

425	<p style="text-align: center;">THE ALBERTA ENERGY REGULATOR PROCEEDING ID NO. 436</p> <p style="text-align: center;">IN THE MATTER OF the Regulatory Appeal by Obsidian Energy Ltd. of the Alberta Energy Regulator's decision to issue an Environmental Protection Order to Obsidian Energy Ltd., pursuant to Sections 113 and 24 of the Environmental Protection and Enhancement Act On March 23, 2023 (Regulatory Appeal 1943624)</p> <hr/> <p style="text-align: center;">AER PROCEEDING VOLUME 7</p> <hr/> <p style="text-align: center;">Calgary, Alberta December 2, 2024</p>	426																																																																																	
427	<p style="text-align: center;">EXHIBITS</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;"></th> <th style="width: 85%;">Description</th> <th style="width: 10%;">Page</th> </tr> </thead> <tbody> <tr><td>1</td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td></tr> <tr><td>4</td><td>EXHIBIT 99.0 - 2018 article entitled "Faults and ..."</td><td>475</td></tr> <tr><td>5</td><td>- was Obsidian Aid to Cross 5</td><td></td></tr> <tr><td>6</td><td></td><td></td></tr> <tr><td>7</td><td>EXHIBIT 100.0 - 2019 article entitled "Connecting Fluid Flow ..."</td><td>475</td></tr> <tr><td>8</td><td>- was Obsidian Aid to Cross 3</td><td></td></tr> <tr><td>9</td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td></tr> <tr><td>11</td><td>EXHIBIT 101.0 - AER Directive 040 - was Obsidian Aid to Cross 11</td><td>488</td></tr> <tr><td>12</td><td></td><td></td></tr> <tr><td>13</td><td></td><td></td></tr> <tr><td>14</td><td>EXHIBIT 102.0 - Screenshot of AER web page Map 631 - was Obsidian Aid to Cross 8</td><td>496</td></tr> <tr><td>15</td><td></td><td></td></tr> <tr><td>16</td><td></td><td></td></tr> <tr><td>17</td><td>EXHIBIT 103.0 - 2017 article entitled "An Efficient Approach ..."</td><td>496</td></tr> <tr><td>18</td><td>- was Obsidian Aid to Cross 7</td><td></td></tr> <tr><td>19</td><td></td><td></td></tr> <tr><td>20</td><td></td><td></td></tr> <tr><td>21</td><td>EXHIBIT 104.0 - 2017 article entitled "An Efficient Approach ..."</td><td>522</td></tr> <tr><td>22</td><td>- was Obsidian Aid to Cross 7</td><td></td></tr> <tr><td>23</td><td></td><td></td></tr> <tr><td>24</td><td></td><td></td></tr> <tr><td>25</td><td>EXHIBIT 105.0 - Section 4.1.8 of AER Directive 065 - was Obsidian Aid to Cross 12</td><td>561</td></tr> <tr><td>26</td><td></td><td></td></tr> </tbody> </table>		Description	Page	1			2			3			4	EXHIBIT 99.0 - 2018 article entitled "Faults and ..."	475	5	- was Obsidian Aid to Cross 5		6			7	EXHIBIT 100.0 - 2019 article entitled "Connecting Fluid Flow ..."	475	8	- was Obsidian Aid to Cross 3		9			10			11	EXHIBIT 101.0 - AER Directive 040 - was Obsidian Aid to Cross 11	488	12			13			14	EXHIBIT 102.0 - Screenshot of AER web page Map 631 - was Obsidian Aid to Cross 8	496	15			16			17	EXHIBIT 103.0 - 2017 article entitled "An Efficient Approach ..."	496	18	- was Obsidian Aid to Cross 7		19			20			21	EXHIBIT 104.0 - 2017 article entitled "An Efficient Approach ..."	522	22	- was Obsidian Aid to Cross 7		23			24			25	EXHIBIT 105.0 - Section 4.1.8 of AER Directive 065 - was Obsidian Aid to Cross 12	561	26			428
	Description	Page																																																																																	
1																																																																																			
2																																																																																			
3																																																																																			
4	EXHIBIT 99.0 - 2018 article entitled "Faults and ..."	475																																																																																	
5	- was Obsidian Aid to Cross 5																																																																																		
6																																																																																			
7	EXHIBIT 100.0 - 2019 article entitled "Connecting Fluid Flow ..."	475																																																																																	
8	- was Obsidian Aid to Cross 3																																																																																		
9																																																																																			
10																																																																																			
11	EXHIBIT 101.0 - AER Directive 040 - was Obsidian Aid to Cross 11	488																																																																																	
12																																																																																			
13																																																																																			
14	EXHIBIT 102.0 - Screenshot of AER web page Map 631 - was Obsidian Aid to Cross 8	496																																																																																	
15																																																																																			
16																																																																																			
17	EXHIBIT 103.0 - 2017 article entitled "An Efficient Approach ..."	496																																																																																	
18	- was Obsidian Aid to Cross 7																																																																																		
19																																																																																			
20																																																																																			
21	EXHIBIT 104.0 - 2017 article entitled "An Efficient Approach ..."	522																																																																																	
22	- was Obsidian Aid to Cross 7																																																																																		
23																																																																																			
24																																																																																			
25	EXHIBIT 105.0 - Section 4.1.8 of AER Directive 065 - was Obsidian Aid to Cross 12	561																																																																																	
26																																																																																			
428	<p style="text-align: center;">UNDERTAKINGS</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;"></th> <th style="width: 85%;">Description</th> <th style="width: 10%;">Page</th> </tr> </thead> <tbody> <tr><td>1</td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td></tr> <tr><td>4</td><td>UNDERTAKING 1 - To provide the full non-cut-off copy of the email that is in Exhibit 6.01 on PDF page 4</td><td>510</td></tr> <tr><td>5</td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td></tr> <tr><td>8</td><td>UNDERTAKING 2 - To review the reference to two additional Leduc wells within 25 kilometres in Exhibit 06.01, PDF page 16, fourth bullet, and confirm which wells they were and whether at the time they were considered to be seismogenic</td><td>546</td></tr> <tr><td>9</td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td></tr> <tr><td>12</td><td></td><td></td></tr> <tr><td>13</td><td></td><td></td></tr> <tr><td>14</td><td></td><td></td></tr> <tr><td>15</td><td></td><td></td></tr> <tr><td>16</td><td></td><td></td></tr> <tr><td>17</td><td></td><td></td></tr> <tr><td>18</td><td></td><td></td></tr> <tr><td>19</td><td></td><td></td></tr> <tr><td>20</td><td></td><td></td></tr> <tr><td>21</td><td></td><td></td></tr> <tr><td>22</td><td></td><td></td></tr> <tr><td>23</td><td></td><td></td></tr> <tr><td>24</td><td></td><td></td></tr> <tr><td>25</td><td></td><td></td></tr> <tr><td>26</td><td></td><td></td></tr> </tbody> </table>		Description	Page	1			2			3			4	UNDERTAKING 1 - To provide the full non-cut-off copy of the email that is in Exhibit 6.01 on PDF page 4	510	5			6			7			8	UNDERTAKING 2 - To review the reference to two additional Leduc wells within 25 kilometres in Exhibit 06.01, PDF page 16, fourth bullet, and confirm which wells they were and whether at the time they were considered to be seismogenic	546	9			10			11			12			13			14			15			16			17			18			19			20			21			22			23			24			25			26			429
	Description	Page																																																																																	
1																																																																																			
2																																																																																			
3																																																																																			
4	UNDERTAKING 1 - To provide the full non-cut-off copy of the email that is in Exhibit 6.01 on PDF page 4	510																																																																																	
5																																																																																			
6																																																																																			
7																																																																																			
8	UNDERTAKING 2 - To review the reference to two additional Leduc wells within 25 kilometres in Exhibit 06.01, PDF page 16, fourth bullet, and confirm which wells they were and whether at the time they were considered to be seismogenic	546																																																																																	
9																																																																																			
10																																																																																			
11																																																																																			
12																																																																																			
13																																																																																			
14																																																																																			
15																																																																																			
16																																																																																			
17																																																																																			
18																																																																																			
19																																																																																			
20																																																																																			
21																																																																																			
22																																																																																			
23																																																																																			
24																																																																																			
25																																																																																			
26																																																																																			

429	<p>1 Proceedings taken at the Govier Hall, Calgary, 2 Alberta 3 _____ 4 December 2, 2024 Morning Session 5 6 A. Bolton The Chair 7 B. Zaitlin Hearing Commissioner 8 T. Stock Hearing Commissioner 9 10 B. Kapel Holden AER Counsel 11 O. Chijioke AER Counsel 12 A. Huxley AER Counsel 13 (Via Videocast) 14 A. Lung AER Staff 15 N. Hymers AER Staff 16 M. Rahimabadi AER Staff 17 18 P. Fitzpatrick For Regulatory Compliance 19 Branch 20 J. Allison For Regulatory Compliance 21 Branch 22 A. Hall For Regulatory Compliance 23 Branch 24 25 D.P. Langen For Obsidian Energy Ltd. 26 A. Barrington For Obsidian Energy Ltd.</p>	430	<p>1 K. Di Rocco, CSR(A) Official Court Reporter 2 _____ 3 (PROCEEDINGS COMMENCED AT 9:00 AM) 4 THE CHAIR: Good morning. 5 Please be seated. 6 Okay. Welcome, everybody. I believe we 7 might have some preliminary matters we need to 8 deal with before we move on, Mr. Langen. 9 D.P. LANGEN: Yes. Good morning, 10 Mr. Chair and Commissioners. I had promised at 11 the end of the hearing day on Friday that we 12 would get back to you in respect of whether or 13 not Obsidian was going to sit a reply panel to 14 speak to the new evidence that came in through 15 the opening statement of CLM. I can confirm 16 that we do intend to sit a reply panel. 17 THE CHAIR: Okay. 18 D.P. LANGEN: At this stage, 19 the -- or the content of that panel is a little 20 up in the air. We do know that Dr. Verdon will 21 be on that panel. There may be others. We're 22 just determining that. 23 And, unfortunately, there's a bit of a 24 wrinkle with respect to Dr. Verdon. Dr. Verdon 25 had something unexpected arise over the weekend 26 that required him to return home to the UK, and</p>
431	<p>1 so he will not be able to appear in person 2 because he's in the UK. So we're seeking leave 3 of yourselves and -- and your fellow 4 Commissioners to have him appear virtually for 5 that reply panel. 6 THE CHAIR: Okay. And when 7 would you like to seat your rebuttal panel -- 8 or your reply panel? 9 D.P. LANGEN: Well, obviously 10 after the CLM panel is complete. I would 11 think, right now, the way the schedule is 12 flowing, that that would probably be Wednesday 13 morning. 14 The other thing to keep in mind is that -- 15 now, I haven't spoken to Dr. Verdon about this. 16 He's eight hours ahead, so morning is best for 17 him. If we do it late in the afternoon, it's 18 very late in his day. But I haven't spoken to 19 him. I have been on proceedings where 20 witnesses were nice enough to accommodate the 21 time zone differences and accommodate our time 22 zone versus there, but I haven't spoken to him 23 about that. I'll just raise that with you now. 24 THE CHAIR: Okay. Thank you. 25 Do you have other preliminary matters you 26 want to raise or -- I'd like to hear from</p>	432	<p>1 Mr. Fitzpatrick on the -- 2 D.P. LANGEN: No. 3 THE CHAIR: -- virtual 4 appearance as well. 5 D.P. LANGEN: No other preliminary 6 matters. 7 THE CHAIR: Okay. Thanks. 8 Mr. Fitzpatrick, any comments on the 9 potential for Mr. Verdon to appear virtually? 10 P. FITZPATRICK: Good morning, sir. 11 Yes. That's -- that's fine with CLM. 12 THE CHAIR: Okay. Okay. So I 13 think we'll just have to -- you know, I think 14 that's acceptable to the Panel. I think our 15 technology will accommodate it. We have done 16 this previously, so that shouldn't be a 17 problem. 18 And do you know whether he will be 19 participating in a public session or in-camera 20 session? 21 D.P. LANGEN: Thank you, 22 Mr. Chair, for raising that. His -- as I 23 understand it currently -- his reply will be 24 confidential, is how I understand it currently. 25 THE CHAIR: Okay. I think that 26 works for us. We will need to just confirm the</p>

