7 other well, the same process would be followed; you'd
8 look at the -- Canadian Natural's provided picks in
9 respect of the -- the formations at issue in this
10 hearing and then confer with Mr. Vickerman's analysis
11 with respect to fractures?

12 A Yeah. That would -- that would be what we would do.
13 The -- again, we were hoping to get detailed picks
14 earlier in the process ideally with FMIs that would
15 have been applied to us with the different layers so we
16 wouldn't have to muddle through. But first step was
17 Kris analyzes, looks for fractures, and we just say
18 that there's some evidence of fracturing in various
19 layers.

20 Q Thanks.

21 And to confirm, then, the -- the evidence remains
22 that the fractures that were observed are found within
23 the confinement strata that are at issue in this
24 hearing?

25 A Based on looking at the Tab 3, there is some evidence
26 of fracturing in this 9-33 well that we have been

1 discussing.

2 Q One moment. I'm just going to confer before moving on
3 to the next subject.

4 Thanks. That is all I've got, I believe, for
5 the -- the fracture analysis and moving on to the
6 subject of appropriate monitoring conditions under
7 Issue 2 of the hearing.

8 So if we could pull up, please, Exhibit 32.02,
9 starting at PDF 44. It's paragraph 141 of ISH's
10 submission. And it relates to the monitoring
11 conditions proposed by ISH and its experts. And maybe
12 if we could zoom out a little bit if that's still
13 legible because it carries over to the next page just
14 for context. It's not -- yeah. Does that work? Is
15 that legible across the room? If not, we can just zoom
16 in and ask to scroll up and down if that's better.
17 Just let me know.

18 So the first question would be that ISH has
19 expressed that a minimum of one well per pad be
20 instrumented for monitoring, and am I correct in
21 understanding that that would be monitoring of pressure
22 and temperature?

23 A A. LAGISQUET: Yeah. That's correct.

24 Q Thanks.

25 And then the following zones are proposed to be
26 monitored by ISH in this paragraph: It's Wabiskaw B

1 gas, the Clearwater caprock in -- in brackets, the
2 Wabiskaw D and the McMurray formations. Now, before we
3 jump into the next question, can we just clarify what's
4 meant by the "McMurray formations", if there's any more
5 specificity required there?

6 A That would be the reservoir zone.

7 Q Thanks.

8 And are you able to provide a justification based
9 on the evidence in the record for monitoring of zones
10 outside of the Wabiskaw B gas?

11 A So the Clearwater is mentioned as -- because it's the
12 caprock. So you would want to monitor for integrity of
13 the caprock. The Wabiskaw D is mentioned because
14 that's the bitumen-bearing formation closest to the
15 Wabiskaw B shut-in assets. The McMurray formation is
16 mentioned as meaning the reservoir zone so that you can
17 have a direct measurement -- indication of temperature
18 and pressure development in the steam chamber. And the
19 Wab B obviously is the zone of interest.

20 Q Thanks.

21 And you'll note that my question is limited to the
22 zones that are outside of the Wabiskaw B. If I asked
23 ISH for a ranking in terms of preference between the
24 three, could you provide one?

25 A Yeah. Let me confer for a minute.

26 Q Yeah.

1 A So ISH is obviously interested in what's happening to
2 their Wabiskaw B asset; right? We also appreciate that
3 while the well is there, there is an opportunity to
4 monitor more than one zone; right? So there is a
5 matter of efficiency there where, you know, it would be
6 valuable for CNRL to get information in the
7 bitumen-bearing formation as well as their caprock and
8 also at the same time be able to monitor ISH's gas
9 assets.

10 So in terms of preference, it's really a matter of
11 perspective, so I -- I really -- you know, whether you
12 are CNRL or whether you're ISH, I think they're all
13 relevant, and they provide data that can inform changes
14 in -- in the formations.

15 Q Thanks.

16 Now, in terms of ISH's preference, could I --
17 could I have a witness on behalf of ISH -- are they
18 able to provide a ranking in terms of the preference
19 between the three zones outside of the Wabiskaw B?

20 A J. CHODZICKI: Yeah. Just conferring on
21 that.

22 So obviously from -- from ISH's standpoint,
23 Wabiskaw B is important for -- most important for us,
24 but then we would look at -- for the wider perspective
25 of -- of what information could be gleaned, and it
26 would be the Clearwater caprock, and it would be the

1 Wab D and the McMurray. So then with those zones, you
2 could then tell if something unusual is happening from
3 the McMurray to the Wab D to the Wab B, which is most
4 important for ISH. And obviously -- heaven forbid we
5 ever get up to the Clearwater -- then we've got bigger
6 problems in the area. But those would be the -- in an
7 ideal situation of monitoring -- a thorough monitoring
8 of a SAGD operation, that would be the -- kind of the
9 preferred intervals.

10 Q Thanks.

11 Just want to make sure that I'm understanding that
12 evidence correctly. So the preference as stated --
13 obviously the Wab B is the zone that ISH, you know,
14 produce -- or intends to produce from in the long-term.
15 But after the Wab B, the evidence was first Clearwater
16 as it's the caprock, then the Wab D, then the McMurray
17 in terms of a preference or -- and feel free to
18 contradict or say that you can't make a preference.

19 A So further suggests McMurray first -- obviously Wab B,
20 then McMurray, then Wab D, then the Clearwater. So I
21 had that backwards.

22 Q Great.

23 A But Wab B is --

24 Q So McMurray, Wab D, Clearwater in terms of --

25 A Correct.

26 Q -- ISH's preference? Thanks.

1 Now, can you explain what the basis for that
2 stated preference is just with respect to each zone
3 specifically, please, and, if possible, in relation to
4 the issues identified for this hearing?

5 A A. LAGISQUET: So operations will be in the
6 McMurray formation if we look at KN08/KN09; right? So
7 that's where the steam is being injected. That's where
8 we would want to have temperature and pressure
9 information.

10 Then through the evidence, I believe we conveyed
11 the fact that because of the close proximity
12 stratigraphically between the McMurray and the
13 Wabiskaw D and, you know, the risk of overconductive
14 heating and potentially overpressuring if the
15 barrier -- if a barrier present and -- and forms like
16 undrained condition, you would also want to -- to
17 measure temperature and pressure there to kind of
18 inform what's happening from the bottom up; right?

19 There is obviously clear concerns around caprock
20 integrity. I think we discussed that at length through
21 the last few days. So obviously it's a zone of
22 interest. But looking at ISH's interest, we would want
23 to look at then the Wabiskaw B first and then the
24 caprock. So it's not a matter of which one is more
25 important. I think they all give you different
26 information that is valuable to try and understand

1 what's happening. And the data is never used in
2 isolation; right? You use -- CNRL mentioned that a few
3 times. This is an integrated workflow. So the
4 information from an obs well would never be used in
5 complete isolation.

6 Q Thanks.

7 And just to clarify in your response, I believe
8 you referred to discussions over the last few days
9 about integrity of that caprock. By that, I'm assuming
10 you meant the confining strata that we've been
11 discussing as opposed to the Clearwater, which is
12 identified as the caprock in -- in ISH's submission?

13 A Well, we -- we discussed both, right, when
14 Dr. Chalaturnyk yesterday reviewed the geomechanical
15 model. You know, he made a point that the modelling is
16 adequate when you are looking at caprock integrity --
17 addressing caprock integrity questions. Where it may
18 be less adequate is to evaluate whether the confinement
19 strata would act, you know, as -- would provide
20 integrity, you know, and protect the Wabiskaw B.

21 Q Thanks.

22 Now, Ms. Lagisquet, I'm interested, I think,
23 primarily in your evidence on this question. But what
24 would be the incremental cost, in your view, of
25 instrumenting a well in each of these formations as
26 we've discussed? Say -- for example, adding -- if

1 you're going to the Wabiskaw B to instrument it, what's
2 the incremental cost increase to a well to -- to add
3 the other formations?

4 A And that assumes that the well is already there, right,
5 and the well can be instrumented? Is that the -- the
6 assumption and -- I need to make?

7 Q It's probably worthwhile to explore both that
8 assumption and if it's not already there.

9 A Yeah. So I would say if the well is already there and
10 assuming that it's compatibility with the type of
11 instrumentation that we suggest to add, it would be
12 minimal incremental cost, I would say. It's difficult
13 to quote because it would -- it would depend on what we
14 land on the number of zones that we -- we land on
15 monitoring, number of thermocouples, and so on and so
16 forth. But I would say in the -- yeah, 75, 100K. I
17 would be --

18 Q So is that to say 75,000 to \$100,000 per additional
19 zone to be instrumented for monitoring --

20 A No, no, no.

21 Q -- or --

22 A Total.

23 Q Total?

24 A Yeah.

25 Q For -- for all of the zones?

26 A Yes. I believe so, yeah.

1 Q And in -- that's in the case where you've got a
2 preexisting well that goes all the way into the
3 McMurray?

4 A Yeah. There could be much less.

5 Q Now, in the case where you don't have a preexisting
6 well that goes all the way into the McMurray, what
7 would be the incremental cost increase?

8 A Yeah. I would say an incremental well would be in the
9 order of 3, 400K.

10 Q Is that per zone or for all three?

11 A No. That would be the whole vertical well all the way
12 to the -- the McMurray.

13 Q Thank you.

14 And that -- so to understand that evidence,
15 it's -- the hypothetical well would be a new well
16 that's the incremental cost increase to change it from
17 being simply drilled and instrumented for the
18 Wabiskaw B to being drilled and instrumented for the
19 McMurray formation? Is that --

20 A That --

21 Q -- the --

22 A No. That would be a brand-new well.

23 Q That's what I mean. So the -- the cost increase --
24 you've got two hypothetical wells, one that's drilled
25 to the Wab B and instrumented to monitor that, one
26 that's drilled to the McMurray formations and

1 instrumented for all of the formations you've
2 identified. The difference in cost between those two
3 wells, in your view, would be on the order of what?

4 A J. CHODZICKI: So I think you're assuming if
5 there's a well that we drill and then we want to just
6 monitor the Wab B versus three other zones. So that's
7 where I think we would -- there would be another
8 75,000 -- say -- say they cost 25,000 to monitor the
9 Wab B -- assume the well is drilled. Assume it's in
10 place. Then you monitor the Wab B, and -- and, again,
11 that cost could be 25 to 50,000. Then you're
12 monitoring other zones at the -- at the same time.
13 Now, we don't have a full feel for what these costs
14 are, but we're assuming that -- perhaps another 25,000
15 per zone. So say -- that's where we come to the
16 100,000 or so estimate. But it's -- once you have a
17 well in place, and then you've got to run wirelines
18 and -- and -- and the monitoring sensors at the certain
19 depths. That's where we're trying to come up with a
20 ballpark estimate.

21 Q Thanks.

22 And do we have evidence, then, that would suggest
23 what the cost difference between -- we'll call it sort
24 of the Cadillac, I guess, well versus the Honda --
25 sorry to all Honda owners in the audience, but ...

26 A I think that's -- that's where, you know, there is a --

1 a disagreement when we have that in that one table that
2 showed the -- the multi-well piezometers and the number
3 was coming to a very high amount. You know, depending
4 what the use is for other wells -- say you have to have
5 a strat well to properly define the geology. Say you
6 have to do a DFIT test on a well to get a better feel.
7 There are some synergies that can be obtained, and
8 that's what we're hopeful for. Again, we are not
9 experts on what CNRL has in house for actual costs and
10 where there could be some cost savings.

11 Q But am I correct, though, in understanding that
12 Ms. Lagisquet is an expert in these types of projects
13 and can opine on the cost -- you know, the ballpark
14 cost of -- of doing --

15 A A. LAGISQUET: Yeah.

16 Q -- these types of things?

17 A Yeah. So the ballpark cost of a well, that would be --
18 with, like, three to four zone being instrumented with
19 thermocouples and piezometer -- would be in the order
20 of 3 to 500K. Like, it's really hard to give you,
21 like, an absolute estimate, but I'm sure there could be
22 some cost efficiencies that could be found too; right?

23 And so if you want to contrast that -- the cost
24 estimate that Canadian Natural provided, I think we
25 would have to compare the assumptions that were made
26 for the cost because it's -- it's really hard for me,

1 you know, to -- to -- to tell where that 2.4 million, I
2 believe, that was quoted came from. I'm not saying
3 it's wrong. I'm not saying it's right. We would have
4 to see the assumptions that were used.

5 Q Thanks.

6 And now I will ask the witness panel to just
7 confer and review paragraph 141 if possible. So if we
8 could get the entirety of it up on the screen, and
9 then, panel -- witness panel, let me know if you have
10 trouble reading it or anything. And just to confirm,
11 all of the subparagraphs, so(a)(i) through (iii) all
12 the way down to (g) of subparagraphs of paragraph 141.

13 Let me know, I guess, when you've reviewed.

14 A Yeah. I think we're good.

15 Q Thanks.

16 Based on the evidence that's come out through the
17 hearing and the process leading up to now, are there
18 any monitoring conditions that you would change or
19 remove from this list?

20 A Based on the information that was exchanged during
21 this -- this hearing -- and I'm talking about the last
22 four days -- and the clarification around the
23 solvent-assisted start-up in particular, I think
24 potentially dropping the -- the monitoring conditions
25 around solvent -- and it's also the fact that that
26 monitoring is primarily associated with de-risking a

1 technology that is not yet commercially proven. So
2 really it would be a choice that Canadian Natural makes
3 to de-risk that technology, and it doesn't necessarily
4 impact ISH's interests.

5 Q Thanks.

6 Anything else in that list, or is that it?

7 A J. CHODZICKI: Looking at the -- the items,
8 obviously we -- ISH is not that concerned about the
9 SAGD, but the Wab B is always the monitoring that would
10 be of interest to us. And thus having adequate
11 monitoring in the Wab B with sufficient monitoring
12 wells properly located to be able to check for
13 variations in temperature and pressure over the SAGD
14 pools still is valuable information both for ISH and
15 for CNRL.

16 Q Thanks. But --

17 A A. LAGISQUET: And when we say -- sorry.
18 When we're not concerned about SAGD, and we're not
19 concerned about SAGD performance per se. We're
20 concerned about the impact that SAGD could have on the
21 Wab B. I think we made that very, very clear. But,
22 again, we appreciate that an observation well would be
23 primarily to monitor the performance of SAGD, right,
24 not -- it has an indirect impact on how you manage to
25 monitor the gas zone in -- in the Wabiskaw B; right?
26 So there would be some efficiencies again there. If

1 you end up draining a well, why not monitor all the
2 zones to guarantee the absence of impact. So I would
3 be in the middle between the Cadillac and the -- and
4 the Honda right there.

5 Q Thanks.

6 Just to confirm, the question is very specifically
7 about whether there's any changes to this paragraph and
8 the monitoring conditions. I think we've explored
9 the --

10 A Yeah. So that would be primarily on the solvent-assisted
11 monitoring.

12 Q And no other amendments or deletions?

13 A No.

14 A J. CHODZICKI: You're talking just on the
15 solvent paragraph or on other parts -- other --

16 Q No. All of paragraph 141(a) through (g) --

17 A Right.

18 Q -- is there anything you'd take out?

19 A Right. And that's what we're talking about, (a), we
20 could -- we could definitely relinquish the desire for
21 more monitoring of the other zones. But I just wanted
22 to touch on perhaps the Wabiskaw B should have some
23 monitoring, especially if SAGD operations are imminent
24 in the Wabiskaw D zone, which is very close to the
25 Wabiskaw B zone. So we would say, Yeah. We could get
26 by with less monitoring with the multi-zoned piezometer

1 wells, but we would want to monitor the Wabiskaw B, and
2 perhaps there should be one point that is used to
3 monitor the Wabiskaw D as well, which is so close to
4 the Wabiskaw B.

5 A A. LAGISQUET: Yeah. And that -- that's part
6 of finding those efficiencies. You know, like,
7 we've -- we've seen that there is that KN25, I believe,
8 that could be a future pad, and obviously as you get
9 higher in the stratigraphy, then you get closer to the
10 Wab B. So I think it's in everybody's best interest to
11 try and monitor that zone as much as possible to ensure
12 that there is no impact, or if there is impact, then we
13 can remediate it.

14 Q Thanks.

15 So then -- and, again, please just focus on the
16 act -- the question that I'm asking here because I
17 don't need to have further explanation in response to
18 the answer necessarily.

19 But the next question is: Is there any monitoring
20 condition that should be there but is not contained in
21 paragraph 141? Anything that you would add to the
22 monitoring conditions based on what's come out in the
23 hearing process or even also specifying certain
24 monitoring conditions, for example, the placement of
25 the monitoring well, et cetera? If there's anything
26 like that, let us know.

1 A So we did identify a location for the monitoring well
2 already, and it's at -- in my report, so it's there for
3 reference, if necessary.

4 But, no, to your question with the exception of
5 the -- of the solvent monitoring, we wouldn't add or
6 remove anything.

7 Q Thank you.

8 A J. CHODZICKI: I'll add to that. If we could
9 pull up Exhibit 15.01, page 106, Tab 3, and we could
10 just talk through this diagram a bit because this gives
11 useful context.

12 So you see on the right side the 10-1 well. The
13 10-1 is the current monitoring well. That's the
14 current monitoring well and essentially supports what
15 is happening at the KN06 pad, and we see there is some
16 distance to the other.

17 So the 10-34 was the one we talked about
18 yesterday, will be potentially a monitoring well. That
19 will be useful information for KN08, of course subject
20 to assuming the proper Directive 020 regulations are
21 followed with the downhole abandonment of the McMurray,
22 and ISH has supported CNRL on converting this to a
23 monitoring well. That's useful information.

24 We see the yellow star -- the yellow star is the
25 proposed 1-3 monitoring well location. ISH supports
26 that -- that well, and, you know, again, the full

1 details of what will be proposed for that well is still
2 to be determined.