<p style="text-align: right;">433</p> <p>1 time that Mr. Verdon would be available and 2 just make sure it's acceptable to the rest of 3 the participants, but Wednesday morning would 4 seem to work at this point. 5 D.P. LANGEN: Okay. Thank you, 6 sir. 7 And just -- just to reconfirm that we 8 haven't quite determined whether there'll be 9 other witnesses as well, but we'll -- we'll -- 10 THE CHAIR: Yeah. Understood. 11 D.P. LANGEN: Okay. Thank you, 12 sir. 13 THE CHAIR: Okay. Other 14 preliminary matters? No? None? Okay. Then I 15 think we can proceed with the cross-examination 16 of the CLM witness panel. 17 A. BARRINGTON: Good morning, 18 Mr. Chair and Commissioners. Good morning. 19 ERIK KULEBA, CLAUDIO VIRUES, Previously 20 Affirmed 21 TODD SHIPMAN, MAURICIO CANALES, ELWYN GALLOWAY, 22 Previously Sworn 23 A. Barrington Cross-examines the Regulatory 24 Compliance Branch Witnesses 25 Q A. BARRINGTON: Mr. Kuleba, I have 26 some questions for you. My name is Amy</p>	<p style="text-align: right;">434</p> <p>1 Barrington. 2 So in making your decision to issue the 3 EPO, it was solely the record of the decision 4 maker at Exhibit 05.01 that you relied on; is 5 that correct? 6 A E. KULEBA: I actually believe 7 it's 6.01. 8 Q Thank you. 9 And the supplemental information marked as 10 Exhibit 06.02 was used by CLM's staff, who 11 supported you, but not used in your own 12 decision-making; is that correct? 13 A That's correct. I did not look at that 14 information directly. It would have been 15 provided to me verbally in their explanation of 16 their conclusion. So ... 17 Q Okay. So it was provided to you verbally, the 18 information. And was that in advance of 19 issuing the EPO? 20 A Yes. Information in there is in my record of 21 decision. The information in the supplemental 22 information package is the information they 23 had, the evidence they had to support what they 24 told me. So I did not look at it myself, but 25 it's their supporting evidence of what they 26 told me. So ...</p>
<p style="text-align: right;">435</p> <p>1 Q Okay. So when was the first time that you 2 actually reviewed the information set out in 3 Exhibit 06.02? 4 A In preparation for this proceeding, I believe 5 there was an IR that asked if I had seen 6 anything in it, and that's the first time I had 7 looked at it. So ... 8 Q And the staff who supported you and relied on 9 the supplemental information, that would be 10 Drs. Shipman and Dr. Canales; correct? 11 A That is correct. 12 Q And you confirmed in your direct evidence that 13 both Dr. Shipman and Canales supported you in 14 the respect of the seismic events in issue, 15 both in advance of and up to the issuance of 16 the EPO; correct? 17 A Correct. 18 Q I want to understand a little more about the 19 timeline and the scope of your interaction with 20 the AGS and AER staff who advised you. To do 21 this, I'm going to be referring to the record 22 of decision maker at zero -- 06.01. 23 So when the November 29, 2022, seismic 24 event occurred, when did you first hear of it 25 and from whom? 26 A I heard about it as I was walking out the</p>	<p style="text-align: right;">436</p> <p>1 office that day, on November 29th. I believe 2 I got a Teams message from a manager in 3 Grande Prairie that said there was an 4 earthquake. 5 Q And it appears from a November 30th, 2022, 6 email thread in Exhibit 06.01 -- and it appears 7 you were copied on that internal email 8 discussion of that date relating to that event; 9 is that correct? 10 A Yes. I was on an email thread, yeah. 11 Q Okay. For the record, that email chain is at 12 PDF 4 to 9. 13 The AER announcement indicating that AGS's 14 initial view was that the November 29, 2022, 15 event was natural was posted on the AER's 16 website later that day, on November 30th, 2022; 17 is that correct? 18 A Yes, I believe so. 19 Q Okay. And then on March 16th, 2023, another 20 seismic event occurred between the 21 November 30th, 2022, AER announcement and the 22 occurrence of the March 16th, 2023, event. Did 23 you have any interaction with the individuals 24 advising you about that November twenty -- 2022 25 event? 26 A I did not have interaction with them during</p>

<p style="text-align: right;">437</p> <p>1 that time period.</p> <p>2 Q Okay. So --</p> <p>3 A Sorry. Let me clarify that. About the -- the</p> <p>4 seismic events. Sorry.</p> <p>5 Q Were you aware that the AER and AGS was</p> <p>6 gathering further seismic data at that time?</p> <p>7 A Yes. Dr. Canales -- his manager had notified</p> <p>8 myself and my field ops manager of the area</p> <p>9 that they were sending out the nodal array.</p> <p>10 So ...</p> <p>11 Q Okay. So you did have some degree of</p> <p>12 interaction, then, following the November 30th</p> <p>13 event, then, between that date and the next</p> <p>14 seismic event on March 16th that's the subject</p> <p>15 of the EPO? You had some interaction as it</p> <p>16 related to the --</p> <p>17 A Yes. But not with -- that the individual is</p> <p>18 advising me on the EPO. So ...</p> <p>19 Q Okay.</p> <p>20 A Yeah.</p> <p>21 Q Were you aware that the AER and AGS was having</p> <p>22 that data processed, and, if so, did you know</p> <p>23 who was processing it?</p> <p>24 A No.</p> <p>25 Q Okay. So on March 16th, following the seismic</p> <p>26 event, March 16, 2023, you were again copied on</p>	<p style="text-align: right;">438</p> <p>1 an internal email discussion of that date</p> <p>2 relating to the March 16th, 2023, seismic</p> <p>3 event, and we heard you testify on</p> <p>4 November 29th, which was last Friday, that:</p> <p>5 (as read)</p> <p>6 There was initial correspondence from</p> <p>7 AGS that they suspected it was</p> <p>8 induced.</p> <p>9 And that correspondence is at Exhibit 06.01</p> <p>10 between PDF pages 10 to 12; is that correct?</p> <p>11 A Yes. I believe so.</p> <p>12 Q Okay. So on March 17th, 2023, CLM contacted</p> <p>13 Obsidian requesting a meeting to discuss the</p> <p>14 seismic events in Peace River. Was that</p> <p>15 your -- at your direction?</p> <p>16 A No.</p> <p>17 Q Were you aware the call was being made?</p> <p>18 A No.</p> <p>19 Q Then on March 20th, 2023, you attended a</p> <p>20 4:00 PM meeting to discuss the November 2022</p> <p>21 and March 2023 seismic events; correct?</p> <p>22 A Yes.</p> <p>23 Q And you prepared a summary of the discussion in</p> <p>24 that meeting; correct?</p> <p>25 A Yeah.</p> <p>26 Q Okay. Can we please pull up those notes.</p>
<p style="text-align: right;">439</p> <p>1 They're at Exhibit 06.01 at PDF 14.</p> <p>2 Okay. It says there in the first bullet</p> <p>3 that there was an analysis completed by AGS</p> <p>4 showing the events southeast of Peace River can</p> <p>5 be attributed to a single well; correct?</p> <p>6 A Yes.</p> <p>7 Q Were you provided a copy of a summary of that</p> <p>8 analysis in the March 20th meeting?</p> <p>9 A No, I was not.</p> <p>10 Q Okay. So I note in that same exhibit,</p> <p>11 Exhibit 06.01, starting at PDF 15, there's a</p> <p>12 March 21st email from Ms. Cabot to you titled</p> <p>13 "Notes from meeting with SME".</p> <p>14 This email is dated March 21st, but in the</p> <p>15 heading in the email, it shows the date prior,</p> <p>16 March 20th, 2023. Is that what you see?</p> <p>17 A Yes. That's what I see.</p> <p>18 Q Okay. I assume that this email from Ms. Cabot</p> <p>19 is her providing notes from a March 2023 --</p> <p>20 20th, 2023, meeting amongst the individuals</p> <p>21 listed and that you did not attend the</p> <p>22 March 20th, 2023, meeting that is documented in</p> <p>23 this email; is that correct?</p> <p>24 A That's correct, yeah.</p> <p>25 Q Okay. Then, on March 21st, Ms. MacCormack</p> <p>26 provided you with a presentation on the recent</p>	<p style="text-align: right;">440</p> <p>1 Peace River seismic events, that she then</p> <p>2 scheduled a meeting to discuss that</p> <p>3 presentation; is that correct?</p> <p>4 A Yes.</p> <p>5 Q Okay. And the presentation that is referred to</p> <p>6 is on PDF pages 19 to 36 in Exhibit 06.01; is</p> <p>7 that correct?</p> <p>8 A Yes.</p> <p>9 Q Okay. So subsequently on that same date,</p> <p>10 March 21st, 2023, you met with Dr. Canales to</p> <p>11 go through the presentation; is that right?</p> <p>12 A Yes. That's correct.</p> <p>13 Q And that meeting is documented in your notes in</p> <p>14 this same exhibit, 06.01, at PDF 37; is that</p> <p>15 correct?</p> <p>16 A Yes.</p> <p>17 Q Okay. So up until that meeting on March 21st,</p> <p>18 2023, the only material you received that had</p> <p>19 any analysis of the seismic events in the EPO</p> <p>20 was the presentation that Dr. Canales gave you</p> <p>21 and the March 21st, 2023, email from Ms. Cabot;</p> <p>22 is that correct?</p> <p>23 A Yes.</p> <p>24 Q Okay. And on March 22nd, 2023, Dr. Shipman and</p> <p>25 Dr. Canales met with Obsidian. Is that your</p> <p>26 understanding?</p>

<p style="text-align: right;">441</p> <p>1 A Yes. That was their technical meeting. Yeah.  2 Q And you did not attend that meeting; is that  3 correct?  4 A That's correct. I did not attend.  5 Q And on March 23rd -- or -- yes. March 23rd,  6 2023, you and Dr. Shipman, amongst others, met  7 with Obsidian for a due process meeting; right?  8 A Yes.  9 Q And you testified on November 29th last week  10 that you went into that meeting and had not  11 made up your mind about issuing the EPO, and  12 then you said, near the end of that meeting,  13 you told Obsidian you would be issuing the EPO;  14 is that correct?  15 A That is correct, yes.  16 Q Okay. And how long was that meeting?  17 A By recollection, I don't think we took the full  18 hour it was scheduled for, but I couldn't tell  19 you exactly how long.  20 Q Okay. And so later that same afternoon, on  21 March 23rd, 2023, the AER, at your direction,  22 issued the EPO against Obsidian; correct?  23 A Yes.  24 Q And between March 21st, 2023, when you met with  25 Dr. Canales, and he provided you with his  26 presentation, until the issuance of the EPO,</p>	<p style="text-align: right;">442</p> <p>1 were you provided with any more analysis in  2 respect of the two seismic events referenced in  3 the EPO?  4 A No.  5 Q Okay.  6 A. BARRINGTON: Okay. Thank you,  7 Mr. Chair. Those are all my questions.  8 Thank you.  9 THE CHAIR: Thank you.  10 D.P. Langen Cross-examines the Regulatory  11 Compliance Branch Witnesses  12 Q D.P. LANGEN: Good morning,  13 gentlemen. I have a few questions for you.  14 Mr. Kuleba, if we can pull up CLM's  15 response to IR 1.4. That's Exhibit 66.1.  16 We're going to go to PDF 5, please. We'll just  17 scroll down a little bit. Okay. Thank you.  18 In that IR, and in the responses to  19 Questions A and B, you indicate that  20 Dr. Canales and Dr. Shipman, your  21 co-witnesses -- if we can go down a little  22 further, please. Keep going. Keep going.  23 Sorry. All the way down to the answers. Right  24 there. Thank you.  25 You indicate that Dr. Canales and  26 Dr. Shipman supported and advised you in your</p>
<p style="text-align: right;">443</p> <p>1 role as decision maker in issuing the EPO. Do  2 you see that there?  3 A E. KULEBA: Yes.  4 Q And you confirm that Dr. Canales and  5 Dr. Shipman supported and advised you in  6 advance of and up to the issuance of the EPO to  7 my colleague this morning. And the reason that  8 Dr. Canales and Dr. Shipman supported you and  9 advised you is because -- and I -- I don't mean  10 this in any critical way -- is because you  11 don't have the requisite technical knowledge or  12 experience as it relates to both natural and  13 induced seismicity? Is that fair?  14 A That's fair, yeah.  15 Q Mr. Galloway, you're a late addition to this  16 hearing panel; correct?  17 A E. GALLOWAY: That's correct.  18 Q Okay. Your participation arises from your  19 response to certain specific information  20 request responses that CLM -- CLM filed; is  21 that correct?  22 A That's correct.  23 Q Now, Mr. Virues, if I mispronounce your name, I  24 apologize.  25 A C. VIRUES: Virues.  26 Q Virues. I'll try.</p>	<p style="text-align: right;">444</p> <p>1 If we can go to CLM's response to IR 1.4  2 again, just right where we are. And you see  3 sub (c) in the answer, your name is not  4 there -- do you see that -- as an advisor?  5 A Yes, I see that.  6 Q Okay. When were you first substantively  7 involved, from a technical perspective, in the  8 subject matter of this proceeding?  9 A I was working on the response to 50.03, the  10 exhibit from MPD Reservoir Engineers.  11 Q So you were pulled in after Obsidian filed its  12 evidence; correct?  13 A That's correct.  14 Q Now, while we're here, Mr. Kuleba, if we look  15 at 1.4(d) on the screen, it says that the  16 individuals listed in 1.4(c) did not advise  17 you. Is it safe to say that those individuals  18 were advising Dr. Canales and Dr. Shipman?  19 A E. KULEBA: Yes. I believe that  20 they work in the team that looks at the induced  21 seismicity as a whole.  22 Q So, just for clarity, Dr. Canales, those  23 individuals listed there in 1.4(c), they  24 advised you?  25 A M. CANALES: Well, they support  26 the work we were doing, yes.</p>

<p style="text-align: right;">445</p> <p>1 Q Okay. And same answer for you, Dr. Shipman?</p> <p>2 A T. SHIPMAN: Yeah. They work on</p> <p>3 the same subject matter.</p> <p>4 Q Okay. Now, Dr. Canales, I understand from your</p> <p>5 curriculum vitae -- I don't think we need to</p> <p>6 pull it up -- that you commenced your</p> <p>7 post-secondary education in 2009, obtaining</p> <p>8 your bachelor's degree in 2015; is that</p> <p>9 correct?</p> <p>10 A Yes.</p> <p>11 Q You then entered a PhD program -- you're a</p> <p>12 bigger person than I -- at the University of</p> <p>13 Alberta in 2015, and you graduated in May 2020;</p> <p>14 correct?</p> <p>15 A Yes.</p> <p>16 Q Your professional career started with the AER</p> <p>17 in September 2019, just prior to obtaining your</p> <p>18 PhD; is that correct?</p> <p>19 A Yes.</p> <p>20 Q And you've been working for the AGS or AER for</p> <p>21 approximately five years?</p> <p>22 A Yes.</p> <p>23 Q Now, Dr. Canales, immediately following the</p> <p>24 first seismic event referenced in the EPO, the</p> <p>25 one that occurred on November 29th, 2022, you</p> <p>26 became involved in assessing the event and it's</p>	<p style="text-align: right;">446</p> <p>1 cause; correct?</p> <p>2 A M. CANALES: Yes.</p> <p>3 Q And, Dr. Shipman, I have the same question for</p> <p>4 you. Immediately following the November 29th,</p> <p>5 2022, seismic event, you became immediately</p> <p>6 involved in assessing that event?</p> <p>7 A T. SHIPMAN: Correct.</p> <p>8 Q If we can pull up Exhibit 6.02, please. Just</p> <p>9 going to PDF page 1. Okay. And, Dr. Canales,</p> <p>10 you'll see that this is the -- you'll agree</p> <p>11 this is the supplemental information that CLM</p> <p>12 filed at the start of this proceeding; correct?</p> <p>13 A M. CANALES: Yes.</p> <p>14 Q And if we look at the table of contents, your</p> <p>15 name is prominent?</p> <p>16 A Where specifically?</p> <p>17 Q Well, we look at 02, mail, January 16th.</p> <p>18 A Yes, I see that.</p> <p>19 Q Okay.</p> <p>20 A Yeah.</p> <p>21 Q Yeah. So there are a number of emails with</p> <p>22 your name on them; correct?</p> <p>23 A Yes.</p> <p>24 Q And is that because you're the one who compiled</p> <p>25 this or compiled the most of it?</p> <p>26 A Yes. Yes.</p>
<p style="text-align: right;">447</p> <p>1 Q Let's go to PDF 4, please, of that exhibit, and</p> <p>2 if we go to the bottom, you'll see there's an</p> <p>3 email dated November 30th from Virginia Stern</p> <p>4 addressed to you, Dr. Canales, and Dr. Shipman</p> <p>5 as well as others. Do you see that there?</p> <p>6 A Yes.</p> <p>7 Q And if we look at that email thread as it</p> <p>8 continues from 11:14 AM to 11:54 -- so we have</p> <p>9 to scroll -- I always get confused because it's</p> <p>10 in reverse order. You have to scroll up, I</p> <p>11 believe. Let's stop there for a second. Right</p> <p>12 there. You see it concludes at 11:54 on the</p> <p>13 same day?</p> <p>14 A Yes, I can see that.</p> <p>15 Q Okay. Now, if we go to -- sorry. And that</p> <p>16 email thread was initiated by you, Dr. Shipman;</p> <p>17 fair?</p> <p>18 A T. SHIPMAN: I would have to</p> <p>19 see --</p> <p>20 Q Okay. Well, let's --</p> <p>21 A I'll take your word for it, but --</p> <p>22 Q Well, why don't we go -- I don't -- let's go</p> <p>23 back down to the original 11:14 AM one. Right</p> <p>24 there. Thank you.</p> <p>25 And if you -- if you look just immediately</p> <p>26 above -- so just scroll up a bit more. There</p>	<p style="text-align: right;">448</p> <p>1 we go. At 11:20 --</p> <p>2 A Yes.</p> <p>3 Q -- AM, you asked a question. So you --</p> <p>4 A Yes, I see that.</p> <p>5 Q So you initiated the discussion thereafter?</p> <p>6 A Correct.</p> <p>7 Q Okay. If we can go to PDF 25 of this document,</p> <p>8 please.</p> <p>9 You'll see here that this is an email dated</p> <p>10 January 16th, 2023, from you, Dr. Canales, that</p> <p>11 includes a slide deck. It says "attachments",</p> <p>12 "6 megabytes". Do you see that there?</p> <p>13 A M. CANALES: Yes.</p> <p>14 Q And the analysis that's referred to in that</p> <p>15 email is on the next -- I think it's the page</p> <p>16 up it starts. Right there. It goes from page</p> <p>17 PDF 19 to -- I believe, and downward. But this</p> <p>18 is the slide deck that was attached to that?</p> <p>19 A Yeah, I believe so. Yes.</p> <p>20 Q Okay. You believe or -- we can take the</p> <p>21 time --</p> <p>22 A I'm going --</p> <p>23 Q -- for you to --</p> <p>24 A -- to check, yeah.</p> <p>25 Q -- confirm. So...</p> <p>26 A So...</p>