3 And we see up by KN09 -- if we look -- we talked
4 that gap yesterday in that KN09 pad where there is
5 about 600 metres in between strat tests, which looks
6 like an insufficient well density to fully determine
7 what is there. And then where this 10-2 shows as
8 another -- that's another GOB well that's been shut in,
9 but there was talk yesterday about the proposal to
10 drill a new strat test just to the northeast of
11 approximately this location. That would be useful
12 information. Also, CNRL would learn some more about
13 the Wab D at that location, and that could be another
14 good monitoring well to include. So that's kind of the
15 location of the potential monitoring wells.

16 The advantage of monitoring wells is -- we talked
17 about -- they talked about temperature diffusion
18 yesterday and how temperature effects are much slower
19 than pressure effects. Now, I think pressure effects
20 are still slow in a reservoir considering there is
21 variation of permeability, and we have seen the
22 variations of pay thickness through here. So that's
23 where more monitoring wells come into play. But to
24 just say, One monitoring well at one location of 10-1
25 is sufficient, well, no, we don't think it's
26 sufficient, but that's why we see there is now

1 application to do more monitoring here.

2 And so temperature -- it's not just you're
3 monitoring the pressure. You are monitoring the
4 temperatures also, which could be an indication of some
5 kind of premature breakthrough happening or something
6 strange happening that you might want to know about.
7 So that's what we -- you know, we're looking at for
8 monitoring, is just to give the aerial context on the
9 map.

10 Q Thanks.

11 Now, I just need to confer a little bit before
12 moving on to our next subject matter. Thanks.

13 Now, zooming in a little bit on some more
14 monitoring conditions and potential approval
15 conditions, et cetera, we'll be talking about gas
16 composition analysis, and ISH refers to that
17 specifically -- and, actually, if we could go back,
18 please, to Exhibit 32.02, page 46 I think we were
19 looking at. It's paragraph (c), (d), and (e), which
20 I -- yeah. They're all on para -- page -- I think it
21 would be 46 -- or 45. Sorry.

22 What type of gas compositional analysis and at
23 what frequency should these analyses be conducted
24 during the life of the KN08 and KN09? And if you could
25 support that answer when you're providing as well.

26 A A. LAGISQUET: Okay. I will start on this

1 one.

2 So the proposal to collect gas samples is to have
3 a mean to be able to evaluate if the Wabiskaw B gas
4 pool has been contaminated or not, right? So you would
5 want to test before SAGD operations commence, and you
6 would definitely want to test when they're completed,
7 right? That being said, if something has happened and
8 you haven't had any data point in between to indicate a
9 gradual contamination of the pool, the only thing you
10 can say is that the pool has been contaminated, right,
11 instead of being able to monitor as time goes by. So
12 it would be preferable to be able to have data points
13 in between the pre SAGD and the end of SAGD.

14 In terms of frequency, my colleague and I agree
15 that annual would likely be a good -- a good frequency
16 to be able to monitor the changes in gas composition.

17 And to address your question, what we would be
18 looking for is deltas against the baseline composition.

19 Q Thanks.

20 Now, in terms of a baseline composition, are you
21 aware of any gas samples that have already been
22 collected and analyzed from the Kirby Upper Mannville
23 II gas pool?

24 A J. CHODZICKI: I think you're talking
25 historical -- historical samples. Yes, there have been
26 some historical analyses. I think in one of ISH's IRs,

1 I believe we provided some -- some baseline samples.
2 Also, of course, we would want to see a new baseline
3 sent now because -- just to confirm now with SAGD
4 operations what is the current baseline.

5 Q So is there any -- I guess can you point us to a reason
6 in evidence or through analysis as to why previous gas
7 samples may or may not be suitable for the purpose of
8 establishing a baseline?

9 A A. LAGISQUET: It's just because of the
10 advantage. They're pretty old. They're pre-GOB
11 shut-in obviously, so in fairness also to CNRL, I think
12 it would be going to have a baseline that we can all
13 agree upon, and so collecting gas samples now pre SAGD
14 would be preferable in terms of quality of the data.

15 Q Thanks.

16 Now -- now, you would have heard Canadian
17 Natural's witnesses describe the process required to
18 obtain a gas sample through their direct evidence. Do
19 you disagree with that process or the description of
20 that process in any way?

21 A J. CHODZICKI: So part of it -- part of new
22 samples could be done as part of a new well drilling if
23 you were to perforate that zone. We understand CNRL's
24 concerns about them wanting to produce the well for a
25 bit, which in some cases you'd have to have some kind
26 of temporary exemption to be able to produce that well

1 for a bit, and I understand CNRL's concern that there
2 would be some costs. And we're talking on a shut-in
3 well -- a shut-in well that's -- should be still tied
4 in, could be produced for a bit, but they're talking
5 about trying to clean that well up a bit because it had
6 been shut in for a while. So you would produce it for
7 a bit, and then you would sample that gas. So it did
8 sound a bit arduous. You know, maybe you could do
9 something a little simpler. It's a hard -- I'm not
10 fully aware of what -- what they're proposing exactly,
11 but in principle I understand that there's some work
12 required.

13 Q So I guess in general, then, you don't have any strong
14 disagreement with what Canadian Natural's witnesses
15 presented as the process that would be required to
16 obtain a gas sample from a -- from the relevant pool?

17 A A. LAGISQUET: Yeah. Provided that it's
18 feasible to -- to be -- to reopen a GOB shut-in gas
19 well for the purpose of collecting a gas sample. I
20 think their description was correct in the sense that
21 you would have to flow the well for a while to ensure
22 that you have a representative sample, and I think
23 that's the whole purpose behind collecting a new sample
24 versus using historical samples, is to ensure that at
25 the end of the day we are representative.

26 Q Now -- and bear with me. It's a little speculative,

1 but would it be possible to identify some other
2 monitoring condition, the pressure temperature, et
3 cetera, over time, that is a little bit more easy to
4 monitor than a deviation in which could trigger a
5 requirement to collect a gas sample?

6 A J. CHODZICKI: Yeah. That -- that would be a
7 reasonable compromise, that, you know, the pressure and
8 temperature differences over time are what could
9 trigger all of a sudden a need to understand there's
10 been a sudden change in temperature that may indicate
11 something is breaching. And you could say, Okay. We
12 need to do a closer work at this well and grab a proper
13 sample. That's a fair statement to make.

14 Q So you've identified pressure and temperature as
15 variables that could be monitored as a trigger point
16 perhaps for gas compositional analysis. Are there any
17 others?

18 A A. LAGISQUET: I can take that one. The
19 challenge is the -- the response time, right, and the
20 interpretation of -- of those pressure and temperature
21 data. So the closest you are to the zone, the easier
22 to get, again, representative information. So the
23 preference would be collect the gas sample. We
24 appreciate it might be complicated to do that, but
25 that's the best -- that's the best option.

26 Q Thanks. And thank you as well for the segue into my

1 next subject.

2 On time lines, what would be a reasonable time
3 line, do you think, in terms of either between some
4 other triggering event saying, We need to take a gas
5 sample or between a gas composition sample
6 demonstrating some anomalous result and a response
7 being required? What's a reasonable amount of time in
8 those types of situations?

9 A So I'm going to try to answer your question.

10 Q It's a bit of a long one. Sorry.

11 A Yeah. And -- and the challenge with answering is the
12 fact that it's really hard to interpret data in
13 isolation, and I think that's what we've seen through
14 this -- the conversation we've had over the last few
15 days.

16 And so taking information from a single data point
17 and -- and hoping that that data point is going to tell
18 you the whole answer is -- is an incomplete approach;
19 right? And that's why we're proposing a series of
20 monitoring conditions. Because in isolation, they
21 wouldn't be able to tell you the full story.

22 So now, you know, going back to monitoring well,
23 like we understand -- the time line -- it takes time to
24 establish a trend. By the time you establish trend,
25 you know, assuming that the well is actually giving
26 you -- giving you accurate data, it could take a while

1 and it could be too late. And that's why we want obs
2 wells in combination with gas compositional analysis to
3 understand what is happening over time.

4 Q Thanks.

5 Now, just to clarify, I think the evidence that
6 you've presented speaks for itself in respect of the
7 value of multiple data points in relation to
8 monitoring. In parking that issue, if we could move in
9 very specifically to the time lines. What would be a
10 reasonable time line if the data available suggests
11 that there are adverse events occurring in relation to
12 steam migration? What's a reasonable time line for an
13 operator to report that to the Regulator and for there
14 to be corrective action applied to -- to remedy the
15 situation if it's identified?

16 A J. CHODZICKI: Okay. So I understand with
17 the 10-1 monitoring well there are some monitoring
18 conditions in place that CNRL report unusual changes in
19 pressure and temperature to the Regulator. I
20 understand that there is an annual report that gets
21 filed on the performance of a SAGD. The 10-1
22 monitoring well will be filed with the next -- I think
23 it's Directive 54 -- I can't remember -- report. But,
24 you know, if the data is obtained monthly, ISH gets a
25 copy of that monthly data. So I would assume, upon an
26 unusual change in temperature or pressure, that could

1 be reported fairly soon, like, within a month after it
2 happening if we're getting the data every month, as
3 opposed to waiting for the annual performance report of
4 the SAGD project. So I think if an unusual temperature
5 or pressure change -- I think -- I thought the word was
6 they're to notify immediately, which one -- you know,
7 one month is pretty immediate compared to an annual
8 report -- then that would then suggest that you need to
9 do some follow-up investigation right away to determine
10 what is causing this unusual change. And an unusual
11 change wouldn't be, like, 01. It would be something --
12 say you're off a degree or your pressure has suddenly
13 jumped up a couple hundred kilopascals or something
14 like that. So I think it would be fair to say
15 immediate, which would imply, you know, within a month
16 to try and understand what has happened.

17 Q And then I guess the second part of that question would
18 be in relation to what's a reasonable time frame in
19 which ISH would want to see a corrective action or
20 mitigation strategy, however you want to phrase it, in
21 the event that some adverse condition is -- appears to
22 be occurring?

23 Like, how long do you have once the pressure
24 transducers tell you something weird is happening
25 between then and when the steam gets to the gas, that
26 type of a question?

1 A So I just wanted to clarify. Are you talking the first
2 step is to first understand what is going on, which
3 would imply, like, take a gas sample first? That would
4 be the first step. And then you would try to
5 understand what -- what has happened, that were gas
6 analysis, a sample would come in handy at that point in
7 time. As for other mitigating measures, let me confer.

8 Q I think -- just to clarify, I'm trying to provide as
9 little structure here as possible in the response. I
10 just -- I want to -- I want to better understand the
11 urgency or the time line with which a response would be
12 necessitated based on the issues we've been discussing
13 in this hearing for the last three-and-a-half days.

14 A A. LAGISQUET: So I'm going to attempt an
15 answer here. You would have your gas compositional
16 analysis. You would identify acceptable bounds in
17 terms of results, and as long as they are within those
18 margins that would be considered, you know, an
19 acceptable data point. If you start going off track on
20 your results, that's when you would want to take
21 action, and that would be probably a collaborative kind
22 of approach with CNRL to understand what data we're
23 seeing, how it's being interpreted, and take the
24 corrective actions. One of them might be, you know,
25 reduce your steam rates, for instance.

26 I would say once the gas starts being contaminated

1 there is no turning back. So in terms of remediation,
2 the only appropriate remediation I would see is reduce
3 your steam rates, reduce your pressure to minimize --
4 to attempt to minimize the impact. But the risk at
5 that point would have materialized.

6 Q Would there be any other mitigative or corrective
7 actions that you think might be worth contemplating and
8 time lines on which to implement those in response to
9 observed anomalies and data?

10 A J. CHODZICKI: So thinking about that, we
11 would -- again, with additional monitoring, it gives
12 you the potential to compare what's happening at the
13 one well to the other wells to make sure this isn't
14 some unusual data spike.

15 I know we've mentioned as another monitoring
16 condition surface recorders; right? Surface recorders
17 compared to downhole recorders could also indicate is
18 there some weird difference. Because as we discussed
19 for 10-1 in our filings, that not knowing what's
20 happening downhole -- and we're -- we're confident we
21 can get the proper mechanical configuration of the
22 gauges downhole -- then we still want to have
23 double-checks on those gauges with surface recording.

24 And then looking at the location of that anomaly
25 that gets observed, comparing it to other recorders,
26 other observation wells, we can then say, Is this some

1 localized phenomenon or just a bad gauge that needs
2 replacement? So at that time we would attempt to say,
3 Hey, there's something unusual here; you need to look
4 at this.

5 As for what happens -- if it's truly an event and
6 the subsequent gas analysis says, Yeah, we've got some
7 high CO2 and high H2S gas that's suddenly noted, at
8 that point, there's not much really we can do. It's
9 out of -- it's out of our hands, and it just becomes a
10 matter of time, then, as to how other parts of the
11 field respond, which is where you then have the other
12 monitoring wells to see if there's a temperature or
13 more a pressure change that can be observed at these
14 other locations that then gives you the -- some -- some
15 confidence that, Okay. It's more localized. Hopefully
16 it stays local and we don't see this -- these effects
17 spreading. Of course, over time, yes, H2S will
18 diffuse -- other gases will diffuse, but if it's
19 localized, hopefully we can just live with that one
20 event. But once it happens, it happens. Like, we're
21 not experts on how you would try and block that from
22 happening, if it has happened.

23 Q Thanks.

24 Moving on -- away from conditions, et cetera, and
25 monitoring, I know I said earlier that I finished
26 talking about fractures, but I misled you. My

1 apologies for that. We're going to go back to a
2 discussion of fractures, Issue Number 1, presence of --
3 or potential presence of faults and fractures.

4 If we could pull up, please, Exhibit 32.02 at PDF
5 page 22, paragraph 59. And if we can just zoom in on
6 that one, please. Thanks.

7 So here ISH's submission states that the
8 interpreted FMI logs show evidence of fracturing below
9 the McMurray zone between the McMurray and the Wabiskaw
10 zones and above the Wabiskaw zone. And the statement
11 is that: (as read)

12 This confirms ISH's interpretation that there
13 are existing fractures in the strata
14 underlying KN08 and KN09.

15 So we've heard some evidence on this, heard it
16 discussed. But now if we could please go to
17 Exhibit 32.08 at Tab 4. It's PDF page 46. Oh, there
18 we are.

19 So the FMI interpretation and summaries shows a
20 summary of fractures identified at different intervals
21 within the 9-33 well. Yesterday the question was asked
22 on where these fractures occur and at what intervals.
23 So can ISH provide approximate intervals where these
24 fractures are projected to occur?

25 Sorry. I'm hearing that that's already been
26 addressed. So we can move on more to the fracture

1 density, I think, which was the -- the more point about
2 this.

3 So in the -- unless you've got more on that, but I
4 think I already asked that earlier. Yeah. I realized
5 it as I was reading it.

6 So moving on to the subject of stratigraphy and
7 fractured density, so yesterday it was described that
8 the fracture density approached maybe approximately
9 five fractures per metre in a confined layer. We just
10 are seeking clarity here as to whether this is over all
11 of the confining layer, like all six units that
12 Canadian Natural has identified, or within a single
13 kind of sublayer of that and, if so, identify which
14 sublayer.

15 A K. VICKERMAN: Okay. So -- so on the plot,
16 the fracture density is the -- the magenta-shaded areas
17 on the third and fourth tracks from the right-hand
18 side. And the -- the difference between these two,
19 the -- the one that's on the third from the right-hand
20 side is the fracture count. So that's the number of
21 fractures encountered in a -- a 1-metre sliding window.

22 The next track over is fracture density, and
23 that's a -- a calculated number. So if you have a --
24 an inclined well -- or if you -- if you have a well and
25 hit a fracture that's steeply inclined to the borehole,
26 it's -- you're less likely to hit it. And if you now

1 hit several of those things that are less likely to be
2 hit, if you project the presence of an unlikely feature
3 laterally, it -- it implies a density in a -- in a
4 volumetric sense.

5 And so the -- for instance, if we look at just
6 below 546, there's -- there's three fractures there.
7 And that -- the -- the fracture density -- each track
8 there is counting two fractures per metre. And so it's
9 saying that it's a more -- bit over four fractures per
10 metre is -- is the volumetric density of those
11 fractures at that depth.

12 You know, this -- this isn't enough data to do a
13 distributive fracture network analysis, that kind of
14 question. That's a -- that's a bigger -- bigger
15 question, I think, is, you know, how -- how many
16 fractures are there present everywhere. But, you know,
17 it's -- if you were to say that the -- the confinement
18 interval is at 520 to, you know, perhaps 560 on this
19 plot and we encounter -- two, four, six -- seven
20 fractures in that metre -- or in that interval -- so
21 it's not -- as I said, it's not highly fractured, but
22 there are fractures present.

23 I would note that these -- I wouldn't expect -- if
24 you had a -- a well, say, 10 metres away from this
25 well, like, very close, you wouldn't necessarily see
26 fractures in the exact same stratigraphic layers. They

1 would be -- tend to occur in -- in layers that have
2 similar mechanical properties. So -- and -- and that
3 may be a fracture in the layer of -- above where we see
4 it in this well or below where we see it in this well.
5 But, overall, you might expect to see fracture density
6 similar to this nearby.

7 Q So just in the spirit of confirming the evidence and
8 confirming our understanding, you did a little kind of
9 back of the napkin type of calculation there for
10 fracture density over the -- the kind of confining
11 strata that we've been talking about. Could we just
12 confirm what those numbers are? Can you have a quick
13 look at this exhibit and -- and the strata that we were
14 talking about earlier and look at the number of
15 fractures and do the division there for us?

16 A So we're -- we're seeing seven fractures in this --
17 however many there is -- 20 -- 35-, 40-metre interval.
18 So -- --

19 Q So 7 over 35?

20 A -- sure. So that would tell you the -- the density of
21 fractures that are in the orientation that this well
22 can sample. So there -- this well has a particular
23 deviation that's -- if you look at the track on the --
24 on the left side, there's a -- a tadpole track there.
25 The long tadpole is pointing down towards where the
26 well is drilled. So this well is drilled in a -- in an

1 inclined southeasterly direction, and so it's going to
2 tend to see fractures that are striking perpendicular
3 to that trend.

4 What you can't tell from this is whether there are
5 fractures in the opposite direction that are parallel
6 to that -- the deviated wellbore trend. And so it's --
7 it's unknown to project sideways on this.

8 Q So I guess the -- understanding fracture density, then,
9 in that context, it would probably be better to phrase
10 it as "observed fracture density" for that well?

11 A That's fair. If you were to combine this with the
12 other well, which was drilled in an orthogonal
13 direction to it that saw fewer fractures, you might
14 start to develop a picture that, you know, maybe there
15 are seven fractures in that confining strata observed
16 by this well, and the other well that was not too far
17 away and drilled in a different direction saw two or
18 three -- whatever that number is. You might combine
19 those two together and say, you know, this describes
20 what the -- the fracture network might look like.

21 COMMISSIONER CHIASSON: Mr. McClary, Commissioner
22 Barker has a question following on.

23 W. MCCLARY: Yeah.

24 COMMISSIONER BARKER: Thank you, Mr. McClary.

25 Mr. Vickerman, on this line of questioning, of
26 these wells that you're saying that are about seven

1 that you've identified in this well, how many of them
2 are drilling induced and how many of them are naturally
3 occurring, in your opinion?

4 A So the ones that we picked as the magenta-coloured ones
5 are naturally occurring. The -- the drilling induced
6 are those -- the -- the ones that are near the centre
7 of the tadpole track with a grey circle and two lines
8 pointing out in -- in -- in opposite directions.

9 COMMISSIONER BARKER: Okay. And then --

10 A So there's three of those on -- in that interval here.

11 COMMISSIONER BARKER: Okay. Thanks.

12 And then in your -- were you able to interpret of
13 any of those fractures, the naturally occurring
14 fractures that were closed or -- versus open?

15 A K. VICKERMAN: Yeah. So I've only -- I've
16 only spoken to the magenta ones. The magenta ones are
17 those that we think are open because they have -- they
18 have that conductive appearance.

19 There are a number of the yellow -- the smaller
20 yellow fractures that are here are the healed fractures
21 that we've identified. And that was using that line of
22 evidence about it's overconductive on the inside of the
23 cusp or the trough and -- and often a very subtle
24 appearance as opposed to conductive looking, like
25 the -- the magenta ones that we have.

26 COMMISSIONER BARKER: Okay. Thank you.

1 Thank you, Mr. McClary.

2 A Yeah. So, I mean, on that point, that means that there
3 is actually a higher total fracture density if you
4 include the -- the healed versus the -- the open here.
5 So there -- there are a couple of healed fractures in
6 that -- in that interval. So, you know, do you count
7 seven? Do you count nine?

8 Q W. MCCLARY: Thanks.

9 And then I guess in terms of identifying them in
10 the stratigraphy, your approach -- if -- if you are
11 asked to identify them in that way would be, again, to
12 go back to CNRL's picks on the zones and then using a
13 calculation as we've described to count the fractures
14 over the -- the height of the -- the zone? Is that --

15 A K. VICKERMAN: Yeah, I think that's fair.

16 Q Thanks.

17 A I -- I -- I would -- I would suggest that because
18 there's been disagreement in the intensity of
19 fracturing between my interpretation and CNRL's that it
20 would be worth looking at other wells to get a -- a
21 better picture because I -- you know, some of the
22 features that were -- a lot -- three -- a lot of the
23 features that were described as "tool marks" by the --
24 my opposite interpreter -- I -- I disagree. Some --
25 some were borehole breakouts falling features; some
26 were image processing features. And if -- if

1 everything's called a "tool mark", maybe nothing's a
2 tool mark. So I -- I have suspicions about that.

3 I would -- you would want to look at -- look at
4 the whole thing. I would -- I would look at all the
5 wells, and then you can get a -- a better idea.
6 There -- there's not that many fractures in here, so
7 whether --

8 A A. LAGISQUET: Again, it's back to being --
9 is it representative --

10 A K. VICKERMAN: Yeah.

11 A A. LAGISQUET: -- right --

12 A K. VICKERMAN: Yeah.

13 A A. LAGISQUET: -- looking at two wells out
14 of --

15 Q Thanks.

16 And I'm really just investigating the -- the use
17 of the -- the unit as described -- like, the -- the
18 fracture density.

19 A K. VICKERMAN: Yeah. When you have a
20 sparse -- a -- you know, a modest number of fractures
21 like this, it's -- it is hard to upscale it to a -- to
22 a larger sense. You always have to -- am I on?

23 Q You're on, yeah.

24 A You have to make sure that you remember the geometry of
25 the measurement, you know, which direction was the well
26 in, and -- and take note that you may have areas, you

1 know, like the -- the southern end here that have more
2 fractures and may -- you may have other areas that have
3 fewer fractures. And you do that by looking at the
4 data you have. And -- and that it is fair to look at
5 particular units and -- and summarize that there may be
6 two in this unit and none in that unit, but it's --
7 it's a -- a measurement of a -- of a diffuse and, you
8 know, varying density open space.

9 Q Thanks. I'm just trying to let you finish here.

10 W. MCCLARY: I am cognizant of the time,
11 and I have two more questions that I think might
12 require a small amount of conferring between the
13 witness panel, and then my colleague, Ms. Peddlesden,
14 has a few more questions. I think maybe two -- two
15 questions, five minutes max. I'm hopeful that we can
16 finish before lunch, Commissioner Chiasson. Is that
17 possible here?

18 COMMISSIONER CHIASSON: I was just thinking about time
19 check because I'm -- our reporters will need a break
20 soon, so ...

21 W. MCCLARY: Yeah. I think we could be
22 done in a matter of seven or eight minutes here.

23 COMMISSIONER CHIASSON: Okay. Let's -- let's proceed
24 then.

25 Q W. MCCLARY: Now, as I mentioned, this next
26 question might require a little bit of conferring

1 between the witnesses, but keep in mind that we got
2 lunch. Take your time. If answers need -- need you to
3 confer, go ahead.

4 Can anything be inferred from the density of
5 healed fractures in the strata that we were concerned
6 with?

7 A K. VICKERMAN: Yeah. I don't think so. I
8 think it's common to see open and healed fractures
9 together. There would be a tendency for, in
10 particular, the lithologic units to heal up more and
11 others to -- that's a -- it's common to see them mix
12 like this.

13 Q Thank you.

14 Now, in the -- and this is the last one for real.
15 Do we have in the data that we have in the hearing --
16 based on the data that's been analyzed and presented,
17 et cetera, are we able to assess whether there's
18 connectivity between fractures that exist or if there's
19 a sufficient fracture density to suggest that there's
20 fracture pathways that are present within the relevant
21 confining strata, and, if so, what would your
22 assessment be on that? And maybe what we'll do is I'll
23 switch places with our SMEs here while you guys confer.

24 A So from the two wells that I looked at, I don't -- I
25 don't know if you can make that statement or confirm or
26 deny it necessarily.

1 A J. CHODZICKI: So the only way to
2 conclusively tell if you see evidence of fractures that
3 may or may not be a connected path would be to do a
4 DFIT test. That's where you, then, establish is there
5 truly a problem in a certain area. The individual
6 fractures just suggest there is potential for that, but
7 the DFIT test is -- will more conclusively state is
8 this rock competent?

9 Q S. PEDDLESSEN: All right. So I'll wrap up
10 with a final question, if Will confirms that's good to
11 go?

12 And I'm Ms. Peddlesden. I'm here to ask you about
13 Issue 5, the thermal compatibility.

14 S. PEDDLESSEN: Ms. Arruda, please put up
15 Exhibit 15.01 at page 502.

16 Q S. PEDDLESSEN: So these are the four wells,
17 three of which ISH is a WIP and the operator. I just
18 wanted to go through them quickly.

19 Number 1, is ISH aware that any well integrity
20 issue must be reported to the AER on the digital data
21 system, the DDS?

22 A J. CHODZICKI: I believe we are aware. If
23 there's a problem with the wellbore that -- yeah, the
24 DDS is how you submit if you observe some problem with
25 the wellbore.

26 Q Thank you.

1 And Canadian Natural reply submission includes
2 work over proposal schematic diagrams that show -- and
3 they also verbally confirmed on Wednesday -- that there
4 is thermal cement behind the production casing on each
5 of these wells. So I just want you to confirm -- and
6 this should be fairly brief -- that ISH has not
7 identified a well integrity issue.

8 So I'm going to have you lump all three wells, so
9 that would be Well 10-02, 10-03, and 10-34. And I'm
10 just going to give you a series of integrity questions.

11 So the first one: Has ISH noticed surface casing
12 vent flow?

13 A I would say no. A surface casing vent flow would have
14 to be reported, and I haven't heard any reports of
15 surface casing vent flows.

16 Q Gas migration?

17 A I would say, no, we haven't observed any gas migration.

18 Q Evidence of casing failure?

19 A No.

20 Q Evidence of wear that would affect well integrity?

21 A No. We haven't gone to that depth to review wellbore
22 integrity downhole.

23 Q Any other evidence of communication behind the
24 production casing?

25 A We haven't observed definitive evidence of
26 communication behind casing.

1 Q Have you observed any evidence of communication behind
2 casing?

3 A No. There was only these theories in a previous
4 submission discussing 10-34, and nothing was
5 substantiated from that.

6 Q Are you speaking to submissions to Proceeding 430?

7 A In the -- this proceeding there's the 10-1
8 investigative report that references the 10-34 well,
9 but we, again, don't have any concrete evidence of
10 behind-pipe communication. There was a previous report
11 done for 10-1 that was submitted as part of this
12 proceeding in various submissions, and there is no
13 concrete evidence of behind-the-pipe flow of
14 compromised integrity.

15 Q To help me out, where was their concern?

16 S. PEDDLESSEN: Ms. Arruda, if you could put
17 it to page 503.

18 Q S. PEDDLESSEN: And, Mr. Chodzicki, please use
19 the mouse and speak verbally in a way that the
20 transcript would cancel -- or -- pardon me -- capture
21 where you're pointing.

22 A Okay. The -- their 10-34 and -- there's -- I might
23 have my wellbores mixed up, actually. Let's look at
24 10-2 actually. Yeah. Scroll down, Tab 38.

25 Q Yeah. It's just the next.

26 A Yeah. I'm mixing up -- I think I'm even mixing up my

1 wellbores. As I look at 10-2, it's got perforations in
2 the Grand Rapids, and it has perforations in the
3 Wabiskaw. So there was some talk -- I believe it was
4 the 10-2 well that discussed in the 10-1 investigation
5 report that had some talk about potential behind pipe
6 flow, but we don't have evidence of that. We see there
7 is a -- a removable packer there. Nothing has been
8 investigated on that.

9 And I recall yesterday your suggestion of a CBL
10 log. That would be the one way you could determine
11 behind pipe integrity. No, we have not done that.

12 So back to 10-34, I now see that 10-34 -- scroll
13 down to Tab 39, please.

14 Q 10-34 is up, if that helps. It's at 503.

15 A Yeah. Sorry. Sorry. Yeah. Go up.

16 So 10-34, this is the one that was discussed
17 yesterday about making it a monitoring well. So,
18 again, we don't have any evidence on this one of behind
19 the pipe. It was the 10-2 well I think I was referring
20 to, that possible flow to the Wabiskaw.

21 The only concern we had with this one which was
22 stated yesterday: (as read)

23 Will the McMurray be properly abandoned with
24 cement on the case section of the well that
25 goes over the McMurray?

26 So that was our one comment internally that you brought

1 up yesterday about the need for proper cement across
2 the McMurray SAGD zone. So --

3 Q Yeah. And that was my next question. Was your
4 thoughts on Canadian Natural's response that they would
5 run a pulsed neutron spectroscopy log, a PNX log, at
6 Well 10-34 thereby justifying keeping it open so they
7 could put the wire down on an annual or once every two
8 years.

9 S. PEDDLESSEN: And, Ms. Arruda, just to help
10 out, could you put up page 224, same exhibit.

11 Q S. PEDDLESSEN: So Canadian Natural proposed
12 using Well 10-34 to run a PNX log and get this type of
13 data?

14 A If -- if the Regulator doesn't have a problem with the
15 zone staying open -- and this is useful data -- then we
16 could support it provided there is the casing integrity
17 and the cement integrity. So if this is legal to do,
18 to get this kind of information, that would be helpful
19 for everybody to understand the SAGD performance. So
20 as long as it's legal.

21 Q And I would like to speak to what the concerns would be
22 with the thermal drainage box, being -- like, if we
23 look back at 503 -- or pardon me -- 502, page 502. And
24 if you could note if 10-3 4 is in the KN08 drainage
25 box. So just speak to the risks, please,
26 Mr. Chodzicki.

1 A Well, it is a good point that 10-34 could only monitor
2 only the very edge of the drainage box where you might
3 not even see much SAGD development. So location isn't
4 the greatest for that type of -- of measurement.
5 Perhaps you could still gain some information, but
6 1-3 -- think of where the 1-3 observation well, that
7 would be more suited to the centre of the SAGD
8 development for that kind of logging.

9 So, again, I can't comment if the Regulator allows
10 CNRL to get that kind of log information. ISH doesn't
11 have a problem with it. But it doesn't appear to be
12 the best suited within the SAGD box, considering it's
13 right at the edge, however, still valid for monitoring
14 the Wabiskaw B gas zone.

15 Q And would you be concerned about deformation of the
16 production casing?

17 A I think that could be a risk. So that -- you know, if
18 you start seeing very high temperatures at that well --
19 and, again, I'm not sure how this monitoring of these
20 wells that aren't fully thermally compliant is allowed
21 by the Regulator. I'm not -- I'm not an expert on
22 these regulations, but I understand that the preference
23 is to cement off that McMurray and that would then
24 fully comply with the regulations. But if -- if you
25 allow someone to do that and it's legal, there still
26 could be a risk of some casing deformation, but maybe

1 in time that's part of the monitoring. We say, Hey,
2 this temperature is too high. We need to act on this
3 now and cement this off.

4 Q And just when you were responding to my previous
5 question, I noticed you mentioned that 1-3 would be an
6 appropriate monitoring well. Was that the well that
7 you meant to mention?

8 A No. I'm talking 10-34 here 'cause we're talking the
9 10-34. I'm assuming 1-3 is --

10 Q No, no. Sorry. Mr. Chodzicki, this happened just a
11 little while ago. I just want to make sure the record
12 is correct. And you stated that 1-3 --

13 A As proposed --

14 Q -- is in the middle.

15 A Yes. As proposed by CNRL. 1-3 well is proposed as a
16 monitoring well for the Wabiskaw. It's already
17 drilled.

18 Q I misunderstood. I thought you meant to say 10-3, and
19 I didn't want the record to stand. Thanks.

20 Okay. I appreciate that.

21 J. JAMIESON: We're good to go for lunch
22 unless the Panel has questions.

23 COMMISSIONER CHIASSON: All right. Thank you.

24 The Panel has no questions. Before we break for
25 lunch, Ms. Riley, can you advise, does ISH intend any
26 redirect?

1 M. RILEY: ISH does not intend to
2 redirect.

3 COMMISSIONER CHIASSON: Thank you.

4 So then, Ms. Jamieson, my understanding is that
5 CNRL does have some -- is intending to do some
6 rebuttal?

7 J. JAMIESON: Possibly. And if -- I
8 actually can't say definitively right now. If we could
9 break for lunch, we'll certainly come back --

10 COMMISSIONER CHIASSON: You would like the lunch break
11 to consider that.

12 J. JAMIESON: If we could, please.

13 COMMISSIONER CHIASSON: I am assuming that we are
14 sound to release the witness panel for ISH, so thank
15 you all very much. We appreciate the time that you
16 spent there.

17 (WITNESS STANDS DOWN)

18 W. MCCLARY: Sorry. Commissioner Chiasson,
19 just one thing to flag, I guess, would be I don't think
20 the AER has any questions for CNRL or for Canadian
21 Natural that remain, subject to there being any
22 rebuttal evidence. So it could be the case that we
23 would go straight to -- straight to closing; right?

24 COMMISSIONER CHIASSON: Yeah.

25 J. JAMIESON: Fair enough. I think that is
26 one scenario.

1 W. MCCLARY: Yeah.

2 J. JAMIESON: Because that's us up first.

3 We'll come back and tell you one way or the other.

4 We'll either be a little bit of rebuttal or prepared to

5 do our final argument.

6 W. MCCLARY: So with that in mind, do we

7 want a little bit of a longer lunch?

8 J. JAMIESON: That would be great, if we

9 could have it.

10 W. MCCLARY: That's where I was going.

11 J. JAMIESON: Thank you. Appreciate that.

12 COMMISSIONER CHIASSON: How -- how -- how much

13 longer -- how much longer do you suggest, counsel?

14 J. JAMIESON: Yeah. Fair enough. Is it

15 possible to restart at 2:00? So it's over an hour. An

16 hour 20.

17 COMMISSIONER CHIASSON: Yeah, we're looking at not

18 quite an hour and a half, then. I think -- I'm

19 assuming that's -- that's acceptable. That still gives

20 us the timing to -- to -- to fit -- to fit in because

21 the other thing I guess I would flag is that I am aware

22 that there are a few people that have travel

23 arrangements end of day, so we do need to be live to

24 that.

25 J. JAMIESON: Understood. And I can tell

26 you that if we do any rebuttal, it's going to be brief,

1 like 10 to 15 minutes. There's just a couple of things
2 that we may need to respond to.

3 COMMISSIONER CHIASSON: All right.

4 So any concerns about that timing, Ms. Riley? No.
5 Okay. So we will break now. We will reconvene at 2:00
6 and then see quite where we're going then. Thank you,
7 all.