<p style="text-align: right;">449</p> <p>1 Q If we go to PDF 6, maybe that'll help. That's 2 the start of the slide deck. 3 A Yes. Yes. 4 Q So you -- that's your analysis that you're 5 referring to in the email I just put you to? 6 A Yes. 7 Q Okay. Thank you. 8 Now, as aside -- an aside, Dr. Canales, 9 there are three other slide decks in 10 Exhibit 6.02. You prepared each of those slide 11 decks; correct? 12 A Yes. 13 Q Dr. Canales, immediately following the second 14 seismogenic event referenced in the EPO, the 15 one that occurred on March 16th, 2023, you 16 became involved in assessing that event and its 17 cause; correct? 18 A Yes. The March one, yes, as well. Yeah. 19 Q And, Dr. Shipman, the same thing? 20 A T. SHIPMAN: I was involved in 21 the results of the assessment. I personally 22 didn't do any assessment. 23 Q With respect to the March 16 event or the 24 November 29th, 2022, event? 25 A Correct. I -- I'm not a seismologist. 26 Q You're not a seismologist. So you -- all</p>	<p style="text-align: right;">450</p> <p>1 the -- all the assessment you're telling me was 2 done by -- at least as presented is done by 3 Dr. Canales? You have a team of people that 4 provide input, but -- 5 A M. CANALES: Yes. Yes. I -- I 6 lead the assessment but with collaboration from 7 other team members, including Dr. Shipman. 8 Yeah. 9 Q Yeah. But he didn't do the analysis. He 10 just -- 11 A No. It was -- 12 Q -- had -- 13 A -- me. 14 Q -- input? 15 A Yeah. 16 Q Yeah. Okay. Now, on March 21st -- and this 17 was alluded to in a discussion Ms. Barrington 18 had with Mr. Kuleba earlier. On March 21st, 19 you met Mr. -- or -- sorry -- Dr. Canales with 20 Mr. Kuleba and presented that PowerPoint 21 presentation that's referred to on the screen 22 at Exhibit 6.01; correct? 23 A Yes. 24 Q And in that presentation, you advised 25 Mr. Kuleba that the Obsidian well, the 14-18 26 well, was the likely cause of the seismic</p>
<p style="text-align: right;">451</p> <p>1 events; correct? 2 A Yes. 3 Q And Mr. Kuleba asked you what the best possible 4 action would be to prevent another event, and 5 you recommended that action be taken to prevent 6 a subsequent seismic event; correct? 7 A Yes. 8 Q Did you discuss -- did you recommend that issue 9 in EPO, or you just said action had to be 10 taken? 11 A No. Nothing about the EPO. No. 12 Q Just action had to be -- 13 A Just action, mitigation plans and so on. 14 Q Dr. Canales, if we can go to your CV, please. 15 It's Exhibit 57.01, PDF 811. 16 D.P. LANGEN: Sorry? Exhibit 17 Number? 57.01, PDF 811. 18 N. HYMERS: What's the page 19 number? 20 D.P. LANGEN: 811. Thank you. 21 Q D.P. LANGEN: Now, sir, 22 Dr. Canales, at the time you were doing your 23 work advising Mr. Kuleba in relation to the 24 seismic events in question, your title at the 25 AER was geophysicist; correct? 26 A M. CANALES: Yes.</p>	<p style="text-align: right;">452</p> <p>1 Q Who supervised or oversaw your work? 2 A My manager at the time was Chris Filewich. 3 Q And your title changed to senior geophysicist 4 in February of this year; correct? 5 A Yes. 6 Q I note that you indicate at the top of your CV 7 that you're a professional geoscientist, and I 8 assume that's with APEGA? 9 A Yes. 10 Q And you were registered with APEGA on 11 October 6th, 2023; correct? 12 A Yes. 13 Q So prior to that date, you were a 14 geoscientist-in-training? 15 A Member-in-training, yes. 16 Q Member-in-training. 17 So the work you undertook in supporting and 18 advising Mr. Kuleba prior to the issuance of 19 the EPO on March 23rd, 2023, was done while you 20 were a member-in-training with APEGA; correct? 21 A Yes. 22 Q Dr. Shipman, we can agree that you didn't 23 author the various reports that CLM has filed 24 on the record of this proceeding; Dr. Canales 25 and Virues did? 26 A T. SHIPMAN: I -- no. I am not a</p>

<p style="text-align: right;">453</p> <p>1 co-author.  2 D.P. LANGEN: We'll need that  3 exhibit once again. Thank you. This is  4 Exhibit 57.01, and we're going to go to  5 PDF 819. Let me know once you have it. There  6 we go.  7 Q D.P. LANGEN: Dr. Shipman, that's  8 your CV; correct?  9 A T. SHIPMAN: Correct.  10 Q You adopted it in this proceeding; correct?  11 A Correct.  12 Q You said it was accurate; correct?  13 A Correct.  14 Q When did you update this CV last? Did you  15 update it for this proceeding?  16 A I -- I believe I updated it for this  17 proceeding.  18 Q You originally started work with the AER in  19 2010; correct?  20 A August 2010.  21 D.P. LANGEN: And if we can go to  22 page 3 of that CV. So we just gotta go down.  23 Right there. Thank you.  24 Q D.P. LANGEN: I note that you don't  25 list that you're a registered member of APEGA,  26 and I take it that's because you're not?</p>	<p style="text-align: right;">454</p> <p>1 A T. SHIPMAN: Correct.  2 Q It says there that you're a registered  3 geologist in Arizona; correct?  4 A Correct.  5 Q And that registration is with the Arizona State  6 Board of Technical Registration; correct?  7 A Correct.  8 Q Will you take, subject to check, Dr. Shipman,  9 that you've not been registered with the  10 Arizona board since March of 2015?  11 A The Arizona board of -- declassified geologists  12 as being required to be registered. I'm not  13 sure the date on that. So...  14 Q So you're not registered because you don't have  15 to be?  16 A Correct.  17 Q Okay. But your CV says that you are?  18 A Correct.  19 Q So this is incorrect?  20 A Yes.  21 Q Mr. Kuleba, the AER has a public interest  22 mandate; correct?  23 A E. KULEBA: That is correct.  24 Q And in keeping with that mandate, in issuing  25 the EPO, the AER was acting in the public  26 interest; correct?</p>
<p style="text-align: right;">455</p> <p>1 A Yes. The EPO was issued to address the risk of  2 the seismicity.  3 Q And you would agree, sir, that when exercising  4 the public interest, a mandate of the AER, the  5 AER should do so using all available data and  6 information at its disposal?  7 A I believe we need to have acceptable evidence  8 to support the decision. And, in this case,  9 there was a significant risk, and we  10 believed -- and through my discussions with the  11 subject matter experts, they were confident  12 that they had the evidence to support the  13 conclusion.  14 Q But if you had other data that wasn't presented  15 to you that might inform your decision, one  16 would think it's in the public interest for you  17 to have that data. Would you not agree?  18 A Yes. I would consider everything put in front  19 of me.  20 Q No. That wasn't my question, what was put in  21 front of you.  22 I'm saying if the AER had other data that  23 informed the decision you were going to make,  24 it is in the public interest that you be  25 informed of that data, correct, and what it  26 says?</p>	<p style="text-align: right;">456</p> <p>1 A Oh, that I should be told about it?  2 Q Yes.  3 A Yes, generally, I would expect that.  4 Q Okay. And you would agree, Mr. Kuleba, that  5 the subject matter of this proceeding is of  6 significant public interest?  7 A Yes.  8 Q Dr. Canales and Mr. Galloway, you each have  9 applied science degrees; correct?  10 A M. CANALES: Yeah. Engineering.  11 Geophysical engineering, but yes.  12 A E. GALLOWAY: Yes.  13 Q And as applied scientists, you're taught to  14 think critically and use data and analysis to  15 reach conclusions; correct?  16 A M. CANALES: Yes.  17 A E. GALLOWAY: Yes.  18 Q And each of you can agree that, as critical  19 thinkers, more data is better than less data?  20 A M. CANALES: Depends on the  21 quality of the data.  22 Q Fair comment.  23 But first you get the data; then you can  24 assess the quality; correct?  25 A M. CANALES: Yes. Yes.  26 A E. GALLOWAY: I also agree.</p>



457	<p>1 Q My engineering profs would be proud.  2 Mr. Kuleba, if you can pull up the record  3 of the decision maker, Exhibit 06.01. And  4 we're interested in PDF page 9. Let's just  5 scroll down a little bit, please. Right there.  6 Thank you.  7 On that page, there's an email from a video  8 journalist with CBC dated November 30th, 2022,  9 at 9:43 AM. Do you see that there?  10 A E. KULEBA: Yes, I do.  11 Q In that email, the journalist is asking for an  12 interview in relation to the November 29th,  13 2022, seismic events that the EPO attributes to  14 Obsidian; correct?  15 A Yes. This obviously came before the EPO was  16 issued. So ...  17 Q And we can see that the CBC's journalist email  18 created a thread within the AER and AGS that  19 concludes on the same date, November 30th,  20 2022, at 5:17, which is on PDF 4. If we can go  21 up to that page, please. That's it. Thank  22 you.  23 Do you see that there?  24 A Yes.  25 Q Your name's at the top of that email, so I  26 assume that the -- this email thread is sourced</p>	458	<p>1 from your email records?  2 A Yes.  3 Q Let's go back to PDF page 6 of that page -- or  4 that exhibit, please. And we're interested in  5 the -- that's perfect -- the 11 AM email of  6 November 30th, 2022. Do you see that there?  7 A Yes.  8 Q And this is where you were first added to the  9 thread -- the email thread; correct?  10 A Yes, I believe so.  11 Q Okay. You'll take, subject to check?  12 A Yeah. If you don't mind scrolling to the one  13 below.  14 Yes, it appears that way, then.  15 Q Okay.  16 A Sorry. You can scroll back up.  17 Q So I'm going to focus you, sir, on the email  18 just below. So let me just get my bearings  19 here. PDF 6. Yeah. We're perfect. We're  20 right where we need to be. Okay. Actually, if  21 we go a little over, please. Right there.  22 Thank you.  23 I'm going to focus you on the email there  24 that starts at -- that's the same date, 10:53  25 time stamp. Do you see it?  26 A Yes.</p>
459	<p>1 Q And this email was from Chris Filewich, which I  2 believe is -- was, at the time at least,  3 Dr. Canales's supervisor; is that right?  4 A Yes, I believe so, but I'll let Mauricio --  5 sorry -- Dr. Canales confirm that.  6 A M. CANALES: Yes.  7 Q Okay. Thank you.  8 And, as I understand it -- and I may be  9 wrong, so that's why I ask the question --  10 Mr. Filewich works for AGS, not AER,  11 recognizing that the AGS is a department of the  12 AER? So ...  13 A E. KULEBA: Yes. He is -- works  14 in a different department, which is part of the  15 AER in the last few months, but he was part of  16 AGS at this time.  17 Q Yeah. Okay.  18 A It just recently changed. So ...  19 Q Now, you'll see there that in that email at  20 10:53 AM on November 30th, Mr. Filewich  21 questions whether an interview is in the best  22 interest of the AER, and he goes on to state  23 that, and I quote: (as read)  24 Our seismologists still have not  25 completed their analysis.  26 Do you see that there?</p>	460	<p>1 A Yes.  2 Q And then he goes on to say that, and I quote:  3 (as read)  4 Anything we see -- anything we did say  5 would have to be either a deflection  6 or speculation at that -- at this  7 point.  8 Do you see that there?  9 A Yes.  10 Q When you read this email, what do you think  11 Mr. Filewich meant by "speculation"?  12 A That they had not done enough analysis to give  13 anything substantial.  14 Q And do you agree at the time that the email was  15 written, Mr. Filewich was of the view that  16 anything said to the press would be  17 speculation? And why -- why was he concerned  18 that it would be speculation? For the reason  19 you just gave?  20 A I -- I couldn't speak to what Mr. Filewich was  21 thinking with that word at that time. So ...  22 P. FITZPATRICK: And that -- that was  23 exactly the point I was rising to -- to speak  24 to, is that Mr. Kuleba is not in a position to  25 speculate as to what someone else was thinking.  26 D.P. LANGEN: Speculation on</p>