8 _____

9 PROCEEDINGS ADJOURNED UNTIL 2:00 PM

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1 Proceedings taken at Govier Hall, Calgary, Alberta

2

3 February 9, 2024 Afternoon Session

4

5 Cindy Chiasson Panel Chair

6 Brian Zaitlin Panel Member

7 Meg Barker Panel Member

8

9 William McClary AER Legal Counsel

10 Shannon Peddlesden AER Legal Counsel

11 Andrew Lung AER Staff

12 Denise Parsons AER Staff

13 Anastasia Stanislavski AER Staff

14 Fahad Hamdan AER Staff

15 Maryam Rahimabadi AER Staff

16 Susan Harbidge AER Staff

17 Maksim Khaferllari AER Staff

18 Felix Chiang AER Staff

19 Scott Botterill AER Staff

20 Baohong Yang AER Staff

21 Elwyn Galloway AER Staff

22

23 J.P. Jamieson For Canadian Natural

24 Resources Limited

25

26

1 M. Riley For ISH Energy Ltd.

2 A. McLeod For ISH Energy Ltd.

3

4 S. Murphy, CSR(A) Official Court Reporter

5 S. Burns, CSR(A), RPR, CRR Official Court Reporter

6

7 (PROCEEDINGS COMMENCED AT 2:03 PM)

8 COMMISSIONER CHIASSON: Okay. So welcome back.

9 Ms. Jamieson, I believe you were to -- to update
10 us on which route -- which route we're going now.

11 J. JAMIESON: We are going both routes.

12 COMMISSIONER CHIASSON: All right.

13 J. JAMIESON: So we do need to re-seat a
14 witness, Canadian Natural witness briefly. I want to
15 bring Mr. Peter Thomsen up. It should only take five
16 or ten minutes, but I think we -- it's important that
17 we do so.

18 COMMISSIONER CHIASSON: All right. So I had a
19 previous hearing where we did this, and so what I'm
20 going to suggest that we do is when -- when we bring
21 Mr. Thomsen up, perhaps your first question could be
22 just to get him to affirm that -- and I don't recall
23 whether -- whether he was sworn or affirmed, but just
24 to confirm that he's still bound by that previous
25 affirmation.

26 J. JAMIESON: Absolutely. We could go

1 either way. I've given the court reporters a heads-up
2 that we could ask that he be reaffirmed.

3 COMMISSIONER CHIASSON: Okay. Super. Thank you.

4 THE COURT REPORTER: Do you want me to re-swear --

5 J. JAMIESON: I think that would be
6 efficient.

7 PETER THOMSEN, Re-sworn

8 J. Jamieson Re-examines the Canadian Natural Resources
9 Limited Witness Panel

10 Q J. JAMIESON: Thank you. So I said five
11 minutes, Mr. Thomsen, and then you brought all your big
12 binders, so that wasn't to scare anybody.

13 The question is simply: Ms. Peddlesden yesterday
14 had questioned Canadian Natural on their intentions --
15 the intended workover for the 10-34 well. We heard
16 Ms. Peddlesden came back to that question with the ISH
17 panel in terms of the plan.

18 Can you please reiterate what Canadian Natural's
19 intention was and then address Ms. Peddlesden's
20 questions, please?

21 A All right. Good afternoon, Commissioners.

22 So previously with respect to Ms. Peddlesden's
23 questions about the 10-34 well, Canadian Natural -- we
24 had previously communicated, and we were not planning
25 to place a cement plug in the 10-34 well below the
26 existing perforations and across the McMurray

1 formation.

2 Subsequently, we have reviewed a directive, the
3 AER Directive 20, to ensure our plans are -- are
4 compliant with directives, and upon further
5 consideration, we have realized that the McMurray
6 formation should be cemented. Canadian Natural will be
7 placing a cement plug across the McMurray formation.

8 Q Thank you, Mr. Thomsen.

9 So that would be subject to any questioning from
10 the staff or ISH. Thank you.

11 COMMISSIONER CHIASSON: Any questions on that,
12 Ms. Riley?

13 M. RILEY: None.

14 COMMISSIONER CHIASSON: Thank you.

15 Ms. Peddlesden?

16 S. PEDDLESDEN: No.

17 COMMISSIONER CHIASSON: Good. Then no questions.

18 Thank you, Mr. Thomsen. You are released. That was
19 nice and -- nice and quick in spite of the --
20 Ms. Jamieson's misgivings about your binders. So thank
21 you.

22 (WITNESS STANDS DOWN)

23 COMMISSIONER CHIASSON: So, then, I -- we're good to
24 proceed to -- to closing?

25 J. JAMIESON: We are. Maybe indulge us. If
26 we could have five minutes. I do have a hard copy of

1 the -- of the final comments on its way.

2 COMMISSIONER CHIASSON: M-hm.

3 J. JAMIESON: And being old school, of a
4 vintage, I really prefer the paper, so if you're okay
5 with that.

6 COMMISSIONER CHIASSON: I understand that. You may
7 have seen the binders that I keep flipping open, and
8 that -- that's fine.

9 And, Ms. Riley, will you want -- will you want a
10 few minutes after Ms. Jamieson is completed with hers?

11 M. RILEY: Yes. I would appreciate that.

12 COMMISSIONER CHIASSON: All right. Thank you.

13 We'll -- we'll -- five? Ten? What? Any idea, or do
14 you want to wait and hear what she has to say?

15 M. RILEY: Probably I suspect that what I
16 can get done in five, ten won't help, so --

17 COMMISSIONER CHIASSON: Okay. We'll -- we'll give you
18 a break, then, after that. All right. Thank you.

19 So we will just relax then for five minutes or so.

20 (ADJOURNMENT)

21 COMMISSIONER CHIASSON: So, Ms. Jamieson, we are ready
22 whenever you are.

23 Final Submissions by J. Jamieson

24 J. JAMIESON: Thank you.

25 Good afternoon, Commissioners. On behalf of
26 Canadian Natural, I want to thank you all as well as

1 the AER staff and legal counsel for your time and
2 attention in reviewing the evidence in this proceeding.

3 I'm pleased to be here this afternoon to make
4 these closing remarks on behalf of Canadian Natural.

5 As the Panel is aware, this is an application to
6 amend Commercial Scheme Approval Number 11475 for the
7 recovery of crude bitumen from the Wabiskaw/McMurray
8 deposit by adding two new steam-assisted gravity
9 drainage boxes to the Kirby project, KN08 and KN09.
10 Specifically, this application is for the recovery of
11 crude bitumen from the Wabiskaw bitumen zone only and
12 does not include the Wabiskaw D bitumen zone.

13 Canadian Natural made its amendment application
14 pursuant to Section 13(1) of the Oil Sands Conservation
15 Act and the AER Draft Directive 023, Category 3
16 amendment. In its amendment application, Canadian
17 Natural identified ISH as a petroleum and natural gas
18 rights holder in the KN08 and KN09 boxes. ISH and
19 Canadian Natural are working-interest partners in the
20 Kirby Upper Mannville II gas pool.

21 Canadian Natural engaged with ISH over the course
22 of several months by providing a draft copy of the
23 application and confidential core logs to examine plus
24 responding to its concern within the application at
25 pages 12 to 15 -- that's Exhibit 001.01 -- and meeting
26 in person on at least two occasions to try to resolve

1 ISH's concerns. The parties were unable to come to an
2 agreement and are here today requesting this Panel's
3 assistance in resolving the issues between them.

4 Canadian Natural has provided a map showing the
5 relative positions of the KN08 and KN09 drainage boxes
6 and the Kirby Upper Mannville gas pool. Sorry. I may
7 have misspoke already.

8 So I just want to be clear that the recoveries of
9 the crude bitumen is from the McMurray bitumen zone and
10 does not include the Wabiskaw D bitumen zone. Yeah?
11 Sorry. I must have misspoke.

12 All right. So we did provide this map. It shows
13 the relative positions of the KN08 and KN09 drainage
14 boxes in the Kirby Upper Mannville 2 or II gas pool.
15 That's Exhibit 022.02, PDF page 5. ISH based its
16 statement of concern and request to participate in this
17 hearing on the potential for adverse effects to ISH's
18 gas production. Specifically, as we understand it,
19 ISH's concern with the potential for Canadian Natural
20 steaming operations will lead to an increase in H2S in
21 the gas pool and thereby souring it from the currently
22 sweet gas stage.

23 In its -- in its submission ISH asserted that it
24 is directly and adversely affected by Canadian
25 Natural's intended bitumen production because the
26 conditions of approval Canadian Natural proposed:

1 (as read)

2 ... do not make adequate provision for the
3 conservation of ISH's overlying gas interest.
4 And the reference for that is Exhibit 32.02, ISH's
5 submission, PDF page 5, paragraph 1.

6 Canadian Natural understands that ISH does not
7 seek an order preventing Canadian Natural from
8 developing the bitumen resources, but rather is asking
9 that in the event the application is approved, in the
10 public interest the Panel imposes the conditions set
11 out at pages 44 and 45 of ISH's submission. That's
12 Exhibit 32.02, ISH submission, PDF page 10,
13 paragraph 22. And I believe those were modified to
14 some extent by the questions asked by AER legal counsel
15 this morning -- or this afternoon -- this morning.

16 On September 6, 2024 -- '23, this Panel set out
17 five hearing issues, which I'll address in detail in a
18 moment. In our view, the key decision that this Panel
19 needs to make is whether Canadian Natural SAGD
20 operations at the KN08 and KN09 boxes present a risk to
21 ISH's overlying interests in the Wabiskaw B gas pool,
22 and if so, whether Canadian Natural's proposed
23 mitigation measures are reasonable in the
24 circumstances.

25 Canadian Natural submits that the technical
26 evidence filed in this proceeding demonstrates that

1 there is an effective barrier between the McMurray
2 formation and the Wabiskaw B gas pool and that there is
3 little to no evidence of an open fracture network that
4 could increase that risk. Further, Canadian Natural's
5 proposed mitigation measures and monitoring program are
6 reasonable, given the nature of the potential effects,
7 the practicability, the effectiveness, and an
8 examination of cost versus benefits.

9 Canadian Natural requests that the application be
10 approved and that the approval be conditioned on
11 Canadian Natural's proposed mitigation measures and
12 monitoring program.

13 So I'll just take a step back. The legal
14 framework for this application is well established
15 pursuant to the Responsible Energy Development Act,
16 REDA, this Panel's task is to determine whether the
17 application should be approved with --

18 THE COURT REPORTER: Ms. Jamieson, slow down a bit,
19 please.

20 J. JAMIESON: Oh. Sorry. Too fast? I
21 will.

22 -- with or without conditions.

23 Section 2 of REDA states that the AER's mandate is
24 in part to: (as read)

25 ... provide for the efficient, safe, orderly
26 and environmentally responsible development

1 of energy resources in Alberta.

2 In arriving at its decision, this Panel must also
3 consider certain factors in its governing legislation,
4 including the Oil Sands Conservation Act, and the Oil
5 Sands Conservation Rules. Section 3 of the Oil Sands
6 Conservation Act sets out certain purposes, including
7 to effect conservation and prevent waste of the oil
8 sands resources of Alberta and to ensure orderly,
9 efficient, and economical development in the public
10 interest of the oil sands resources -- of the oil sands
11 resources of Alberta. It also includes ensuring the
12 observance in the public interest of safe and efficient
13 practices in the exploration for and the recovery of
14 crude bitumen.

15 Section 3 of the Oil Sands Conservation Rules,
16 specifically Subsections (3) to (5), make it clear that
17 conservation of the oil sands resource is to be
18 safeguarded by ensuring bitumen reservoir pressure is
19 not reduced through production of the overlying gas.

20 REDA and Section 3 of the Responsible Energy
21 Development Act General Regulations also require this
22 Panel to consider the social, economic, and
23 environmental effects of the proposed energy resource
24 activity.

25 Canadian Natural submits that the only
26 potential -- or the only effects that need to be

1 considered in this application that are relevant are
2 economic and that the economic factors should be part
3 of the Panel's assessment of the potential consequences
4 of adverse impact to ISH, and I'll come back to that
5 shortly.

6 ISH has also raised in the context of this
7 proceeding the application of the Oil and Gas
8 Conservation Act. In particular, ISH has argued that
9 an approval under Section 13 of the Oil Sands
10 Conservation Act cannot be contrary to the Oil and Gas
11 Conservation Act.

12 Canadian Natural agrees that the OGCA is relevant
13 to this proceeding. The purpose of the OGCA is in
14 effect to -- the conservation of and to prevent the
15 waste of oil and gas resources as well as the
16 responsible management of wells, facilities, and sites
17 throughout their life cycle.

18 As a majority and joint owner of the gas resource,
19 Canadian Natural shares a mutual interest in and
20 responsibility to protect the overlying gas zone while
21 pursuing the development of the bitumen resource.

22 Canadian Natural has acknowledged its
23 responsibilities in this regard and believes it has
24 proposed a safe and responsible approach to the
25 development of bitumen. And for that, I'll reference
26 Exhibit 15.01, PDF page 6 of 61, as well as

1 Mr. Iannattone's comments in his opening statement.

2 With respect to your task in evaluating the
3 evidence, we note that the AER Panel for KN06 -- for
4 the KN06 proceeding was faced with very similar issues
5 to the ones being heard in this proceeding. We
6 understand that you are not bound by the AER decision
7 report in that proceeding; however, we would suggest
8 that this Panel could take a similar approach.

9 In the KN06 proceeding, in addition to the hearing
10 issues, the Panel set out to answer two overarching
11 questions: Number 1. Do we find that Canadian
12 Natural's proposed operations as permitted by the
13 approval may cause direct and adverse effects to ISH?
14 2. If the answer to the first question is "yes", are
15 there reasonable steps that could be taken to avoid and
16 mitigate these effects?

17 In considering what is reasonable, the KN06 Panel
18 determined what was reasonable in the circumstances
19 depends on the nature of the potential effects, as well
20 as the effectiveness and benefit of the proposed
21 mitigation measures.

22 I'll turn very briefly to the gas over bitumen
23 decisions. I know that this Panel is very familiar
24 with those decisions. I don't -- you know, I'm not
25 going to go into any detail, but I would like to
26 highlight a couple of points that I do believe are

1 relevant to this proceeding.

2 First, it was in the Energy and Utility Board's
3 Decision 2005-122 in which the EUB relied on
4 conclusions from the 2003 regional geological study and
5 shut in a number of gas wells, including those in the
6 Kirby Upper Mannville II gas pool. The stated goal at
7 the time was to maintain adequate pressure in the
8 bitumen reservoirs -- reservoir to ensure efficient
9 production of the bitumen resource. Essentially, the
10 bitumen resource was given priority in time.

11 Since then, gas producers, including Canadian
12 Natural and ISH, were extended -- have been extended
13 compensation for the shut-in gas through the Alberta
14 Energy Royalty Adjustments as outlined in the Alberta
15 Natural Gas Royalty Guidelines. For Kirby Upper
16 Mannville II pool, Canadian Natural's accounting
17 records indicated that compensation of approximately \$6
18 million has been provided in royalty adjustments to
19 Canadian Natural and ISH relating to the shutting in of
20 the pool.

21 And that information is on the record, but I can't
22 point you to the exhibit.

23 The third takeaway from the GOB decisions is that
24 where souring of GOB, gas over bitumen, is a risk, it
25 is a monetary one; one that is compensable.

26 The KN06 Panel also recognized that the potential

1 effect of souring the gas from bitumen-bearing
2 sediments over time is the generation of H2S through
3 aquathermolysis, and that's paragraph 2008. I'll just
4 give you the KN06 proceeding decision so it's on the
5 record: AR Decision Report 2021, ABAER 001.

6 The KN06 Panel also included that the nature of
7 this potential adverse effect is commercial.
8 Paragraph 219.

9 Canadian Natural acknowledges that H2S
10 contamination of the Kirby Upper Mannville II pool is a
11 potential consequence of steam from the McMurray
12 reservoir reaching the Wabiskaw P -- B during the
13 producing life of the KN08 and KN09 boxes. However,
14 based on the technical evidence, Canadian Natural
15 asserts that this is a very low risk and that when
16 weighing the benefits and costs involved, its proposed
17 mitigation measures are reasonable.

18 With this -- respect to evaluating this potential
19 impact, this Panel will need to review and weigh the
20 technical evidence. This is a very familiar task to
21 the AER and is certainly one that we would ensure or
22 trust that you will do.

23 You're also being asked to weigh different types
24 of technical evidence: core samples, image logs,
25 seismic, GCMS. Some of it is stronger evidence than
26 others.

1 You also heard Canadian Natural speak of its
2 integrated workflow, and to that I would point you to
3 Exhibit 50.003, Tab 4, PDF page 49, and, again,
4 Mr. Iannattone spoke about it in his opening comments
5 and as well Mr. Lavigne stated specifically how their
6 technical workflow applies to determining the
7 stratigraphic framework and the geological conditions
8 of the proposed boxes.

9 The power of an integrated workflow is the
10 accuracy and consistency of results when multiple
11 datasets support the same conclusion. We ask that you
12 put the most weight on the consistency of Canadian
13 Natural's results.

14 The Panel must also characterize the nature of the
15 asserted risk. First, to determine whether there is,
16 in fact, a risk. A concern is not a risk. We ask that
17 the Panel give due consideration as to whether or not
18 there is an actual risk based on the totality of the
19 evidence or whether some of the concerns raised by ISH
20 are actually perceived risks. We also ask this Panel
21 to recognize that the potential risk can be
22 characterized as monetary only and thus can be
23 adequately accounted for by compensation if, in fact,
24 they do come to bear.

25 I'll just take a moment, please.

26 All right. I'll turn now to the technical

1 evidence, if I could, and this would be a review of
2 the -- the five hearing issues.

3 Now, the first hearing issue, Canadian Natural did
4 sort of separate it into two parts for the purposes of
5 addressing both in their submissions but as well in the
6 presentation by the Canadian Natural witnesses.

7 The first part of the -- the hearing issue is --
8 the first hearing issue is whether there is an affected
9 barrier overlying the bitumen-bearing McMurry formation
10 consisting of a deposit or aggregate of strata that is
11 not permeable to steam over the life of the KN08 and
12 KN09 drainage boxes.

13 In Canadian Natural's view, the evidence clearly
14 demonstrates that there is an aggregate of strata
15 overlying the McMurray formation that is not permeable
16 to steam over the life. Over the KN08 and KN09
17 drainage boxes, there are six identified confining
18 strata units, and Mr. Lavigne, you heard him walk
19 through them from the bottom up. So from the Fort
20 McMurray or -- sorry -- McMurray formation up through
21 the six units. So starting with the post-B
22 non-reservoir, the mid-B1 mudstone, the A2 mudstone,
23 the Wabiskaw D non-reservoir unit, the basal upper
24 Wabiskaw D heterolithic unit, and, finally, the
25 Wabiskaw C at the top.

26 Canadian Natural provided operational evidence

1 that barriers and baffles within the post-B2
2 reservoir -- so starting at the bottom just above the
3 reservoir -- they would be predicted to stop steam
4 chamber rise often below the mudstone-prone inclined
5 heterolithic deposits of the post-B2 non-reservoir
6 unit. This is in the form of the Kirby north PNX logs
7 shown at Exhibit 15.01, Tab 12, page 224.

8 Next -- try again. Okay. Next, Canadian Natural
9 asserts that the mud -- the mid-B1 mudstone, which is
10 sitting in the middle of that regional B1 sequence, so
11 we have the lower B1 sequence, then we have this nice
12 clean mid-B1 mudstone, and then the upper regional B1
13 sequence. So it's the one in the middle that they turn
14 to. That mid-B1 mudstone is correlatable across the
15 drainage boxes and is consistently identified in core.

16 Now, the mid-B1 mudstone is generally recognized
17 as a marine flooding layer and where it's present is
18 capable of sealing. So we have a number of references
19 on the mid-B1 mudstone to substantiate that there is
20 ample evidence on this point.

21 So the core photos can be found at Exhibit zero --
22 that doesn't look right. This is the application:
23 01.01, PDF pages 127 through to 268, and, again,
24 pages 331 through 381.

25 In the hearing submission, Exhibit 15.01, Tab 06,
26 PDF pages 109 to 192, and, again, same exhibit number,

1 15.01, Tab 14, PDF pages 226 through 325. And the last
2 one -- the same? Oh, okay. I see. Thank you. Sorry.
3 There's a range of exhibit numbers here. 42.03 through
4 42.44, and 43.003 through 43.185.

5 All right. Canadian Natural also relies on the
6 evidence that it filed -- the GCMS evidence that
7 corroborates the existence of the mid-B1 mudstone, and
8 there we would have you look to Exhibit 15.01, Tab 11,
9 PDF page 219, PDF page 220, and PDF page 223.

10 And, finally, Canadian Natural provided a rollup
11 summary of all of its evidence, not just on the mid-B1
12 but all of the formations, and that was provided in the
13 form of an Excel table, and it is really a catalogue of
14 the core photos, the image logs, and the well tops of
15 the confinement strata. And for that, we would ask you
16 to review Exhibit 43.197.

17 You've heard some differing views from ISH on
18 whether or not the mid-B1 is present over the majority
19 of the KN08 and KN09 boxes. However, when we ran
20 Mr. Barrie back through those image logs, he can
21 clearly detect mid-B1. He, in fact, identified the
22 mid-B1 in one of the areas where he had -- so within
23 the blue polygon where he had earlier stated that it
24 was absent, he did, in fact, identify it on the screen.
25 Where he wasn't comfortable identifying it as a mid-B1,
26 he did indicate that it was potentially part of that --

1 a muddy consequence.

2 Again, I want to stand corrected. It was the core
3 photos. You'll recall the map in the middle with the
4 blue polygon. So we talked about the core photos that
5 were around there. Thank you.

6 Now, further support was provided for the barriers
7 in this unit, meaning the B1 sequence. That was
8 supported by the GCMS data, and Dr. Fowler recognized
9 this in his report. And Dr. Fowler's report can be
10 found at Exhibit 32.09, Tab 5, page 4, lines 33 to 35.

11 Turning now to the A2 mudstone. The A2 is also
12 recognized as a regional A2. So where it is present,
13 it's generally recognized that it is sealing. The A2
14 at the KN08 and KN09 drainage boxes is present along
15 the southern third and along the edges of the KN08
16 drainage box where it is expected to act as a barrier,
17 and the A2 isopach is provided in Exhibit 15.01,
18 Tab 15, PDF page 326.

19 Now, turning next to the two Wabiskaw D zones, the
20 first one, Wabiskaw D, contains two high volumes of
21 shale units that act as confinement strata. In both
22 the Wabiskaw D non-reservoir unit and the basal upper
23 Wabiskaw D heterolithic unit, even though individual
24 mudstone beds may not have large lateral extents as a
25 unit, it is Canadian Natural's submission that they do
26 have the ability to act as barriers. And this is

1 supported by the presence of a gas cap between the
2 latter unit in the 1AE/10-2 well on the KN09 box. This
3 well not only verifies the presence of a barrier in an
4 area of relatively thin confinement strata, but it also
5 demonstrates how a unit with 50 percent volume of shale
6 can hold back gas caps and, by extension, steam.

7 Core photos that best display the sealing capacity
8 for the gas cap were provided in Exhibit 01.01, PDF
9 pages 370 to 381; Exhibit 15.01, Tab 16 and Tab 17.
10 These are the isopachs of the Wabiskaw D confining
11 strata units. This is also supported by GCMS data in
12 this well, which is located in Exhibit 15.01, Tab 11,
13 PDF page 222.

14 Next we have -- or the last-to-the-final on the
15 top is the Wabiskaw C. It's an argillaceous -- that's
16 the first I've had to say that -- heterolithic mudstone
17 and sandstone succession that is present over the
18 entirety of both boxes. The distribution of the
19 Wabiskaw C is presented in Exhibit 15.01, Tab 19.
20 Canadian Natural has advanced its understanding of the
21 Wabiskaw C since the original GOB rulings discussed --
22 those were discussed this morning. I can't remember
23 which witness it was, but one of the ISH witnesses
24 spoke of this.

25 As hundreds of more wells have been drilled in the
26 Kirby north development area since that time,

1 sand-filled burrows identified on core photos within
2 this unit are discontinuous and vary in distribution
3 from well to well. A torturous connected pathway from
4 these burrows is highly unlikely. The best evidence
5 for this is a review of the Wabiskaw C core photos as
6 catalogued in Exhibit 43.197.

7 The combination of the units will serve to isolate
8 steam from the SAGD operations in the McMurray from the
9 gas zone at the Kirby Upper Mannville II pool.
10 Canadian Natural restates its view that the confinement
11 strata as an aggregate of units will act as a barrier
12 to contain steam over the life of the Kirby -- KN08 and
13 KN09 operations.

14 Canadian Natural utilizes -- sorry -- Canadian
15 Natural utilizes a multidisciplinary approach to the
16 evaluation of its oil sands assets. Multiple datasets
17 have been presented by Canadian Natural which
18 demonstrate the breadth of data included to create a
19 comprehensive geological interpretation. A
20 stratigraphic framework evolves out of the combined
21 datasets of wireline logs, core, image logs, and 3D
22 seismic. For identifying effective containment strata,
23 the stratigraphic framework is foundational.

24 And just as no one confinement strata unit is
25 relied upon for steam containment, no single piece of
26 data is relied upon for defining the confinement

1 strata. Direct and indirect data are corroborated to
2 provide a full assessment. An example of this is the
3 use of GCMS data by Canadian Natural to identify
4 potentially -- sorry -- potential barriers and baffles,
5 both in the reservoir and confinement strata. When
6 used in combination with stratigraphy, GCMS is a tool
7 which predicts -- which is able to predict which low
8 permeability layers within the stratigraphic column
9 will likely be barriers to steam.

10 Just in summary on that first part of Hearing
11 Issue Number 1, Canadian Natural reiterates that it is
12 not relying on one marine mudstone layer, the A2
13 mudstone, or one flooding surface mudstone, the mid-B1
14 mudstone, although both are present at different parts
15 of the boxes, but rather it is the combined package
16 that they've defined by the six units that will work
17 together to effectively contain steam.

18 So I'll turn now to the -- the second part of
19 hearing issue -- the first hearing issue, which was
20 about the low fracture density in the confinement
21 strata, or what is the fracture density. The second
22 part of Hearing Issue Number 1 is whether there are
23 fractures in the strata between the McMurray formation
24 and the Wabiskaw B member that could potentially impact
25 the risk. Canadian Natural has been drilling and
26 operating SAGD wells in the Kirby area now for over

1 11 years. It has extensive knowledge of the
2 stratigraphic layers as well as the lack of faults and
3 fractures in this area.

4 Canadian Natural has drilled cored logged [sic],
5 including image logs, and reviewed several hundred
6 stratigraphic test wells at Kirby north, including 43
7 within the proposed KN08 and KN09 drainage boxes, and
8 conducted in-depth analysis of its 3D. And then an
9 explanation of that can be found further at
10 Exhibit 15.01, page 30 -- PDF page 30, paragraph 27.

11 In the context of this proceeding, Canadian
12 Natural has submitted substantial geological and
13 geophysical evidence that illustrates it is highly
14 unlikely that an open and connected fracture network
15 exists in this area. Now, support for that is --
16 there's multiple points for that. No faults or natural
17 fractures were observed within confinement strata
18 intervals on core data from 24 wells at KN08 and KN09,
19 and that support is found in Exhibit 15.01, Tab 23,
20 page 337.

21 There was disagreement -- you heard it this past
22 week -- between Canadian Natural on the presence of
23 fractures at KN08 and KN09. ISH has argued that there
24 are -- there were several wells with fractures observed
25 on core photos. However, Canadian Natural -- Canadian
26 Natural's evidence shows that all of these fractures

1 were coring-induced.

2 Dr. Wang provided evidence of his interpretation
3 of the image logs, and he repeatedly confirmed that
4 Canadian Natural's evidence is that anything that was
5 being seen could be identified as tool marks.

6 So the 36 image logs that you have on the record
7 here, no natural fractures were observed. That's
8 Canadian Natural's evidence on that point. And you can
9 look to Exhibit 15.01, Tab 23, page 337.

10 Now, Mr. Vickerman did testify that he had
11 analyzed a subset of the image log data which was
12 supplied to ISH, and he, in the end, only reviewed
13 2 out of the 11 image logs supplied by Canadian
14 Natural. He confirmed this morning that the fracture
15 density observed in these two wells is what he
16 characterized as "sparse" in his report, so low
17 fracture density.

18 You also heard yesterday that a feature identified
19 as a fracture from ISH's publicly available image logs
20 at the 1AA/11-2-075-09-W4 well was later reviewed by
21 Mr. Vickerman and was likely characterized as "a bit"
22 or a tool mark, not a natural fracture. And that
23 should be on the transcript, the February 8th
24 transcript, PDF page 78 of 238, lines 9 to 13.

25 Furthermore, Canadian Natural's seismic --
26 3D seismic evidence, their interpretation confirms that

1 no large-scale faulting from salt dissolution or
2 Paleozoic karsting is present at the KN08 and
3 KN09 boxes. Seismic structure and attribute mapping
4 also shows no evidence of fractures or large-scale
5 faulting, and so that -- we would ask that you take a
6 look at Exhibit 01.01, page 28, Section 2.83.

7 Now, with respect to differential compaction,
8 Canadian Natural has acknowledged that a minor amount
9 of differential compaction does exist at the KN08 and
10 KN09 boxes. It can primarily be associated with
11 overlying mud-filled abandonment plugs. These features
12 have been mapped on -- with 3D seismic and further
13 tested with stratigraphic test wells, which have shown
14 no evidence of faults or fractures with the confinement
15 strata. I'm just going to see if I can point you to
16 the map that shows that.

17 We're going to verify for a moment that I didn't
18 misspeak again, and we're going to keep moving so that
19 we can get through this.

20 So also with respect to differential compaction
21 and the impact of it, Canadian Natural's evidence
22 showed that there was no lost circulation events during
23 the drilling of 43 stratigraphic test wells and no lost
24 circulation events during drilling of 16 producer
25 injection -- injector wells at offsetting KN06. And
26 that evidence, I believe, points to whether or not

1 there are existing natural fractures when they go to
2 drill. The exhibit number for that is 50.02,
3 paragraph 65 -- sorry -- page 20, paragraph 65.

4 Another point to be made on low density faults and
5 fractures, the pressure data between the McMurray
6 bottom water leg and the Wabiskaw B Kirby Upper
7 Mannville II gas pool indicated no connectivity between
8 the zones that would be indicative of open faults
9 and/or fractures. This data also confirms if natural
10 fractures did exist but remain undetected at KN08 and
11 KN09, they are closed to fluid -- flow, including
12 steam. And for that we would point you to
13 Exhibit 15.01, Tab 26, page 340.

14 Finally, we would point to Dr. Boone's
15 supplementary report. This is one of the things that
16 he reviewed and looked at, and his evidence showed that
17 in the event -- or his assessment showed that in the
18 event that fractures within the confinement strata
19 exist but are undetected due to the ductile nature of
20 the confinement strata shales at depth, they are most
21 likely closed to fluid flow. That's found at
22 Exhibit 50.03, Tab 1, Appendix C, page 26, paragraph 5.

23 So to sum up on that part of Hearing Issue 1,
24 Canadian Natural evidence, in our view clearly
25 demonstrates that no fractures exist that would pose a
26 risk to steaming operations over the life of the KN08

1 and KN09 drainage boxes or, in the unlikely event that
2 they do exist but are not detected they are closed to
3 fluid flow, including steam.

4 I think the stickies are flying, so I'm just going
5 to take a moment and make sure I didn't misspeak.

6 I just want to go back and drive some clarity
7 around the number of image logs. So I believe Canadian
8 Natural's evidence -- yeah -- show -- it's just this
9 clarity between numbers and who reviewed what. But
10 Canadian Natural's evidence is that they have reviewed
11 36 image logs within the confinement strata, and no
12 natural fractures were observed. 11 image logs went
13 over to ISH as part of this proceeding, and it was
14 those 11 that I had referenced earlier.

15 All right. Let's move forward. Hearing Issue
16 Number 3, this is the maximum operating pressure and
17 what's appropriate in the circumstances.

18 So Canadian Natural did conduct a thorough
19 geomechanical evaluation of the containment risk, both
20 under conditions of the temporary SAGD start-up
21 pressure proposed at 6,600 kPa and also for the
22 long-term SAGD operations at an MOP of 6,000 kPa, and
23 it included a review of the relevant start-up
24 experience in situ stresses and geomechanical
25 modelling.

26 Results of these investigations, in Canadian

1 Natural's view, clearly demonstrate that the
2 confinement strata will contain steam and reservoir
3 fluids in the McMurray formation.

4 Now, Canadian Natural has modified its request.
5 We put this on the record, and the point of it was not
6 for technical reasons, but really it was a willingness
7 to consider ISH's concerns and respond with what they
8 could.

9 So for the requested temporary MOP of 6,600 kPa,
10 two additional constraints have been committed to. One
11 is a maximum continuous time of 24 hours when using
12 bottom-hole pressures above the 5,500 kPa and below the
13 temporary MOP of 6,600 kPa; and, two, a maximum gross
14 steam rate of 180 cubic metres per day -- there's a
15 CWE -- I don't know what that acronym is for, but
16 perhaps somebody technically competent will -- so 180
17 cubic metres per day when using these BHPs above the
18 5,500 kPa. And you'll find the commitments on the
19 record.

20 Canadian Natural shows that the temporary MOP is
21 not always used for circulation start-up, and when it
22 is used -- this is their -- the bulk of their
23 experience -- it is only used for very short durations
24 and for limited volumes.

25 Canadian Natural is also prepared to reduce its
26 long-term MOP of 6,000 kPa to 5,500 kPa, and the MOP of

1 5,500 kPa will be used during and after the application
2 of the proposed hydrocarbon agent solvent-assisted
3 start-up.

4 Evidence was presented of erosion of a portion of
5 the B1 sequence and thinning of the mid-B1 mudstone;
6 however, the mud-dominant lower B1 is present
7 everywhere, and this will act as a stress barrier.

8 Canadian Natural has used DFITs to characterize
9 stresses. The objective of a DFIT is to induce a small
10 hydraulic fracture to interpret minimum in situ stress
11 values. DFITs do not test for connectivity of natural
12 fractures. We heard a little bit of that on the record
13 this morning. I think there's some confusion there.
14 Canadian Natural has interpreted their minimum in situ
15 stress using what they believe to be the best
16 practices, and the characterization shows a minimum
17 stress gradient difference of 1.5 kPa per metre. The
18 stress profile having a higher minimum stress in the
19 mudstone-dominant B1 than the underlying sand is widely
20 accepted due to the higher mud content strata having
21 higher Poisson's ratio.

22 Dr. Chalaturnyk stated that the Poisson's ratio
23 under loading will result in differential stress that
24 will be exhibited in -- in a difference in the stress
25 contrast. Yes. So that's what's on the transcript,
26 February 8th, page 143, lines 6 to 8.

1 Dr. Boone's report, which is found in
2 Exhibit 15.01, PDF page 92, 93, Dr. Boone finds that
3 with regional DFITs, quote: (as read)

4 As it is commonly observed that shales or
5 mudstones will have higher minimum in situ
6 stresses than underlying sands or reservoir
7 facies, it can be concluded with a high
8 degree of confidence that McMurray mudstones
9 will have a stress contrast relative to the
10 McMurray sands that exceeds the 0.5 kPa per
11 metre.

12 Now, Canadian Natural, you know, is providing this
13 evidence because ISH has asserted that an additional
14 DFIT is necessary. In Canadian Natural view, that is
15 simply not the case. They feel that they have provided
16 sufficient evidence on the record that it's not needed,
17 and we would point you to Exhibit 50.02, PDF
18 pages 50-51.