<p style="text-align: right;">461</p> <p>1 speculation.</p> <p>2 Q D.P. LANGEN: Now let's go up to</p> <p>3 PDF page -- sorry -- 4, please. And I'll focus</p> <p>4 you on -- this email, again, is from Chris</p> <p>5 Filewich on November 30th, at 5:17. He says,</p> <p>6 and I quote: (as read)</p> <p>7 Our seismologists feel that the case</p> <p>8 still best aligns with natural</p> <p>9 seismicity rather than induced</p> <p>10 seismicity, based on depth of events</p> <p>11 and lack of clear correlation to</p> <p>12 operational changes at the disposal</p> <p>13 wells; in particular, the 14-18 Leduc</p> <p>14 Formation well licenced to Obsidian</p> <p>15 Energy. We will continue to explore</p> <p>16 this over the next few days. Just</p> <p>17 wanted to keep you in the loop.</p> <p>18 Do you agree that's what it states there?</p> <p>19 A E. KULEBA: Yes, that's what it</p> <p>20 states.</p> <p>21 Q Let's go to PDF page 2 of that exhibit, please.</p> <p>22 This is the November 30th, 2022, AER press</p> <p>23 release or announcement that speaks to the</p> <p>24 November 29th, 2022, seismic event. Do you see</p> <p>25 that there?</p> <p>26 A Yes, I do.</p>	<p style="text-align: right;">462</p> <p>1 Q And you'll see that this shows an update on</p> <p>2 November 30th, 3:10. So that -- I take that to</p> <p>3 mean that's when it was released by the AER?</p> <p>4 A I -- I would speculate so, yes.</p> <p>5 Q And it states that: (as read)</p> <p>6 The AER is continuing to confirm the</p> <p>7 cause of the events, but the initial</p> <p>8 findings point to a natural tectonic</p> <p>9 activity.</p> <p>10 Do you see that there?</p> <p>11 A Yes.</p> <p>12 Q And obviously CLM reached a different</p> <p>13 conclusion approximately four months later on</p> <p>14 March 23rd, 2023, when it issued the EPO;</p> <p>15 correct?</p> <p>16 A Yes, supported by the analysis done between</p> <p>17 this date and when it was shared with me.</p> <p>18 D.P. LANGEN: Let's pull up</p> <p>19 Exhibit 06.01, please. And we're going to go</p> <p>20 to PDF 25, please. I have a bust here. Just</p> <p>21 give me a moment, please.</p> <p>22 If we can go to PDF -- actually, let's go</p> <p>23 to 06.02. I think I'm in the wrong exhibit.</p> <p>24 Apologies.</p> <p>25 And we'll go to PDF 25, please. Thank you.</p> <p>26 Q D.P. LANGEN: Now, Dr. Canales, if</p>
<p style="text-align: right;">463</p> <p>1 you can -- you can see that this is an email</p> <p>2 from you dated January 16th, 2023, to Chris</p> <p>3 Filewich at the AER; correct?</p> <p>4 A M. CANALES: Yes.</p> <p>5 Q And in this email, you're providing a</p> <p>6 preliminary analysis of the Reno cluster</p> <p>7 following the November 2022 event; correct?</p> <p>8 A Yes.</p> <p>9 Q And attached to this -- this is the one we</p> <p>10 talked about earlier -- is the January</p> <p>11 presentation that you prepared, the analysis;</p> <p>12 correct?</p> <p>13 A Yes.</p> <p>14 Q And when you prepared that presentation, you</p> <p>15 were using the regional -- the nodal -- the</p> <p>16 data from the regional nodal array, correct,</p> <p>17 not the one that you installed after the</p> <p>18 November 29th event?</p> <p>19 A The regional array, not the -- not an array</p> <p>20 that we installed. No, we didn't.</p> <p>21 Q That nodal array that you installed was</p> <p>22 installed on December 6th?</p> <p>23 A Yes. It was not used here. Right.</p> <p>24 Q At the time you prepared the January 2023</p> <p>25 preliminary analysis that's in this exhibit,</p> <p>26 the slide deck, the other data you had was the</p>	<p style="text-align: right;">464</p> <p>1 disposal volumes from the 6-14 well, the Belloy</p> <p>2 well, and the 14-18 well, the Obsidian well,</p> <p>3 and the 13-11 well; correct?</p> <p>4 A I had that volumetric data, yes.</p> <p>5 Q For all those wells, all three?</p> <p>6 A Yes. Yes.</p> <p>7 Q If we can go back to the -- oh, we're actually</p> <p>8 there -- PDF 25. And just looking at that</p> <p>9 email, Dr. Canales, you indicate in the first</p> <p>10 paragraph that your analysis and conclusions</p> <p>11 may change depending on further data and</p> <p>12 research.</p> <p>13 A Yes.</p> <p>14 Q Do you see that there?</p> <p>15 A Yes.</p> <p>16 Q And you'll be reaching out to other members of</p> <p>17 the team, including Tyler. Do you see that</p> <p>18 there?</p> <p>19 A Yes.</p> <p>20 Q And what's Tyler's full name?</p> <p>21 A Tyler Hauck.</p> <p>22 Q Can you spell that for me.</p> <p>23 A 'H' -- I'm not sure. It's 'H' --</p> <p>24 Q H-A-U-C-K?</p> <p>25 A Right. Thank you.</p> <p>26 Q If we move to the second paragraph. And there</p>

<p style="text-align: right;">465</p> <p>1 you indicate at that point in time, you  2 would -- were inclined to believe the Reno  3 sequence was natural, but it was difficult to  4 call since there were two suspicious disposal  5 wells. Do you see that there?  6 A Yes.  7 Q And you note that the 6-14 Belloy well, you --  8 you wouldn't confirm an induced seismicity case  9 for it until seeking -- seeing a link to the  10 basement; and for the Precambrian one, which is  11 the 14-18 Leduc well, you wouldn't seek an  12 conclusion of induced seismicity until you  13 found evidence linking it to -- or -- sorry --  14 rather, find evidence about the condition of  15 the reservoir. Do you see that there?  16 A To add more, for the Belloy one, I exemplify,  17 saying that a fault delineating seismic  18 activity through the strata or a robust model  19 that links propagation of the -- the formation  20 through the fault for the Belloy one; and for  21 the Precambrian, I think I was referring to the  22 Leduc: (as read)  23 I would rather find evidence about the  24 conditions of the reservoir. [Yes]  25 Is the reservoir getting filled?  26 Q So at the time when you prepared this</p>	<p style="text-align: right;">466</p> <p>1 presentation, you required further technical  2 data in respect of either or both the 6-14 well  3 and 14-18 well to conclude that the Reno  4 cluster was induced; correct?  5 A Yes. Yeah.  6 Q Dr. Canales, if you can pull up your evidence.  7 It's exhibit -- it's your March report. I'm  8 going to call it the "March reprisal report" so  9 we're on the same page.  10 A Yes.  11 Q Okay. If you can pull that up. It's  12 Exhibit 57.01, starting at PDF 29.  13 And we're interested in paragraph 16(a),  14 which is on PDF 37. Scroll down a little bit,  15 please. Thank you.  16 Now, there, Dr. Canales, you discuss that  17 in Alberta, in the context of disposal-induced  18 seismicity, there's a pattern of relatively  19 shallow activities activating the basement  20 rooted faults. Do you see that there?  21 A Paragraph 16?  22 Q 16(a), yeah. It's right at the very bottom.  23 If you look on the right side, five lines up,  24 it says --  25 A Yes.  26 Q -- "this pattern".</p>
<p style="text-align: right;">467</p> <p>1 A Yes. I see: (as read)  2 This pattern of relatively shallow  3 activities.  4 Yes, I see that.  5 Q Mr. Galloway, your CV, Exhibit 84.1, makes  6 reference to a paper you coauthored that speaks  7 to vertical distances between well trajectory  8 and deeper induced earthquake hypocentres;  9 correct?  10 A E. GALLOWAY: There are several  11 publications listed in my CV. Could you be  12 more specific.  13 Q Well, let's do it this way: We provided your  14 counsel with some aids to cross last week, and  15 we're going to talk about them. Does that  16 sound good?  17 So the first one we're going to pull up  18 is -- is Aid To Cross Number 5. You'll see the  19 first page indicates that -- and this is  20 sourced from a reference on your CV,  21 Exhibit 84.1. And if we go to PDF 2, please.  22 And before we go any further, you've had  23 time to review this aid?  24 A I have.  25 Q Now, this is a copy of a peer-reviewed paper  26 published in 2018, and given you're the lead</p>	<p style="text-align: right;">468</p> <p>1 author, you agree with what's presented in that  2 paper?  3 A I do.  4 Q And I note that the second author is Tyler  5 Hauck, who I was just discussing with  6 Dr. Canales; correct?  7 A Yes.  8 Q And is Mr. Hauck -- is he still with AGS?  9 A He is.  10 Q And what's his title?  11 A He is a geologist, possibly a senior geologist,  12 with the AGS.  13 Q If -- if you find out differently, you'll let  14 me know?  15 A Yes.  16 Q Okay. Let's start at the top of the first  17 paragraph on that article under the abstract,  18 left-hand column. There you discuss what  19 induced seismicity is generally, and you note  20 that it's well documented with numerous cases  21 related to, amongst other things, wastewater  22 disposal. Do you see that there?  23 A This is in the -- the bolded paragraph? I  24 don't see it.  25 Q The second sentence, it says -- and I quote:  26 (as read)</p>

469	<p>1 This phenomenon is well documented</p> <p>2 with numerous cases relating to mining</p> <p>3 wastewater disposal.</p> <p>4 And it goes on.</p> <p>5 A Yes, I see that.</p> <p>6 Q Okay. Moving to the second paragraph. In the</p> <p>7 left-hand column, you identify three</p> <p>8 geomechanical conditions for induced</p> <p>9 earthquakes to occur, and I'm interested in the</p> <p>10 third. As you state, it is -- and I quote:</p> <p>11 (as read)</p> <p>12 The means to perturb stress on the</p> <p>13 fault past the critical condition.</p> <p>14 Do you see that there?</p> <p>15 P. FITZPATRICK: I'm just -- I'm</p> <p>16 sorry to interrupt my friend. I'm -- I'm just</p> <p>17 rising because, with all due respect, I think</p> <p>18 he may have been overexuberant in the way that</p> <p>19 he raised that. He put it to the witness as --</p> <p>20 as -- as things that are required, and the</p> <p>21 article very plainly says "are thought to".</p> <p>22 And that's something very different.</p> <p>23 D.P. LANGEN: That's -- that's a</p> <p>24 fair comment. Thank you, Mr. Fitzpatrick.</p> <p>25 Q D.P. LANGEN: So let's just read</p> <p>26 it in. The article states, and I quote:</p>	470	<p>1 (as read)</p> <p>2 Induced earthquakes are thought to</p> <p>3 require three geomechanical</p> <p>4 conditions: One, the presence of a</p> <p>5 fault; two, nearly critical slip</p> <p>6 orientation of a fault; and, three, a</p> <p>7 means to perturb stress on the fault</p> <p>8 past the critical condition.</p> <p>9 Do you agree that's what it states there?</p> <p>10 A E. GALLOWAY: That is accurate.</p> <p>11 Q Okay. And those are your words?</p> <p>12 A That is what is published in this paper.</p> <p>13 Q And you wrote the paper?</p> <p>14 A Yes. I was the lead author on this paper.</p> <p>15 Q Okay. You go on to say, sir, that this third</p> <p>16 requirement is contentious: (as read)</p> <p>17 Means to perturb stress on the fault</p> <p>18 past the critical condition since</p> <p>19 there are multiple anthropogenic means</p> <p>20 to communicate stress changes.</p> <p>21 Do you see that there?</p> <p>22 A I do.</p> <p>23 Q Do you still agree with that?</p> <p>24 A I do.</p> <p>25 Q And you provide some examples of anthropogenic</p> <p>26 means being pore pressure perturbations being</p>
471	<p>1 transmitted along a fault or poroelastically</p> <p>2 through the rock matrix. Do you see that</p> <p>3 there?</p> <p>4 A I believe so. Is it hidden in the next part of</p> <p>5 the paragraph? Oh, there it is. Yes, I see</p> <p>6 that.</p> <p>7 Q Okay. And immediately below, you state -- and</p> <p>8 I quote: (as read)</p> <p>9 For disposal cases, pore pressure</p> <p>10 diffusion is often the favourite</p> <p>11 speculative explanation since</p> <p>12 continued injection into the permeable</p> <p>13 formations allows plausible</p> <p>14 communication over great distances</p> <p>15 until the intersection with a</p> <p>16 critically unstable fault.</p> <p>17 Do you see that there?</p> <p>18 A I do.</p> <p>19 Q Do you still agree with that statement?</p> <p>20 A I do.</p> <p>21 Q Now, just below that, you then contrast</p> <p>22 disposal cases with hydraulic fracturing since,</p> <p>23 as you know, hydraulic fracturing sees water</p> <p>24 injected into impermeable formations to</p> <p>25 stimulate productivity. Do you see that there?</p> <p>26 A I do.</p>	472	<p>1 Q And you would agree that, given the nature of</p> <p>2 water disposal operations and its purpose, that</p> <p>3 the water is injected into formations that are</p> <p>4 generally permeable or very permeable?</p> <p>5 A I agree.</p> <p>6 Q Let's pull up another one of the aids to cross</p> <p>7 that we provided to you, Aid to Cross Number 3.</p> <p>8 D.P. LANGEN: Do you have it?</p> <p>9 Q D.P. LANGEN: Have you had time to</p> <p>10 review this aid?</p> <p>11 A E. GALLOWAY: I have.</p> <p>12 Q And this is another paper that you published,</p> <p>13 if we look at PDF 2, again with Mr. Hauck;</p> <p>14 correct?</p> <p>15 A This is a presentation of the same study</p> <p>16 presented in the peer-reviewed paper we looked</p> <p>17 at previously.</p> <p>18 Q You just knocked off a few of my questions.</p> <p>19 And you agree with what is presented in</p> <p>20 this presentation paper?</p> <p>21 A I do.</p> <p>22 Q And under the heading "Summary", you state that</p> <p>23 the study you are discussing in the paper</p> <p>24 combines insights from earthquake seismology,</p> <p>25 seismic geophysics, and geology to identify</p> <p>26 factors that contribute to induced seismicity</p>