19 Canadian Natural has also relied on some academic
20 literature to support the concept that in situ stresses
21 tend to be regionally consistent for the same
22 stratigraphic unit. Regionally present mud-prone
23 heterolithic strata such as the regional B1 sequence
24 have consistently similar elastic properties. In
25 addition, the historical Kirby north 146 well data set
26 per circulation start-ups does not show low fracture

1 pressures or variable fracture pressures.

2 We just also want to point to the -- this
3 historical Kirby north 146 well data set for
4 circulation start-up, and that can be found -- that
5 demonstrates regional stress consistency -- at
6 Exhibit 50.002, paragraph 187.

7 In the -- again, one of the things that
8 Dr. Chalaturnyk agreed with was that the historical
9 Kirby north circulation start-up data can be used to
10 understand McMurray stress variations in the Kirby
11 north area. The reference for that is the draft
12 transcript, page 140, lines 17 to 18.

13 So I think the point of that, again, is that this
14 historical circulation start-up data supports the
15 regional stress consistency within the post-B2
16 reservoir and the regional B1 sequence.

17 In Exhibit 50.003, PDF pages 20, 24, the risk
18 consequence of potential start-up steam communication
19 from the post-B2 reservoir to the Wabiskaw B gas is
20 conservatively assessed as between 10 million and
21 100 million. This is a financial risk only since there
22 are no reaction products in the condensed steam during
23 circulation start-up. That would be Dr. Boone's
24 report, I believe.

25 Sorry. Yeah. I'm getting tired. Late in the day
26 here. Yes, this was the question in that table as

1 well. Those are a thousand dollars, so ten thousand to
2 a hundred thousand.

3 So this incremental expense of an additional DFIT,
4 in our -- in Canadian Natural's view, is
5 disproportionate to the consequence of the risk event,
6 and it's also unclear how a DFIT would result in a
7 further risk reduction, most notably because we already
8 have a reliable stress contrast between the regional B1
9 sequence and the post-B2 reservoir sand. Proposed
10 operational limits for the temporary MOP of less than
11 24 hours and a maximum steam rate of 100 cubic metres
12 per day and thus a new DFIT would not change the
13 requested temporary MOP for initiating circulation.

14 Further, the long-term MOP has already been
15 reduced from an acceptable 6,000 kPa to 5,500 kPa,
16 which increases factors of safety. So, again, an
17 additional -- or additional DFITs in the vicinity of
18 KN08 and KN09 would not change the requested long-term
19 MOP of 5,500.

20 And just to take a step back with respect to
21 containing the risk during short-term circulation
22 start-up, so this is at the 6,600, the risk of
23 fracturing through the confinement strata with start-up
24 bottom-hole pressures up to 6,600 kPa is really
25 negligible, in Canadian Natural's view, due to fracture
26 containment mechanisms that limit potential fracture

1 growth. And those include -- and I believe Mr. Thomsen
2 went through them -- a leakoff within the McMurray
3 reservoir confinement strata, a stress contrast between
4 the McMurray reservoir and the confinement strata,
5 elastic stress increases within the McMurray reservoir,
6 limited rate and volume injected with elevated
7 pressures.

8 Furthermore, the geomechanical modelling confirmed
9 that the risk of fracturing during start-up with
10 bottom-hole pressures up to 6,600 kPa is extremely low
11 due to the multiple fracture containment mechanisms,
12 and that -- the modelling that confirms that is at
13 Exhibit 46.002, PDF page 61 to 72.

14 Dr. Chalaturnyk, in his evidence, confirmed that
15 in his review he had, quote: (as read)

16 No issue with the GeoSim fracture modelling
17 conducted of the temporary start-up and
18 evidence that Canadian Natural has provided
19 around fracture containment within the
20 McMurray during the start-up of the SAGD
21 process is convincing.

22 That's in the February 8 transcript, page 140, lines 14
23 to 21.

24 Dr. Chalaturnyk also confirmed that the work with
25 the temporary MOPs was convincing, so, no, he did not
26 have a problem. Lines 8 to 9.

1 Containment risk during long-term operations. The
2 long-term MOP of 5,500 kPa is equivalent to 76 percent
3 of the shallowest base of the Clearwater shale minimum
4 stress. Oh -- sorry -- this is a reference they're
5 providing for this: Exhibit 01.01, PDF page 31.

6 The entire KN08 and KN09 drainage area is
7 underlain by a bottom water interval, and that's shown
8 in Exhibit 01.01, page -- PDF page 44, Figure 210.
9 Canadian Natural interprets the reservoir sand to be in
10 communication with the bottom water sand over almost
11 the entirety of the KN08 pad. McMurray bottom water
12 necessitates SAGD steam chamber pressures to be similar
13 or balanced to the McMurray bottom water pressure over
14 extended periods. It would be highly impractical to
15 attempt SAGD operations at a steam chamber near the
16 long-term MOP of 5,500 kPa due to unsustainable losses
17 of steam into the bottom water. Additional
18 geomechanical modelling was used to confirm that there
19 is minimal risk of confinement strata integrity over
20 the long-term SAGD operations up to an MOP of
21 6,000 kPa.

22 And I don't think I'm going to take you through
23 all of those modelling reports, but we would point you
24 to the geomechanical modelling report, again,
25 Exhibit 46.002, PDF page 61 to 72.

26 Dr. Chalaturnyk did identify some concerns with

1 the modelling specifically related to handling
2 small-scale heterogeneities in the confinement strata
3 properties. You may rely on that exchange. And that
4 was at page 113 of the February 8th transcript, lines 1
5 to 9.

6 It is Canadian Natural's view that the uncertainty
7 in the modelling results due to these modelling details
8 would not significantly impact the comfortably high
9 factor of safety predicted to be present for the
10 proposed long-term MOP.

11 I think I'm going to just check, if I could, with
12 my colleagues and make sure there isn't something
13 critical there I should have covered.

14 All right. We are moving forward. As you are
15 aware, Canadian Natural addressed the Hearing Issues 2,
16 4, and 5 together because they had to do with no
17 appropriate monitoring conditions or conditions of
18 approval that -- that the Panel may be considering.

19 So Canadian Natural set out its proposals for its
20 view of appropriate monitoring conditions at
21 paragraphs 129 through 158 of its hearing submission.
22 That's Exhibit 15.001. And a detailed monitoring
23 strategy was also included as Tab 28, exhibit -- same
24 exhibit number.

25 Canadian Natural then gave due consideration and
26 updated its monitoring proposal in recognition of ISH's

1 ongoing concerns and requested monitoring conditions,
2 and you heard about some of that. Mr. Ollenberger
3 reviewed these updates as part of his direct evidence,
4 and these now include converting the 100/1-3 well from
5 a standing cased well to a Kirby Upper Mannville II
6 pool gas monitoring well prior to steaming of KN08 and
7 KN09, equipping the 10-34 well as a gas monitoring well
8 as an additional location on Pad KN08, and as well
9 providing a fourth gas monitoring well on or in the
10 vicinity of the KN09 pad.

11 These monitoring well commitments in combination
12 with the 10-1 well exceed ISH's request monitoring well
13 commitments -- or requested.

14 Sufficient mobility in the Kirby Upper Mannville
15 II pool supports that a specific location on KN09 is
16 not required to provide adequate monitoring on the KN09
17 pad. In addition to the four gas monitoring well
18 locations just mentioned, baseline and pre-production
19 gas samples will be collected by Canadian Natural from
20 the Kirby Upper Mannville II pool and can be presented
21 as part of annual -- its annual Directive 54
22 presentations, if requested, as part of any approval
23 conditions.

24 Canadian Natural would like to reiterate that
25 ongoing gas samples are not practical, given the
26 upper -- Kirby Upper Mannville wells are currently shut

1 in due to a GOB order and not connected to operating
2 plants or facilities. So ongoing sample adds little
3 actionable value above and beyond that provided by the
4 four gas monitoring wells and ongoing SAGD monitoring.
5 In Canadian Natural's view, its proposed monitoring
6 condition should be evaluated to determine if there are
7 reasonable circumstances, given the nature of the
8 potential effects, and an evaluation of the associated
9 costs and benefits.

10 ISH's requested suite of monitoring -- now, it has
11 been modified, as we understand it, but generally
12 exceeds the monetary risk of the unlikely impacts to
13 the GOBed gas resource.

14 This morning Mr. Chodzicki on behalf of ISH
15 confirmed that ISH's gas valuation assigns current
16 value to Kirby Upper Mannville II pool gas volumes that
17 are currently shut in under GOB where there is no
18 current line of sight to gas volumes being allowed to
19 produce.

20 Just to touch lightly on the solvent issue,
21 Number 4, injected hydrocarbon is expected to stay
22 within the near wellbore region -- you heard
23 Mr. Ollenberger describe that as within 3 metres --
24 fully dissolvable in the bitumen and will be produced
25 back in the very early stages of production.
26 Controlled injection of relatively small amounts of

1 hydrocarbons for this start-up, which will be injected
2 below the long-term MOP of 5,500 kPa, makes the risk to
3 the overlying gas resource from this assisted start-up
4 to be extremely low in Canadian's view.

5 We did hear ISH, I believe this morning, being
6 agreeable to drop its requirement for the monitoring --
7 or the long-term monitoring of the solvent, so we
8 appreciate that.

9 On thermal compatibility, Canadian Natural does
10 believe it's in alignment with ISH for the well
11 workover proposals, and as you heard from Mr. Thomsen,
12 Canadian Natural will be cementing the McMurray
13 formation in the 10-34 well.

14 So I'm going to turn briefly to Dr. Boone's report
15 and then make some closing comments.

16 So Dr. Boone did provide an independent report,
17 both an initial report with our hearing submission and
18 then a supplemental report with Canadian Natural's
19 reply submission that incorporated ISH's technical
20 input. In his reports, Dr. Boone provided a
21 comprehensive review of the parameters that should be
22 considered when assessing steam containment. His
23 assessment was that all the parameters -- you'll recall
24 the table; I believe it's at Exhibit 50.003, page 9 --
25 as well as his oral testimony, but that they -- all the
26 parameters are indicative of successful containment.

1 His conclusion related to Issue 1 was that the
2 confinement strata at the KN08 and KN09 drainage boxes
3 will act as an effective barrier overlying the
4 bitumen-bearing McMurray formation consisting of a
5 deposit or aggregation of strata that is not permeable
6 to steam.

7 Dr. Boone also provided his technical analysis in
8 his supplemental report showing that based on
9 Dr. Chalaturnyk's laboratory tests of the Wab D
10 mudstones from Suncor's MacKay site, the mudstones
11 would be expected to behave in a ductile manner at the
12 depths of the confinement strata for KN08 and KN09. A
13 critical implication of this analysis is that any
14 existing natural fractures or -- fractures or faults
15 that might be induced by the SAGD operations would then
16 be closed and sealed.

17 Dr. Chalaturnyk confirmed yesterday that his --
18 quote: (as read)

19 His report shows that there was no
20 permeability increase associated with the
21 induced shear fractures in either the
22 Wabiskaw or the Clearwater shales.

23 And that's found in the transcript page 173, line 17 to
24 20.

25 Now, Dr. Boone has used the risk assessment
26 process to develop his recommendation for --

1 recommendations for Issues 2, 3, and 4. He concluded
2 that the risks associated with each of these issues is
3 low, and as a result, he recommended that no additional
4 gas monitoring wells would be required or justified and
5 that the temporary -- the proposed temporary MOP of
6 6,600 kPa should be allowed and, thirdly, that solvent
7 injection during start-up should be allowed. And
8 that's at Exhibit 50.003, pages 10, 11, and 12.

9 You've heard some discussion on the present value
10 of the gas in the Wabiskaw B. Given the GOB decision,
11 it's reasonable to assume that this gas will not be
12 produced until SAGD operations in the area have ceased.
13 It would also be reasonable -- this is Dr. Boone
14 speaking. In his view, it would be reasonable to
15 assume that only a fraction of the gas values should be
16 impacted by any localized contamination that might
17 possibly occur. Canadian Natural and ISH agree that
18 the consequence of steam leakage is a financial only,
19 not safety and not environmental risk. It is Canadian
20 Natural's view that the maximal reasonable financial
21 impact to ISH is less than \$1 million.

22 With respect to additional monitoring, Dr. Boone's
23 view is that it should be considered within this
24 context. For an example, an additional monitoring well
25 might cost a million dollars or more. This certainly
26 cannot be justified, given that the risk is of similar

1 magnitude. One must also consider how much impact any
2 monitoring is likely to have in reducing the risk.

3 ISH and Canadian Natural appear to agree that a
4 monitoring well does not actually prevent the risk of
5 gas contamination, rather, it only reduces the
6 consequence if it enables operational changes that
7 mitigate the consequence.

8 And, finally, with respect to the question of
9 whether an additional DFIT should be required,
10 Dr. Boone has also considered this within the risk
11 assessment process. The real risk of a short duration
12 of high-rate steam injection inducing a fracture that
13 connects to the Wabiskaw B gas zone is very low.
14 Canadian Natural -- I think I'm -- yeah. Sorry. I'm
15 switching from Dr. Boone's comments in his report.

16 So this is Canadian Natural's view that really the
17 question of an additional DFIT should be required --
18 that the real risk of a short duration of high-rate
19 steam injection inducing a fracture that connects to
20 the Wabiskaw B gas zone is very low, and, therefore, an
21 additional DFIT is not required to manage this risk.

22 So I'm going to move to a few concluding remarks,
23 and then I'm within reach of being done.

24 So SAGD operations have been occurring in the Fort
25 McMurray area since 1996, 28 years ago, and since that
26 time Canadian Natural has been a significant

1 contributor of SAGD development and they have drilled
2 and operated 390-plus well pairs, all without any known
3 incidents of lost steam to other formations during
4 circulation, start-up, or continuous SAGD operations.

5 The KN08, 09 pads are part of the next development
6 phase of the Kirby north project, and these pads are
7 expected to recover between 30 and 35 million barrels.
8 The project is an example of how bitumen development
9 can create value for all Albertans through positive
10 contributions to the local and regional economies
11 during both construction and operations with direct,
12 indirect, and induced employment. The successful
13 execution of this project will also deliver up to
14 \$250 million in royalties.

15 Canadian Natural understands and respects ISH's
16 concerns and has given ISH's assertions due
17 consideration through the course of this proceeding.
18 Canadian Natural remains of the view that its proposed
19 mitigation measures and monitoring program are
20 reasonable, given the nature of the potential effects.

21 We would encourage you to take a cost-benefit
22 analysis in determining the appropriate mitigation
23 measures and monitoring and that this cost-benefit
24 analysis should consider the value of the remaining gas
25 reserves. ISH provided evidence of the value of the
26 gas remaining in the Kirby Upper Mannville II pool of

1 3.685 million. We're asking the Panel to keep the
2 value of the gas in mind when it considers the
3 monitoring recommendations that ISH has made.

4 Canadian Natural maintains that ISH's proposed
5 mitigations and monitoring will add incremental costs
6 payable by Canadian Natural, approximately 60 percent,
7 and Albertans, 40 percent, and that that can be
8 disproportionate to the value of the remaining
9 recoverable gas and potentially would further delay the
10 development schedule for KN08 and KN09.

11 With respect to ISH's request for a DFIT or a
12 modern DFIT, as Dr. Chalaturnyk characterized it, in
13 the drainage area of KN08 and KN09, Canadian Natural
14 estimates that the cost of a new strat well, including
15 the DFIT, to be \$1.11 million. And that was noted in
16 the table presented by Mr. Ollenberger.

17 Canadian Natural believes that if a modern DFIT is
18 conditioned on -- if the approval is conditioned on a
19 new DFIT test, it is likely that a new strat well will
20 need to be drilled. Best practice entails that DFITs
21 be conducted in vertical wells, and currently Canadian
22 Natural has no vertical standing cased wells suitable
23 for DFIT. All future strat wells, including the
24 commitment -- or the committed -- commitment to gas
25 monitoring on or in the vicinity of the KN09 drainage
26 box, are planned as deviated wells, and therefore would

1 not be suitable candidates for a DFIT. A new vertical
2 well would need to be planned, licenced, and drilled,
3 which could potentially -- wouldn't be potentially
4 executed -- sorry -- it could -- which could be
5 executed at the earliest as part of the winter
6 2024/2025 drilling season.

7 With respect to scheduling, the KN08 and KN09 pads
8 were originally scheduled to begin construction in
9 January 2023. Subject to the decision of this
10 proceeding and capital allocation, Canadian Natural is
11 now scheduled to begin pad clearing in Q1 2025
12 following by drilling in Q1 2026. Pad facility
13 construction is scheduled for completion in Q3 2026
14 with steam-in to follow.

15 Canadian Natural takes this opportunity to
16 respectfully request that if the Panel is considering
17 any monitoring requirements in the approval, that
18 they -- that those requirements be conditioned so that
19 they can be completed prior to steaming versus prior to
20 pad clearing, and that will help avoid any further
21 delay in the KN08/KN09 development schedule.

22 Having said that, it is Canadian Natural's view
23 that its technical evidence and the commitments it has
24 made to continue to enhance monitoring and controls
25 demonstrate that the development and operation of
26 KN08/KN09 will not impact the gas resource.

1 Canadian Natural reiterates its commitment, which
2 is found in the materials, that in the highly unlikely
3 event that the gas is contaminated from its operation,
4 Canadian Natural could, at the time when the gas
5 resource is allowed to be produced, assess connecting
6 the gas to the SAGD infrastructure and burn the gas as
7 fuel in the steam generators or pay reasonable
8 compensation for the contamination. ISH would be
9 fairly compensated for its share of the gas at that
10 time.

11 For all of those reasons and more, Canadian
12 Natural respectfully requests that the application be
13 approved with its proposed monitoring conditions.

14 I'm going to take a moment and just make sure that
15 we covered all the water. That was quite a bit of
16 territory. Just give me a moment, please.