<p style="text-align: right;">473</p> <p>1 observed. Do you see that there?</p> <p>2 A I see that, yes.</p> <p>3 Q And when you say "seismic geophysics" in this</p> <p>4 paper, you're referring to reflection seismic;</p> <p>5 correct?</p> <p>6 A That's correct.</p> <p>7 Q And you go on to state that you demonstrated</p> <p>8 that conduits of paleofluid flow communicated</p> <p>9 hydraulic fracturing pressure at great</p> <p>10 distance, triggering movement along a</p> <p>11 basement-rooted fault approximately 1.5</p> <p>12 kilometres below a Stettler/Big Valley</p> <p>13 reservoir zone. Do you see that there?</p> <p>14 A I do.</p> <p>15 Q And if we look at Figure 1, the distance that</p> <p>16 the paleofluid communicated the -- along the</p> <p>17 hydraulic -- or from the hydraulic fracturing</p> <p>18 from the toe of the 14-21 well -- sorry. Right</p> <p>19 there -- the toe of the 14-21 well as shown to</p> <p>20 the fault -- sorry. The toe of the 14-21 well</p> <p>21 is shown at approximately 1,950 metres. Do</p> <p>22 we -- we can agree to that?</p> <p>23 A Yes.</p> <p>24 Q And the first hypocentre is at approximately</p> <p>25 2,450 metres or about 500 metres. Fair?</p> <p>26 A Approximately.</p>	<p style="text-align: right;">474</p> <p>1 Q And if we can move to PDF 5 of this aid. Thank</p> <p>2 you.</p> <p>3 These are your conclusions. Under the</p> <p>4 conclusions, you indicate that examining</p> <p>5 instances of induced seismicity from multiple</p> <p>6 perspectives provides several lines of</p> <p>7 evidence. Do you see that there?</p> <p>8 A Yes, I do.</p> <p>9 Q And those perspectives you're referring to are</p> <p>10 the ones we discussed on page 3 of the same aid</p> <p>11 or -- seismology, seismic geophysics, and</p> <p>12 geology?</p> <p>13 A That's what we're referencing, yes.</p> <p>14 Q And you also state in your conclusions that:</p> <p>15 (as read)</p> <p>16 No single perspective is definitive on</p> <p>17 its own but, together with evidence --</p> <p>18 with the evidence, points to a</p> <p>19 consistent interpretation.</p> <p>20 You see that there?</p> <p>21 A I do.</p> <p>22 Q And I took this to mean that you're a proponent</p> <p>23 for multi -- multidisciplinary assessment of</p> <p>24 the cause of induced seismicity. Is that fair?</p> <p>25 A I believe so, yes.</p> <p>26 D.P. LANGEN: Mr. Chair, if I can</p>
<p style="text-align: right;">475</p> <p>1 have exhibit numbers for the two aids I just</p> <p>2 discussed with Mr. Galloway.</p> <p>3 THE CHAIR: Thank you. Yeah.</p> <p>4 B. KAPEL HOLDEN: For the Aid to Cross</p> <p>5 Number 5 from Obsidian, which was the 2018</p> <p>6 article entitled "Faults and Associated Karst</p> <p>7 Collapse Suggest Conduits for Fluid Flow that</p> <p>8 Influence Hydraulic Fracturing Induced</p> <p>9 Seismicity", that can be Number 99.0 as an</p> <p>10 exhibit.</p> <p>11 And the Aid to Cross Number 3, which is the</p> <p>12 two -- 2019 article "Connecting Fluid Flow</p> <p>13 Along Faults to Hydraulic Fracturing Induced</p> <p>14 Seismicity, an Integrated Geoscience Study",</p> <p>15 that can be number 100, Exhibit 100.0.</p> <p>16 D.P. LANGEN: Thank you.</p> <p>17 EXHIBIT 99.0 - 2018 article entitled</p> <p>18 "Faults and ..." - was Obsidian Aid</p> <p>19 to Cross 5</p> <p>20 EXHIBIT 100.0 - 2019 article entitled</p> <p>21 "Connecting Fluid Flow ..." - was</p> <p>22 Obsidian Aid to Cross 3</p> <p>23 Q D.P. LANGEN: Dr. Virues -- I</p> <p>24 apologize, sir. Sorry, Mr. Virues.</p> <p>25 A C. VIRUES: I'm not a doctor.</p> <p>26 Q Okay. Thank you.</p>	<p style="text-align: right;">476</p> <p>1 A Mr. Virues.</p> <p>2 Q Okay. If you can pull up your -- your</p> <p>3 evidence. It's Exhibit 57.03. And we're</p> <p>4 interested in PDF page 3. Let me know once we</p> <p>5 have it. 57.03.</p> <p>6 A. LUNG: Mr. Langen, I think</p> <p>7 it might be confidential. Maybe double-check.</p> <p>8 D.P. LANGEN: If I can have a</p> <p>9 moment.</p> <p>10 THE CHAIR: Certainly, yeah.</p> <p>11 D.P. LANGEN: Thank you for your</p> <p>12 patience, Mr. Chair and Commissioners.</p> <p>13 It's -- it's in Exhibit 57.01, PDF 798.</p> <p>14 We're interested in Comment Number 3. We've</p> <p>15 got it on the screen. Thank you.</p> <p>16 Q D.P. LANGEN: In that comment,</p> <p>17 sir, you state: (as read)</p> <p>18 Interpretation of DST results is often</p> <p>19 regarded as an art rather than a</p> <p>20 science.</p> <p>21 And then you have three numbers, 1, 2, 3. And</p> <p>22 those numbers relate to the references at the</p> <p>23 back of your evidence; correct?</p> <p>24 A C. VIRUES: Correct.</p> <p>25 Q If we can pull up Exhibit 82.1, please. Thank</p> <p>26 you.</p>

<p style="text-align: right;">477</p> <p>1 And we can agree, if we go to the -- the 2 next page, beyond the cover, that this is the 3 first reference in your Comment Number 3 that 4 we were just discussing; correct? 5 A Correct. 6 Q Okay. And we can agree that this exhibit is 7 titled "A Primer to DST Chart Interpretation"? 8 A Yes. 9 Q Okay. Can you tell me, sir, did you read the 10 entire document before you finalized your 11 evidence? 12 A I skimmed through it. 13 Q You skimmed it? 14 A Yeah. 15 Q Can you tell me, sir, where in this document 16 the date's located? 17 A Exactly where it is now. 18 Q Let's look at the -- under the introduction, 19 the word -- the -- the text under the 20 introduction. There is a statement at the 21 very -- the very first sentence is a statement 22 that you quote in your evidence; correct? 23 A Correct. 24 Q The next sentence says, and I quote: (as read) 25 However, logical and efficient 26 interpretation can be easily</p>	<p style="text-align: right;">478</p> <p>1 accomplished by understanding the 2 basic factors involved in producing a 3 chart. 4 Do you see that there? 5 A Yes. 6 Q Do you agree with that statement? 7 A Yes. 8 Q Let's move to the next paragraph on the page. 9 Actually, let's move to the last sentence 10 on that same paragraph. It states: (as read) 11 With knowledge of the basic DST shapes 12 and form in mind, even complicated 13 charts can be broken into components 14 and satisfactorily interpreted. 15 Do you see that there? 16 A I see that. 17 Q Do you agree with that statement? 18 A Yes. 19 Q If we move down to the second paragraph, last 20 sentence, it says: (as read) 21 The pressure time chart is a valuable 22 record of the test events and serves 23 to validate the test results. 24 Do you see that there? 25 A No, I don't see that page. 26 Q So second paragraph on the page.</p>
<p style="text-align: right;">479</p> <p>1 A Oh, okay. Second paragraph. 2 Q Last sentence: (as read) 3 The pressure time chart is a valuable 4 record of the test events and serves 5 to validate the test results. 6 Do you see that there? 7 A Yes, I see that. 8 Q Okay. Do you agree with that statement? 9 A Yes. 10 Q If we move to the third paragraph on that same 11 page, it states at the very top: (as read) 12 At the well site, a properly 13 interpreted DST chart also can give 14 an inter -- indication of important 15 reservoir parameters, such as 16 productivity, permeability, pressure, 17 and wellbore damage. 18 Do you see that there? 19 A I see that. 20 Q Do you agree with that statement? 21 A Yes. 22 Q So this paper that you cited concludes that DST 23 data, if properly interpreted, can be used to 24 determine reservoir pressure; correct? 25 A Just establishes pressure. It doesn't stay 26 reservoir pressure.</p>	<p style="text-align: right;">480</p> <p>1 Q Can we go to PDF page 8, please. And we're 2 looking at a summary, and we're interested in 3 the second bullet. That second bullet says, 4 and I quote: (as read) 5 Changes in pressure with time during 6 the flow enclosed in periods of a DST 7 can be interpreted to describe 8 reservoir parameters, such as 9 productivity, permeability, pressure, 10 and wellbore damage. 11 Do you see that there? 12 A I see that. 13 Q So reservoir pressure, according to these 14 authors, can be determined from a DST 15 interpreted; correct? 16 A "Reservoir pressure" has a lot of definitions. 17 So here we are talking about parameters from 18 the reservoir. 19 Q And, sir, can you tell me why -- given the 20 discussion here in this paper about pressure, 21 why you didn't say anything more, other than 22 take the first line out of the top of the 23 paper? 24 A I -- I thought that the first sentence will 25 summarize that DST interpretation is very 26 difficult, and the subject is very subjective,</p>

<p style="text-align: right;">481</p> <p>1 and also it's more like an art.  2 Q Okay. But this paper says that DST and charts  3 can be interpreted if they're done, and the  4 interpretation can be done as long as you're  5 diligent about it, doesn't it?  6 A It says that, but if you read the entire paper,  7 it gives a lot of challenges to interpretation.  8 Like, for example, it provides productivity,  9 permeability. We just saw from DSTs on the MPD  10 evidence that they're talking about reservoir  11 pressure, but there is more parameters that  12 comes from DSTs.  13 Q But it doesn't say that, does it? It just --  14 you're -- you're interpreting the paper;  15 correct?  16 A No, no, no. It says that. It says that it  17 provides productivity, permeability, pressure,  18 et cetera.  19 Q It says, I just put it to you: (as read)  20 Changes in pressure with the time  21 during the flow and closed-in periods  22 of a DST can be interpreted to  23 describe reservoir parameters, such as  24 productivity, permeability, pressure,  25 and wellbore damage.  26 And I put to you, sir, that the premise of this</p>	<p style="text-align: right;">482</p> <p>1 paper is that you can, indeed, interpret DST  2 data to come up with -- just let my finish --  3 reservoir -- reservoir parameter, but you have  4 to be diligent about it.  5 A And also you have to understand that the type  6 of test you're dealing with, the gauge type  7 of -- the gauge type, there is so many levels  8 of understanding that go into the DST.  9 Q Okay. I'm going to come back to my question,  10 which was the authors of this paper are saying  11 that you can, indeed, interpret DST data to  12 determine reservoir parameters, including  13 pressure, so long as you're diligent about it.  14 Do you agree or not?  15 A I agree with that.  16 Q Let's pull up Exhibit 82.2, please. Let's go  17 to the second page, please.  18 This is the second reference to that  19 comment about art and science; correct?  20 A Correct.  21 Q And we can agree that this is a printout from a  22 web page?  23 A Yeah.  24 Q Did you read the entirety of this document  25 before you finalized your evidence?  26 A Yes. I -- there is the -- there are different</p>
<p style="text-align: right;">483</p> <p>1 chapters, different links that you need to  2 read. When it ask you to read more, I -- I  3 click in all the -- all the read-more subjects  4 from this paper.  5 Q We can scroll down just a little bit, just  6 slowly, please. Right there. We'll stop  7 there. You'll see that the term "drill stem  8 test" is highlighted?  9 A Yes.  10 Q Okay. Let's scroll down a little bit more,  11 please. Keep going, please. Keep going,  12 please. I'll tell you when to stop. How is  13 that? Right there. We'll stop.  14 Do you see that "drill stem test" is  15 highlighted again?  16 A Can you repeat.  17 Q Can you see that "drill stem test" -- the --  18 the phrase "drill stem test" is highlighted  19 again?  20 A Yeah, it's highlighted.  21 Q Do you know why?  22 A Normally, when you Google search, it highlights  23 the -- the terms.  24 Q Mr. Virues, you state in your evidence at  25 Exhibit 57.03 -- sorry -- Exhibit 57.01 that  26 DST pressures may not be reliable and that DST</p>	<p style="text-align: right;">484</p> <p>1 data interpretation is very difficult. Does  2 that sound familiar?  3 A Yeah. It's consistent with what I'm -- we were  4 talking about.  5 Q If we can pull up Exhibit 81.7, please.  6 A. LUNG: Mr. Langen, I think  7 that one is a confidential exhibit as well.  8 D.P. LANGEN: Mr. Chair, the  9 record for me has been a bit of a struggle  10 because I -- and I apologize. I -- I was using  11 confidential -- like, unredacted versions to  12 prepare my cross. I'm assuming there is a  13 version of that that's public. We filed  14 redacted ones. I'm happy to go to that one,  15 but I just don't know the exhibit number.  16 A. BARRINGTON: It might be 81.6.  17 D.P. LANGEN: Try 81.6.  18 A. LUNG: That's right.  19 D.P. LANGEN: Okay. Thank you,  20 Ms. Barrington.  21 And we'll go to PDF 8, please. Just to the  22 bottom of the page.  23 Q D.P. LANGEN: You'll see there  24 that -- this is the report by -- the reply  25 evidence of Dr. Pooladi-Darvish.  26 A C. VIRUES: Yes.</p>

485	<p>1 Q You reviewed that evidence?</p> <p>2 A Yes.</p> <p>3 Q You'll see there that he refers to Directive 40?</p> <p>4 A Yes.</p> <p>5 Q He says that Directive 40 confirms that DSTs 6 can be used in determination of initial 7 pressure?</p> <p>8 A Yes.</p> <p>9 Q Okay. Now, we provided your counsel with some 10 aids to cross yesterday at about 9 AM, one of 11 which was Aid to Cross Number 11, which is an 12 excerpt of Directive 40.</p> <p>13 P. FITZPATRICK: I've had some 14 communication with my friend about the -- the 15 excerpt he provided, and I understand that 16 Mr. Virues was of the opinion that -- that to 17 refer to Directive 40, he would need to have 18 the entirety of it.</p> <p>19 D.P. LANGEN: Mr. Chair, I'm happy 20 to file, after I complete my cross, the 21 entirety of Directive 40. As you know, aids to 22 cross themselves are not evidence, and it's the 23 evidence that comes out of the witness's mouth. 24 So what I propose to do is continue, and to 25 the extent that Mr. Virues wants to refer to 26 something else, he can, and we can then file,</p>	486	<p>1 subsequent -- subsequently, the pages that he 2 refers to.</p> <p>3 THE CHAIR: Okay.</p> <p>4 Mr. Fitzpatrick, are you okay with that 5 approach?</p> <p>6 P. FITZPATRICK: Yes, that's fine.</p> <p>7 Thank you.</p> <p>8 THE CHAIR: Okay. Thank you. 9 Please proceed, Mr. Langen.</p> <p>10 D.P. LANGEN: Thank you.</p> <p>11 Q D.P. LANGEN: So, Mr. Virues, 12 you're familiar with Directive 40?</p> <p>13 A C. VIRUES: Yes.</p> <p>14 Q You would agree that Directive 40, like most 15 AER directives, are written to provide guidance 16 or to set requirements for engineers and 17 geoscientists working in the oil and gas 18 industry; correct?</p> <p>19 A Not necessarily guidance. Like, directives 20 needs to be supported by regulatory decision 21 makers. We have -- we have manuals for 22 guidance.</p> <p>23 Q So who is supposed to use these directives, 24 Directive 40?</p> <p>25 A Industry.</p> <p>26 Q Sorry. Industry?</p>
487	<p>1 A Industry.</p> <p>2 Q If we can move to PDF page 4, please. And 3 we're interested -- that's good. Thank you. 4 The second paragraph there says, and I quote: 5 (as read) 6 The requirements detailed in this 7 directive are AER regulations, as 8 enacted under Section 3, 7, 11, and 14 9 of the Oil and Gas Conservation Rules 10 and Sections 78 and 79 of the 11 Geothermal Resource Development Rules 12 (GRDR). This directive addresses 13 pressure and deliverability tests, 14 drill stem tests, and fluid sampling 15 analysis. 16 Do you see that there?</p> <p>17 A Yes, I see.</p> <p>18 Q You would agree, then, as the directive says, 19 it is a regulation?</p> <p>20 A Yes, it's a regulation -- regulatory 21 instrument.</p> <p>22 Q And if we can go to PDF 6 of this aid. I'll 23 direct you to heading 4.51, and it's titled 24 "DST Submitted as Initial Pressures". Do you 25 see that there?</p> <p>26 A I see that.</p>	488	<p>1 Q And at Requirement 36, it states that: 2 (as read) 3 All of the following conditions must 4 be met if a DST pressure is used to 5 satisfy the initial pressure 6 requirement. 7 Do you see that there?</p> <p>8 A I see that.</p> <p>9 Q And the term "initial pressure" means the 10 initial pressure in the reservoir or a pool 11 that the well that is undergoing the DST is 12 targeting; correct?</p> <p>13 A Correct.</p> <p>14 D.P. LANGEN: Mr. Chair, if I can 15 have an aid to cross -- or exhibit number for 16 this aid to cross, please.</p> <p>17 THE CHAIR: Certainly.</p> <p>18 B. KAPEL HOLDEN: Aid to Cross 19 Number 11 used by Obsidian, which is AER 20 Directive 40, "Pressure and Deliverability 21 Testing Oil and Gas Wells", can be marked as 22 Exhibit 101.0. 23 EXHIBIT 101.0 - AER Directive 040 - 24 was Obsidian Aid to Cross 11 25 D.P. LANGEN: If we can pull up 26 exhibit -- thank you, Mr. Chair and</p>