17 Okay. Any questions?

18 COMMISSIONER CHIASSON: No. Actually, we have no
19 questions for you.

20 J. JAMIESON: Thank you very much. I thank
21 you for your patience. That got a little clunky at the
22 beginning. I apologize. Just given the time
23 constraint, we were still trying to get accurate
24 exhibit numbers, and obviously that showed. So thank
25 you for your patience, and those are all our comments.

26 COMMISSIONER CHIASSON: Yes. Yeah. No. And I would

1 say the Panel appreciates that you built in those
2 references. It does make our life easier in the long
3 run.

4 J. JAMIESON: Okay. Wonderful. Thank you
5 very much.

6 COMMISSIONER CHIASSON: And, Ms. Riley, now we're
7 looking at five-minutes, break, or ...

8 M. RILEY: Yes. I would probably need
9 five minutes. I do note that we've been going for
10 about an hour and a half, so I don't know if anyone
11 else needs a bit of a longer break.

12 COMMISSIONER CHIASSON: Well, I think we have the
13 space. You know, let's take -- let's take 15 and come
14 back -- let's plan to come back at 3:40.

15 M. RILEY: Thank you.

16 COMMISSIONER CHIASSON: And that way that gives
17 everyone the chance for a pause. So thank you.

18 (ADJOURNMENT)

19 COMMISSIONER CHIASSON: All right. Thank you. So,
20 Ms. Riley, we'll turn it over to you now.

21 Final Submissions by M. Riley

22 M. RILEY: Thank you very much. I see
23 that I have an entire hour allocated to me to speak,
24 but I have recently received some good advice that I'm
25 going to heed, and that is, be brief, be bright, and be
26 gone.

1 As this proceeding draws to a close, ISH wishes to
2 reiterate its steadfast commitment to the responsible
3 development and conservation of Alberta's natural
4 resources. ISH's objections to CNRL's application are
5 grounded in its deep commitment to responsible
6 development in the public interest, risk to the
7 integrity of ISH's current operations and potential
8 adverse effects on ISH's overlying gas interests.

9 Despite acknowledging that geologic interpretation
10 requires a suite of information, when CNRL engaged with
11 ISH, CNRL refused to share pertinent information.
12 CNRL's evidence was that it did not want to participate
13 in this hearing, which is entirely inconsistent with
14 their refusal to sensibly engage with ISH. From CNRL's
15 first engagement with ISH about this application, ISH
16 has demonstrated a preference to avoid undue expense
17 for both parties and for Albertans generally. ISH has
18 done so by seeking resolution of its concerns through
19 alternative dispute resolution mechanisms, which CNRL
20 declined, favouring instead to proceed with regulatory
21 intervention. This action, coupled with CNRL's
22 insistence on a confidentiality order that seems more
23 procedural than necessary, underscores a reluctance to
24 engage in open constructive dialogue aimed at finding
25 compromise while protecting the public interest.

26 ISH's submissions has detailed the geological and

1 operational risk associated with CNRL's proposed
2 development, particularly highlighting the absence of
3 effective barriers to prevent the migration of steam,
4 fluid, and reaction products. These technical analyses
5 underscore the significant concerns regarding the
6 proposed development's impact on the integrity of
7 adjacent resources.

8 Furthermore, CNRL's approach to managing these
9 risks, including its handling of seismic data and no
10 technical -- no apparent technical basis for its
11 request that long-term maximum operating pressures
12 reveal a disconcerting gap in the robustness of the
13 risk management strategies. ISH's application for an
14 adjournment based on the need to review the synthesis
15 of evidence that had taken two weeks for CNRL to
16 prepare and which was delivered minutes before start of
17 this hearing is a testament to ISH's diligence in
18 ensuring that all potential impacts were thoroughly
19 understood and appropriately addressed.

20 With respect to the closing remarks of
21 Ms. Jamieson, we would ask the Panel to carefully
22 review the transcript with respect to the evidence
23 given by Dr. Chalaturnyk and Mr. Vickerman. While it
24 is possible that we may have misunderstood
25 Ms. Jamieson's remark, ISH believes that Ms. Jamieson
26 may have misquoted ISH's evidence.

1 The AER is mandated to ensure the safe, efficient,
2 orderly, and environmentally responsible development of
3 resources over the entire life cycle. CNRL seeks
4 approval to amend Commercial Scheme Approval
5 Number 11475 for the recovery of crude bitumen from the
6 McMurray bitumen zone. ISH and CNRL agrees that any
7 approval issued in the public interest must be
8 consistent with the purpose of both the Oil Sands
9 Conservation Act as well as the Oil and Gas
10 Conservation Act.

11 Any approval issued must therefore, one, affect
12 the conservation of and the prevention of waste of oil
13 and gas resources of Alberta. It must provide for the
14 economic, orderly, efficient, and responsible
15 development in the public interest. It must provide
16 for the responsible management of a well facility, well
17 site, or facility site throughout its life cycle. It
18 must afford each owner the opportunity of obtaining the
19 owner's share of the production of oil or gas from any
20 pool, and it must control pollution above or at or
21 below the surface in the drilling of wells and in
22 operations.

23 CNRL and ISH agrees that the gas over bitumen, or
24 GOB, decisions do not specifically address wastage.
25 This is because wastage was never the intent or
26 underlying premise or a necessary implication of the

1 GOB decisions. Some of the premises of the GOB
2 decisions were that associated gas production could
3 have a detrimental effect on steam-assisted gravity
4 drainage performance. The extent of the effect would
5 depend on the specific reservoir situation, economic
6 circumstances, and operating strategy. And that
7 thermal bitumen processes could have a detrimental
8 effect on associated gas recovery, but such effects
9 were expected to be relatively minor.

10 ISH and CNRL further agree that while the Court of
11 Appeal of Alberta's decision in the matter of Alberta
12 Energy Company v. Goodwell is authority for the
13 proposition that some wastage may occur during
14 responsible development, it does not amount to a
15 justification for failure to take reasonable measures
16 to avoid wastage.

17 ISH struggles to understand CNRL's comment in its
18 closing remarks regarding the GOB shut-in order. On
19 the one hand, CNRL suggests that gas depletion would
20 impact its production, but on the other suggests that
21 the Wabiskaw C is an effective seal based on the data
22 acquired after the 2005 SSG study. This data does not
23 form part of the record.

24 In its arguments, CNRL proposes that this Panel
25 proceeds as the Panel for KN06 did. ISH would comment
26 that this is a different matter with different hearing

1 issues and different concerns.

2 In its evidence, CNRL expressed the view that the
3 conclusions drawn in the AER's January 2021 decision
4 regarding the KN06 drainage box should continue to find
5 application in this hearing. CNRL specifically relies
6 on the conclusions in the KN06 decision regarding what
7 measures would be reasonable to avoid or mitigate
8 potential impacts as well as what is in the public
9 interest. In its reply evidence, CNRL, however,
10 acknowledged that there are differences in the
11 geological strata present at the KN08 and KN09 area
12 versus the KN06 box and that those differences are
13 relevant to this proceeding.

14 CNRL also state and, as reiterated under
15 cross-examination, that it does not intend to damage or
16 waste the gas resource. It therefore follows that the
17 parties agree that reasonable steps ought to be taken
18 to ensure that any approved production occur under
19 conditions that reflect the intent of the legislation
20 and the bodies.

21 At the outset of this hearing, ISH made the point
22 that all of the relevant evidence is not filed. The
23 Panel correctly found that this is an application, not
24 an appeal, and that it has to determine whether or not
25 to allow the development in the public interest. At
26 the time that CNRL submitted their application,

1 March 11, 2022, the May 13 edition of Draft
2 Directive 23 applied to the application.

3 Pursuant to Section 7 of the draft directive, all
4 geological maps submitted are required to incorporate
5 available well information and seismic data and be
6 annotated with posted well data values. As appeared
7 from the evidence the KN24 and 25 drainage boxes were
8 not met. Section 7.10 also mandates that in situ
9 operations be conducted in a manner that ensures
10 reservoir fluid containment. The directive does not
11 say that applicants are required to use reasonable
12 commercial efforts to ensure containment. This is,
13 then, clearly not only an economic issue but a
14 regulatory requirement.

15 Section 7.10(7) further requires applicants to
16 specify their requested MOP and discuss how it was
17 determined and why it was appropriate. CNRL did
18 specify its requested MOP in its application, but that
19 has evolved over time, and CNRL's final request remains
20 unclear. In any event, CNRL has admitted that with
21 respect to their requested reduction, there isn't
22 really a solid technical justification.

23 The last point under the regulations,
24 Section 7.10(8) of the draft directive requires in
25 situations where geological modelling was conducted
26 that the model's input files be filed. CNRL has not

1 provided the input files nor were assumptions in the
2 model adequately discussed.

3 In its evidence, CNRL acknowledged that the only
4 information relevant to the modelling was contained in
5 the modelling report. This report did not include the
6 input files nor any information regarding deformation.
7 ISH was unable to review and consider the model,
8 interpret the assumptions, test the validity of the
9 model because CNRL declined to provide a copy, and this
10 despite the clear requirements under the directive.

11 CNRL's application has been incomplete from the
12 outset. Although it was initially filed on March 10,
13 2022, it was not until eight months later that CNRL had
14 finally rectified the deficiencies identified by the
15 AER in a series of three SIRs. Even in the time since
16 ISH's application to participate was granted, CNRL has
17 continued to develop its application materials. This
18 is evidenced not only in the deficiencies identified by
19 the AER, but also in CNRL's request to postpone its
20 initial submission in order to take into account new
21 cores and image logs.

22 In addition to the further revisions to CNRL's
23 application, it became apparent through the course of
24 this proceeding that CNRL has had information on hand
25 that would have helped ISH in assessing the application
26 and which would have helped the AER in its decision

1 that it has not provided. Specifically, with respect
2 to GCMS data, CNRL has said that they have several
3 reports from Schlumberger. They have not been filed,
4 but what we do have is that -- their interpretation.

5 On the modelling, I believe the quote is -- or the
6 question was: In your opinion, if there was thermal
7 expansion in the Wabiskaw D, what kind of pressure
8 could that generate? And the answer was: We have not
9 included a prediction or a model of this within the
10 record to bring up.

11 Regarding the image logs, the request was for
12 image logs, and the response was: You don't need image
13 logs because you can do a comprehensive interpretation
14 without them.

15 CNRL further says that it has reviewed all of its
16 core and all of its image logs data and could not
17 identify any fractures. The question is: Did you look
18 at all the information that you did not file? And the
19 answer was: Yes. We could not verify any of that.

20 Another issue is the DLIS files. CNRL's evidence
21 was you require the DLIS files to do a proper job. We
22 still have not seen those.

23 Mr. Vickerman was clear that the information on
24 the record is insufficient to draw final conclusions
25 regarding faults and fractures in the confinement
26 strata. CNRL -- and this is the point of all this

1 history -- has had two years to do a further DFIT to
2 provide further information. If the AER now says that
3 they should file a further DFIT, they can only complain
4 about a delay that is caused by that. They've had two
5 years to do it. If they have not done so, they are the
6 authors of their own misfortune.

7 To be clear, ISH has not and does not seek an
8 order preventing CNRL from developing the bitumen
9 resources. ISH does not specifically advocate for a
10 decision one way or another. It is for the AER to
11 decide whether the development proposed by CNRL
12 complies with the regulatory requirements and if it is
13 ultimately in the public interest.

14 What ISH is asking is that the AER, if it is
15 satisfied that the application ought to be approved,
16 recognize in the conditions of approval that there is
17 unique geology underlying KN08 and KN09 and include
18 appropriate measures to mitigate any resulting risk.

19 I will next address the conditions of approval,
20 including monitoring conditions that ISH requests. I
21 will first provide a summary list and thereafter
22 address the evidence underlying each of the conditions
23 proposed.

24 ISH submits that the following conditions of
25 approval must be imposed: One, a diagnostic fracture
26 injection test, or DFIT, in an appropriate area

1 relative to the KN08 and KN09 drainage boxes must be
2 conducted and the results of that test should be shared
3 with ISH and the AER prior to steaming and the results
4 from the DFIT must also be used to determine the
5 long-term maximum operating pressure.

6 Two, CNRL's undertaking to pay for the cleaning of
7 contaminated gas; alternatively, to compensate ISH for
8 the value of what ISH contends should be sweet natural
9 gas. In the event of contamination, should be noted,
10 together with the AER's expectation, that CNRL will
11 honour its undertaking as a condition of approval.

12 Finally, the following monitoring conditions
13 should be imposed. A minimum of one observation or gas
14 monitoring well per pad instrumented with piezometers
15 cemented on the outside of casing and multipoint
16 thermocouples inside or outside the casing completion
17 that will monitor the Wabiskaw B gas, the Clearwater
18 caprock, the Wabiskaw D, and the McMurray formations.
19 Surface gauges should be installed around all
20 monitoring wells to help verify downhole pressure
21 information.

22 A Wabiskaw B gas sample should be collected
23 directly above the KN08 or KN09 drainage boxes and
24 develop a compositional baseline pre-SAGD operation
25 start-up at KN08 and KN09.

26 Next, gas samples should be collected post-SAGD

1 operation start-up and over the life of the project of
2 KN08 and KN09.

3 And, finally, gas samples should be compared
4 between the baseline and new data to evaluate and
5 detect any compositional anomalies that may be
6 indicative of contamination.

7 I will then speak on the DFIT. Canadian Natural
8 argues that DFIT data tends to be regional, that they
9 have drilled hundreds of wells, and that their
10 assumptions in the modelling was conservative.

11 CNRL, however, agreed that deformation data
12 produced by the modelling was not included in the
13 record. If regard is had to Figure 7 at Exhibit 46.02
14 at PDF page 46, the stress gradient over the
15 confinement strata is, in fact, not conservative but
16 average. And even if it was conservative, the
17 homogenous model cannot predict with any acceptable
18 certainty how the heterogenous underlying strata will
19 behave.

20 CNRL is at pains to point out that the modelling
21 does not indicate that there is any concerns regarding
22 stress in the McMurray and Clearwater formations. ISH
23 does not take issue with that, but that is not what
24 this hearing is about. Deformation information is not
25 part of the record, and that is what we were keenly
26 interested in.

1 There is a different of -- difference of opinion
2 regarding brittle and ductile behaviour of the rock.
3 This is key to determine the impact on fractures within
4 and deformation of the confinement strata during SAGD
5 operations. CNRL did not provide laboratory tests
6 specific to KN08 and KN09 to determine the behaviour of
7 the rock. In the absence of these, there is
8 uncertainty in the quantification of brittle or ductile
9 transition behaviour for the fine-grained zones within
10 the confinement strata.

11 CNRL took issue with Dr. Chalaturnyk's McKay or
12 MacKay River project example. CNRL cannot sit on both
13 chairs. Either the example does not find application
14 or it is proof that the Wabiskaw D could hold back
15 steam in general. It cannot be both. It is either
16 region-specific and then does not apply, or we have
17 confirmation that we have brittle strata.

18 The parties have agree that there are differences
19 in the geology underlying KN08 and KN09, especially
20 when compared to the geology to the east of KN08 and
21 KN09. CNRL's experience in other areas of Kirby north
22 is therefore not determinative of local conditions.

23 If we look at the current DFITs available and we
24 compare the stratigraphy of the areas where we have
25 current DFIT data with the stratigraphy of KN08 and
26 KN09 as interpreted by CNRL, the following is readily

1 apparent. The A2 mudstone is present across all the
2 wells of the -- analyzed in the current DFIT data but
3 is notably absent in two of the wells that form part of
4 the KN08 and KN09 stratigraphy. It is further common
5 cause between the parties that the A2 mudstone is
6 absent over a large part of the KN08 and KN09 drainage
7 boxes.

8 The mid-B mudstone is present with a fairly
9 uniform isopach across all the wells analyzed in the
10 current DFIT data stratigraphy, but the isopach in the
11 wells analyzed over KN08 and KN09 varies significantly.

12 It is also now common cause between the parties
13 that the mid-B1 mudstone is, in fact, not present over
14 the entire drainage area.

15 As assessed by CNRL, the value with conducting
16 DFIT is to determine principal in situ stress that can
17 be used for either leveraging some geomechanical
18 effects for a resource recovery process or for caprock
19 integrity and confinement strata integrity. To be
20 clear, ISH's concern is about the failure of the
21 confinement strata layers that would allow for upward
22 migration of fluids.

23 CNRL decided to not acquire any new DFIT despite
24 the fact that they have drilled many more wells since
25 2021 and argues that the acquisition of a new DFIT with
26 costs ranging from \$375,000 would be unduly punitive.

1 The 9-6 DFIT performed in 2012, which was referred to
2 by CNRL, is the closest data point to KN08 and KN09 but
3 is still located several kilometres away. The results
4 from that test were rejected.

5 The other DFITs available to CNRL are located very
6 far from the zone of interest and were primarily
7 acquired to analyze the caprock integrity, which is not
8 the topic here. Given that CNRL only acquires must-do
9 DFIT, if this data was initially required and the
10 acquisition failed, ISH wonders why this acquisition
11 was not attempted again.

12 This data point shows a lower initial stress data,
13 possibly indicating that this stress regime may not be
14 regional. ISH sustains that the initial stressor on
15 KN08 and KN09 is not -- does not conform to the eastern
16 area where the DFIT is required as the geology is
17 significantly different.

18 The DFIT requested by ISH is aimed at providing
19 information relative to the confinement strata, and new
20 DFIT will allow CNRL to calibrate the minimum stress
21 value in the area of KN08 and KN09. If the newly
22 acquired minimum stress value is lower than CNRL
23 estimated, the risk for the confinement strata to fail
24 is higher.

25 ISH commented that the 2D geomechanical model
26 presented by CNRL is not appropriate to represent the

1 3D dimension of the heterogeneities of the zone of
2 interest, though it is adequate for caprock integrity.
3 CNRL disclosed, during cross-examination, that they're
4 currently developing a 3D geomechanical model, which is
5 still very preliminary, to validate any geomechanical
6 model confirmation of the in situ stress regime and the
7 starting point of the minimum stress path followed
8 under SAGD operations is required to get certainty on
9 the end point of the modelling. If we do not know
10 where we start, we do not know where we will end up.

11 In addition, there were no samples from the
12 confinement strata in KN08 and KN09 tested in the
13 laboratory to support the model inputs.

14 During its direct evidence, CNRL reported that the
15 2D geomechanical model showed uplift of confinement
16 strata. They also added that the uplift or
17 deformations -- the vertical deformations are not shown
18 in the report, just summary plots of the stress levels
19 which are a result of that deformation. It is not
20 clear why CNRL did not include their full
21 interpretation as part of the geomechanical model.

22 Finally, CNRL does not agree to take another DFIT.
23 Their reluctance is related to findings related to a --
24 to a new data point and that it may amend the requested
25 MOP, which would naturally reopen the regulatory
26 process.

1 Further, CNRL takes the view that irrespective of
2 the results of a DFIT, even if there was the unlikely
3 result of having a reduced stress, it would have no
4 effect on their request for a temporary MOP of
5 6,600 kPa. ISH believes that this is in the public
6 interest, to acquire the additional DFIT, given the
7 large uncertainties regarding the geology, the absence
8 of well control, and the distance to the next DFIT data
9 point. The acquisition of a new DFIT should be
10 requested before any SAGD wells are drilled.

11 It is impossible to determine from the
12 geomechanical model if the revised MOP of 5,500 kPa is
13 safe, especially given the fact that the model was
14 designed to test circumstances at 4,000 kPa. The model
15 does not, in fact, answer any of the hearing questions.

16 I will then move on to the second of the
17 conditions that ISH proposes, and that is the
18 undertaking to pay for the gas. In its reply evidence,
19 CNRL reiterated its commitment that in the event that
20 the gas is contaminated from its operations and
21 cleaning of the gas was determined to be
22 cost-prohibitive, it would compensate ISH fairly for
23 its share of the gas. This undertaking is not clear.
24 Will ISH be compensated for sweet natural gas or sour
25 gas? The request that it -- this determination only be
26 made after SAGD operations have been completed and the

1 GOB wells can be opened also raises the question of how
2 CNRL would be applying the gas or using it in its own
3 operations, given that the -- the GOB gas cannot be
4 reopened before the SAGD operations are complete.

5 I will now turn to the monitoring conditions. The
6 first is the request for observation or gas monitoring
7 wells. There are a few points. The first is during
8 the cross-examination CNRL raised the concern that
9 scale plugging inside a well could take place
10 independently of the MOP. This raises the question of
11 whether CNRL is really able to monitor any exceedance
12 to the MOP and if another pressure event could even be
13 undetected if the well is plugged.

14 In its reply evidence, CNRL indicated that it was
15 prepared to accept and modify its risk mitigation
16 measures to include the conversion of the 10-34 well
17 into an additional monitoring well, to convert the
18 1-3 well from a standing cased well to a Kirby Upper
19 Mannville II pool gas monitoring well prior to steaming
20 of KN08 and KN09, to maintain its existing gas
21 monitoring from the 10-1 well, and CNRL has also
22 indicated that it plans to drill a stratigraphic
23 evaluation well in the immediate vicinity of the KN09
24 development and expects that one location could be
25 utilized as a gas monitoring well prior to the
26 commencement of steaming operations.

1 Given the lack of well control around KN09, the
2 heterogeneity of the geology and its lack of continuous
3 barriers between the SAGD McMurray zone and the
4 Wabiskaw B zone, ISH requests that a gas monitoring
5 well be drilled on KN09.

6 The BHI or FMI as submitted does not enable either
7 ISH or the AER to verify the extent of fracturing.
8 CNRL conceded during cross-examination that the digital
9 data of the FMI logs, or DLIS, is required for any
10 interpreter to deliberate professional work and, while
11 available to CNRL, was not provided.

12 CNRL showed various scores showing the range of
13 facies highlighting the heterogeneity of the
14 confinement strata in those drainage boxes,
15 specifically in terms of thickness across the area.

16 Regarding the regional extent of the confinement
17 strata, just a few comments. Again, there is a notable
18 lack of well control over the KN09 drainage box. CNRL
19 said that they were using the barriers or baffles
20 identified by GCMS as a proxy for what SAGD operations
21 will do. CNRL, however, modified the Fustic paper
22 methodology to introduce their own methodology, which
23 was not peer-reviewed. The modification is
24 significant, as, in CNRL's opinion, a forward-stepping
25 increase in concentration with decreasing depth is also
26 a sign for a barrier. ISH and CNRL both agree that

1 GCMS data is one-dimensional and cannot provide any
2 information on the lateral continuity of a barrier.
3 ISH's opinion is that there is one barrier in each well
4 but not in the same strata, suggesting that the strata
5 are not continuous.

6 I will next turn to the issue of conductive
7 heating. CNRL and ISH agree that conductive heating is
8 inevitable. During cross-examination, CNRL quoted the
9 temperature diffusion factor. Thermal conductivity,
10 thermal diffusivity, and specific heat capacity define
11 a material's ability to store and transfer heat. No
12 data is provided in records on any of these factors.
13 Despite a major event at Cenovus in 2013, no studies
14 were done on conductive heating, the pace and impact on
15 overlying strata.

16 CNRL's evidence was that the Cenovus example had 6
17 metres of muddy facies in between the top of the steam
18 chamber and the Wabiskaw D bitumen-saturated sands. In
19 KN08 and KN09, we have perhaps 10 to 12 metres, so
20 there is going to be less heating or much slower
21 heating than at Cenovus. This is not consistent with
22 the confinement strata as defined by CNRL as 3.8 metres
23 to 14.3 metres at the maximum. This includes the
24 Wabiskaw D upper and Wabiskaw C, both located above
25 Wabiskaw D bitumen.

26 Total thickness of the layers between the top of

1 the SAGD reservoir and Wabiskaw D bitumen ranges from
2 10 metres to 12 metres. CNRL pointed to the PNX log on
3 Well 6-04 indicating temperature progression above the
4 top of the reservoir towards the Wabiskaw D bitumen and
5 showing that temperature reached 60 degrees at
6 50 metres after four years. Wabiskaw D bitumen could
7 surely start to expand at this temperature and should
8 start to immobilize at 80 degrees Celsius. How hot
9 will it be after ten years of SAGD operations? How
10 long will it take to reach 150 degrees Celsius?
11 Despite CNRL claiming that they operate more than 140
12 SAGD well pairs and they run PNX on an annual or
13 biannual basis, this is the only PNX log provided by
14 CNRL.

15 CNRL cited that Wabiskaw D production after it --
16 it's mobilized by conductive heating is highly
17 unlikely. We question whether an overpressure event
18 like the one observed at Christina Lake would occur at
19 KN09 and -- KN08 and KN09.

20 During cross-examination, Dr. Boone also stated
21 that once the steam hits the top of the reservoir, it's
22 there for ten years and conduction continues to occur,
23 and any bitumen up there is mobilized when it is
24 heated. The good thing is that you get a little bit
25 more oil out of that. The application does not allow
26 for production of Wabiskaw D, even as a consequence of

1 approved production.

2 Note that CNRL chose not to communicate about the
3 existence of two pads, KN24 and KN25, that are already
4 approved by the AER. They're adjacent to KN09 to the
5 north and dedicated to Wabiskaw D production.

6 The overpressure event observed in 2013 at
7 Cenovus's Christina Lake pad more than 11 years ago is
8 well documented. The event should have been considered
9 by CNRL and the risk analysis for this application,
10 given that the stratigraphy between the KNIDA is
11 virtually identical to that in the Christina Lake
12 example. The KN08/09 pads are placed in the same
13 valley as the Kirby north IDA and also contain very
14 similar confinement strata units. The impact is high,
15 as it required Cenovus to drill several wells to
16 mitigate the overpressure and continues to be monitored
17 and remediated today.

18 CNRL confirmed that they don't have a prediction
19 or a model that predicts the pressure in the Wabiskaw D
20 over the KN08 and KN09 drainage boxes due to conductive
21 heating. Dr. Boone said he did not include this in his
22 risk assessment. ISH is concerned that CNRL did not
23 consider the risks associated with an overpressure
24 event created by conductive heating.

25 I will now make a few brief comments on the
26 confinement strata. The first is the A2 mudstone. The

1 parties are in agreement that the A2 mudstone is absent
2 over the majority of KN09 and -- KN08 and KN09. On the
3 Wabiskaw C, CNRL asserts that the Wabiskaw C is a
4 continuous seal, contrary to the SSG evaluation done at
5 the time of the GOB shut-in order but provide no data
6 to support their point. This is the only strata that
7 is continuously present across the KN08 and KN09
8 drainage boxes.

9 Regarding the mid-B1 mudstone, it is apparent that
10 ISH and Canadian Natural disagree on the lateral extent
11 of the mid-B1 mudstone. A map of the areas where ISH
12 and CNRL each plot the absence of the mid-B1 mudstone
13 appears in the record at Exhibit 50.003, PDF page 50.

14 During cross-examination, CNRL conceded that there
15 are some differences in the lithologies expressed in
16 the underlying lower B1 regional sequence, the
17 overlying upper B1 sequence, and that those differences
18 can cause some difficulties in interpreting -- oh,
19 interpretation, I suppose -- and that mid-B1 mudstone
20 has a variable character. And that is because the
21 mid-B1 mudstone doesn't have a direct seismic
22 indicator. It is apparently obvious that it is -- its
23 existence is extrapolated through regions where we do
24 not have well control as well.

25 In their reply submission, CNRL conceded in -- the
26 absence of the mid-B1 mudstone in the 1-3 well and

1 acknowledged that the core in well 9-3 that would
2 supposedly have contained the mid-B1 mudstone was lost.

3 In its argument, CNRL says that Mr. Barrie
4 conceded that there was mid-B1 mudstone within his blue
5 line polygon. Mr. Barrie, in fact, said that if it
6 would move the cross-examination along, he would agree.
7 He also indicated that it was difficult for him to
8 examine.

9 I will now speak to the surface gauges. The
10 parties agree that there is a declining pressure in the
11 10-1 well and that the cause is unknown. Parties also
12 agree that data from earlier variations could not be
13 verified. Surface gauges would have at least confirmed
14 that what we saw was accurate. The costs attached to
15 these surface gauges are inconsequential.

16 Regarding the collection of a sample, it seems
17 that the parties have agreement that a pre-production
18 of the -- or at least a pre-SAGD operation
19 compositional baseline should be collected. The
20 parties also seem to agree that once the SAGD
21 operations are completed and the GOB gas could be
22 produced, there should be another sample. The question
23 is whether there is any necessity for further sampling
24 across the lifetime.

25 Having only two points in time for the gas sample
26 is inadequate, in ISH's view, to ensure the protection

1 of the gas resource. In any event, if this GOB order
2 is lifted before SAGD operations have been exhausted at
3 KN08 and KN09, the only way to determine the effects of
4 CNRL's operations would be to complete a sample before
5 SAGD operations have concluded in any event.

6 CNRL takes the view that such gas sampling would
7 be uneconomical when compared to the value of the gas
8 resource. ISH disagrees with this discount methodology
9 applied by CNRL. It is CNRL, however, who wishes to
10 develop the bitumen, potentially to the detriment of
11 ISH's gas interest. The protection of ISH's gas
12 interest and CNRL's obligations under Directive 23 to
13 ensure reservoir containment suggest that
14 appropriate -- an appropriate metric for determining
15 the economy of conducting gas sampling should be
16 derived from the anticipated cost of constructing the
17 well pads.

18 On the last condition, and that is the comparison
19 of the -- of the sample results, it seems that the
20 parties are in agreement. ISH acknowledges that CNRL
21 has experience with the developments in the Kirby north
22 area, but the evidence of this week showed that the
23 geology underlying KN08 and KN09 differs from other
24 areas in Kirby north. CNRL admitted under
25 cross-examination that it's primarily driven by a
26 profit motive and they do what is right for them. That

1 is, "doing it right" according to their mission
2 statement.

3 Part of the reason that CNRL gave for its initial
4 extension request was the need to retain a third-party
5 expert. But under cross-examination, Dr. Boone
6 admitted that he has not been retained by anyone other
7 than CNRL over the past year. Dr. Boone opined on
8 Issues 1 to 4 in this hearing and drew conclusions on
9 matters that are outside of his area of expertise. ISH
10 submits that the evidence advanced by CNRL should be
11 given little weight, both as a result of the partisan
12 nature of its witnesses and also because CNRL's
13 evidence has materially changed in response to ISH's
14 submissions.

15 With the limited evidence that CNRL has provided,
16 ISH has shown there are significant uncertainties
17 concerning the effects of CNRL's planned development.
18 ISH submits that this Panel is ultimately tasked with
19 doing what is right for Albertans. In other words, the
20 Panel should only approve this application if it is in
21 the public interest. CNRL has told us what is in its
22 interest and suggests that the Regulator should approve
23 its application, taking the view that ISH's statement
24 of concern was unjustified. This despite the fact that
25 CNRL has provided no technical basis for reduced MOP
26 and despite the fact that CNRL has refused to provide

1 ISH and the Regulator with sufficient information to
2 reasonably evaluate CNRL's application.

3 Ultimately, ISH wishes to protect its gas
4 resource. The imposition of conditions proposed by ISH
5 will ensure that the gas resource, which is owned by
6 Alberta, is not wasted. ISH presented a diverse panel
7 consisting of industry experts qualified to review and
8 assess the hearing issues. ISH's expert panel
9 leveraged their broad and diverse experience to deliver
10 an objective analysis. A subset of the monitoring
11 proposed by ISH as well as its geologic interpretation
12 has also -- has already been incorporated by CNRL,
13 proving that the opinion presented by ISH is relevant
14 and accurate.

15 In conclusion, ISH would request the Hearing Panel
16 to include its proposed conditions of approval in the
17 conditions, should it decide to approve the
18 application. Those are my submissions.

19 COMMISSIONER CHIASSON: Thank you, Ms. Riley.

20 I do have one question for you. So if I
21 understand correctly, part of what you indicated in
22 ISH's proposed conditions is that this Hearing Panel
23 take -- essentially take CNRL's undertaking in relation
24 to compensating ISH if there is contamination to the
25 gas resource and embody that as a condition to the
26 approval. Am I understanding you correctly there?

1 M. RILEY: It is more the AER's
2 expectation that CNRL will honour its obligation to be
3 included as a condition of approval.

4 COMMISSIONER CHIASSON: Okay. And can you, I guess,
5 point the Panel to where we have -- where our authority
6 would flow from to impose such a condition.

7 M. RILEY: I think it is part of your
8 overarching authority to make any condition in the
9 public interest. The reason ISH includes this request
10 is because in previous applications, similar types of
11 conditions or undertakings have been made, and when it
12 came time to enforce those, the attitude was, Well, it
13 was not a condition of approval and therefore not
14 binding. If it is a factor that the Panel will take
15 into account in coming to its conclusion, we would
16 submit that it should be included as -- as part of the
17 conditions.

18 COMMISSIONER CHIASSON: Okay. Thank you. I
19 appreciate your answer.

20 Ms. Jamieson, it looks like you would like to add
21 something for our consideration in on my question.

22 J. JAMIESON: Yeah. May I?

23 I'm familiar with the AER's practice to just, you
24 know, articulate an expectation that any commitments
25 that a company makes be honoured, so just that general
26 type of language. I'm not familiar with this type of

1 commitment being actually baked in or made into a
2 condition of the approval. So I'll leave that with
3 you, but that would be unusual, in my experience.

4 Thank you.

5 COMMISSIONER CHIASSON: Thank you. We appreciate your
6 input.

7 So I think that brings us to the end of -- end of
8 this hearing. So, parties, thank you very much for
9 your participation. On behalf of the Panel, I would
10 like to say that we appreciate the efforts of counsel
11 and witnesses through what was a very full week, and we
12 thank you all for your respect, your civility, your
13 patience, and your good humour, and I'm sure we'll all
14 think of broccoli in new ways coming out of the --
15 coming out of this hearing.

16 The Panel would also like to take the opportunity
17 to publicly give thanks to the AER staff who supported
18 this hearing, including Mr. Lung and the rest of the
19 hearing services team, our subject matter expert team
20 who helped us through this vast range of very technical
21 information, and our counsel, Mr. McClary and
22 Ms. Peddlesden. Thank you all so much for your support
23 on this process.

24 So going forward, as the Hearing Panel, we will
25 review the evidence and the submissions, and we will
26 issue our decision on Canadian Natural's amendment

1 application. We will issue a written decision within
2 90 days of the close of this hearing, so the clock
3 starts sticking. Tomorrow is Day 1.

4 Each of the parties who have participated in this
5 hearing will receive a copy, and the decision will also
6 be posted on the AER website. And so this hearing is
7 now closed.

8 For anyone who has to travel beyond the Calgary
9 area, I wish you safe travels, and thank you all very
10 much.

11 And the one -- the one thing I forgot to mention,
12 which I should not, was thank you so much to our court
13 reporters for the magnificent job they've done all
14 week.

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16 PROCEEDINGS CONCLUDED

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1 CERTIFICATE OF TRANSCRIPT:

2

3 We, Sandie Murphy and Sandra Burns, certify that
4 the foregoing pages are a complete and accurate
5 transcript of the proceedings, taken down by us in
6 shorthand and transcribed from our shorthand notes to
7 the best of our skill and ability.

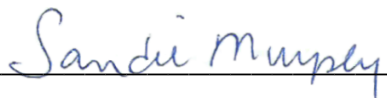
8 Dated at the City of Calgary, Province of Alberta,
9 this 9th day of February 2018.

10

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14

Sandie Murphy, CSR(A)

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Official Court Reporter

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Sandra Burns, CSR(A), RPR, CRR

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Official Court Reporter

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