<p style="text-align: right;">489</p> <p>1 Ms. Kapel Holden.  2 If we can pull up Exhibit 81.7, please.  3 Sorry. 81 point -- actually, if we can have --  4 it's 81.6. Thank you. Just for the record.  5 We're going to PDF 9, please. We'll go to the  6 bottom, please.  7 Q D.P. LANGEN: Mr. Virues, you'll  8 see there's a footnote there. This, again, is  9 Dr. Pooladi-Darvish's reply evidence, Footnote  10 Number 4. And he states in that footnote, and  11 I quote: (as read)  12 I point out that hydraulic --  13 hydrological studies of the Alberta  14 Basin conducted by the scientists of  15 Alberta Geological -- Geological  16 Survey rely on pressures from DST.  17 Do you see that there?  18 A C. VIRUES: I see that.  19 Q Does the name Brinsky ring a bell, sir?  20 A I think I saw that name in an article.  21 Q If you can pull up Aid to Cross Number 8,  22 please. You've had time to review this aid?  23 A Yes.  24 Q If we go to the second page, please. You'll  25 see that this is a screenshot -- a screenshot  26 of -- of a web page that's accessed, and the</p>	<p style="text-align: right;">490</p> <p>1 web page is shown where it's accessed on the  2 first page. And it's a distribution of a  3 hydraulic head in the Leduc hydrostratigraphic  4 unit, Map 631. Do you see that there?  5 A Yes.  6 Q And you can download it if you press the  7 buttons below.  8 And if we go to the next page. Sorry.  9 Keep going. Right there. So I have to zoom  10 out initially, please. And this is the map  11 that was produced. And if we go to -- to the  12 text just below the bottom. If we go to the  13 bottom, please. Right there.  14 And if you look under the map -- and you  15 might want to zoom in a bit -- it says that --  16 again, it has the title "Map 631, Distribution  17 of Hydraulic Head in the Leduc  18 Hydrostratigraphic Unit", "Hydrogeology by:  19 J. Brinsky". Do you see that there?  20 A I see that, but this is out of my area of  21 expertise. This is hydrogeology.  22 Q That's fine. I'm not -- I'm not going to ask  23 you questions about expertise --  24 A Okay.  25 Q -- here.  26 We can agree that J. Brinsky is a geologist</p>
<p style="text-align: right;">491</p> <p>1 with the AGS?  2 A I think he's a hydrogeologist.  3 Q Hydrogeologist. I stand corrected. Sorry,  4 Mr. Brinsky.  5 Now, if we move to the column in the middle  6 of the page. So keep the zoom in if you can.  7 Yeah. Thank you. And then go up. Okay.  8 Thank you.  9 There's a heading stating "Methodology".  10 If you can zoom in to just a bit more so we can  11 see the text there. Thank you.  12 Mr. Brinsky of AGS states under  13 "Methodology" -- you'll see first sentence:  14 (as read)  15 The hydraulic head distribution map  16 [which is the map that's shown on the  17 screen] is a result of an empirical  18 Bayesian kriging technique using  19 public available pressure data from  20 537 drill stem tests from oil and gas  21 wells.  22 Do you see that there?  23 A I see that.  24 Q If we move to the next paragraph, it says:  25 (as read)  26 Using the methodology of Singh et al.</p>	<p style="text-align: right;">492</p> <p>1 2017, the cumulative interference  2 index, CII, was determined and used to  3 identify and remove tests that have  4 been influenced by production or  5 injection. Figure 4.  6 Do you see that there?  7 A I see that.  8 Q And when he refers to "tests", he's referring  9 to the DST tests that he referred to in the  10 first paragraph. Agreed?  11 A Yes.  12 Q So in this instance, in preparing this map,  13 Mr. Brinsky used a large number of DST tests,  14 and then he filtered them using, as he  15 indicates here, a methodology that Singh et al.  16 developed in 2017 in a paper. Do you agree to  17 that -- agree to that? That's what it says.  18 A Well, I don't know whether Brinsky only worked  19 on this because he would need engineering  20 subject matter expertise.  21 Q Are you talking about the methodology?  22 A No. I'm talking about screening the DSTs.  23 Q Right. He says he used the Singh 2017 index.  24 A Yes. But that -- that cumulative interference  25 index, I think, is a hydrogeology way to  26 interpret the DSTs.</p>

493	<p>1 Q That's fine, sir.</p> <p>2 But he used that methodology to filter DST</p> <p>3 tests; correct?</p> <p>4 A Yes. But probably -- I don't know whether he</p> <p>5 interacted with engineering. You need that.</p> <p>6 Q That -- that's not what I'm asking you, sir.</p> <p>7 I'm just -- I'm just asking you that he says</p> <p>8 that he filtered the DST tests.</p> <p>9 A Yeah. So I'm providing commentary on my</p> <p>10 thoughts about using this interference index</p> <p>11 when you don't have engineering involved.</p> <p>12 Q That's fine.</p> <p>13 Now, Mr. Virues, we provided your counsel</p> <p>14 with an excerpt of the 2017 Singh et al. paper</p> <p>15 that is referred to here, and it's Aid to Cross</p> <p>16 Number 7. If you can pull that up, please.</p> <p>17 A. LUNG: Sorry, Mr. Langen.</p> <p>18 We don't appear to have Aid to Cross Number 7.</p> <p>19 D.P. LANGEN: Just give me a</p> <p>20 moment.</p> <p>21 A. LUNG: Sorry. That's my</p> <p>22 mistake. I do have it. Can you give us a few</p> <p>23 minutes.</p> <p>24 D.P. LANGEN: No worries, sir.</p> <p>25 THE CHAIR: Mr. Langen, just</p> <p>26 while we're waiting, we're kind of around</p>	494	<p>1 10:30. So look for a natural spot. You don't</p> <p>2 need to conclude right away. If you want to</p> <p>3 finish with this witness, just maybe look for</p> <p>4 an opportune moment for a break.</p> <p>5 D.P. LANGEN: Sure. Thank you,</p> <p>6 sir.</p> <p>7 Q D.P. LANGEN: Mr. Virues, you've</p> <p>8 had time to review this aid?</p> <p>9 A C. VIRUES: I -- I tried, but</p> <p>10 it's out of my area of expertise. It's written</p> <p>11 by a hydrogeologist.</p> <p>12 Q That's fine, sir.</p> <p>13 I'm just going to ask you, this is the</p> <p>14 paper that's referred to in the aid I just</p> <p>15 provided to you; correct?</p> <p>16 A Yes.</p> <p>17 Q Okay. And we can agree that if we look at the</p> <p>18 author's name, Amandeep Singh, as well as Dan</p> <p>19 Palombi and Nevenka Nakevska -- I apologize to</p> <p>20 those individuals -- they're all shown on that</p> <p>21 page in Footnote A as being with the Alberta</p> <p>22 Geological Survey, or AGS. Do you see that</p> <p>23 there?</p> <p>24 A Singh, Palombi, and Nakevska, yes.</p> <p>25 Q Yes. Thank you for correcting me.</p> <p>26 And if we look at -- if we go to PDF page 4</p>
495	<p>1 of that aid, we look at -- go down a little</p> <p>2 bit, please, under "Previous". We're on the</p> <p>3 wrong page. PDF 3. My mistake. Keep going.</p> <p>4 That's PDF 2. Thank you. Right there.</p> <p>5 If we look under Heading 2.1, "Assessing</p> <p>6 Production and Injection Effects".</p> <p>7 A Yes.</p> <p>8 Q You'll see there that the authors state -- and</p> <p>9 I quote -- first sentence: (as read)</p> <p>10 Pressure data are of primary</p> <p>11 importance for petroleum and regional</p> <p>12 hydrological studies and are commonly</p> <p>13 obtained from DSTs.</p> <p>14 Do you see that there?</p> <p>15 A I see that.</p> <p>16 Q And so the authors of this paper, who are, at</p> <p>17 least at the time it was authored, members of</p> <p>18 AGS, indicate that DST -- DSTs can be used --</p> <p>19 or are of primary importance for petroleum</p> <p>20 studies and are commonly obtained from DSTs.</p> <p>21 Do you see that, the pressure data?</p> <p>22 A I see that.</p> <p>23 Q Okay.</p> <p>24 D.P. LANGEN: Mr. Chair, if I can</p> <p>25 have exhibit numbers for those two aids,</p> <p>26 please.</p>	496	<p>1 B. KAPEL HOLDEN: For Aid to Cross</p> <p>2 Number 8 from Obsidian, it's a screenshot of an</p> <p>3 AER web page, "Map 631, Distribution of</p> <p>4 Hydraulic Head in the Leduc Hydrostratigraphic</p> <p>5 Unit". That can be given Number 102.</p> <p>6 EXHIBIT 102.0 - Screenshot of AER web</p> <p>7 page Map 631 - was Obsidian Aid to</p> <p>8 Cross 8</p> <p>9 B. KAPEL HOLDEN: And then Aid to</p> <p>10 Cross Number 7 used by Obsidian -- that is the</p> <p>11 2017 article entitled "An Efficient Approach</p> <p>12 for Characterization Basin-scale</p> <p>13 Hydrodynamics" -- can be 103.0 as an exhibit.</p> <p>14 EXHIBIT 103.0 - 2017 article entitled</p> <p>15 "An Efficient Approach ..." - was</p> <p>16 Obsidian Aid to Cross 7</p> <p>17 D.P. LANGEN: Thank you, sir. Now</p> <p>18 would be a good time to break.</p> <p>19 THE CHAIR: Okay. It's 10:33.</p> <p>20 So let's resume at ten to 11. Thank you,</p> <p>21 everyone.</p> <p>22 (ADJOURNMENT)</p> <p>23 THE CHAIR: Thank you. Please</p> <p>24 be seated.</p> <p>25 And whenever you're ready, Mr. Langen, you</p> <p>26 can continue.</p>

497	<p>1 D.P. LANGEN: Thank you, sir.</p> <p>2 Q D.P. LANGEN: Dr. Canales, let's</p> <p>3 pull up CLM submissions. It's Exhibit 57.01 at</p> <p>4 PDF 25. PDF 25, please. Thank you. 25.</p> <p>5 Thank you.</p> <p>6 Sir, Dr. Canales -- sorry -- we're focusing</p> <p>7 on paragraph 66. Have you had a chance to read</p> <p>8 it?</p> <p>9 A M. CANALES: I'm going through</p> <p>10 it.</p> <p>11 Yes, I read it.</p> <p>12 Q Okay. And in that paragraph, CLM states that</p> <p>13 CLM took scientific steps to assess the data it</p> <p>14 had available to it at the time the EPO was</p> <p>15 issued. It thoroughly analyzed that data to</p> <p>16 reach its conclusion, and it did so: (as read)</p> <p>17 Based on consideration of the data in</p> <p>18 light of widely accepted methods for</p> <p>19 assessing the probability and strength</p> <p>20 of evidence.</p> <p>21 Do you see that there?</p> <p>22 A What line, if you don't mind?</p> <p>23 Q Sure. We're looking at paragraph 66.</p> <p>24 A Yes.</p> <p>25 Q If you look at left margin of that paragraph</p> <p>26 and we go to the third line, it states -- and I</p>	498	<p>1 quote: (as read)</p> <p>2 The AER's SMEs took scientific steps</p> <p>3 to gather data to thoroughly analyze</p> <p>4 that data and to reach conclusions</p> <p>5 based on consideration of the data in</p> <p>6 light of widely accepted methods for</p> <p>7 assessing the probability and strength</p> <p>8 of evidence.</p> <p>9 Do you see that there?</p> <p>10 A Yes, I see that.</p> <p>11 Q Okay. And we asked that information request --</p> <p>12 and it's IR 1.8 -- what those widely accepted</p> <p>13 methods were for assessing probability and</p> <p>14 strength of evidence, and you replied that they</p> <p>15 were the frameworks for assessing whether a</p> <p>16 seismic event is induced or natural, namely</p> <p>17 Verdon et al. 2019, Foulger et al. 2023, and</p> <p>18 Davis and Frohlich 1993; correct?</p> <p>19 A May I see it?</p> <p>20 Q Sure. If we can pull up Exhibit 71.1, PDF 10,</p> <p>21 please.</p> <p>22 Do you want me to step through the whole</p> <p>23 thing, or how do you want to --</p> <p>24 A Just the point you mentioned --</p> <p>25 Q Okay.</p> <p>26 A -- earlier.</p>
499	<p>1 Q So we'll go -- if we can scroll down. Stop</p> <p>2 there, please.</p> <p>3 (f), you're asked to: (as read)</p> <p>4 Please provide a list of the</p> <p>5 scientific steps that the AER SMEs --</p> <p>6 A Right.</p> <p>7 Q (As read)</p> <p>8 -- took to thoroughly analyze the date</p> <p>9 as stated in Reference (i).</p> <p>10 We can go up to Reference (i), if you'd like.</p> <p>11 That's the question.</p> <p>12 A Right.</p> <p>13 Q If we go down to (f). Can we scroll down to</p> <p>14 (f), please. Thank you.</p> <p>15 And it says, just as I -- was in my</p> <p>16 question: (as read)</p> <p>17 The scientific steps taken by the</p> <p>18 AER's SMEs can be found at Exhibit 57,</p> <p>19 Tab 1, and the initial analysis and</p> <p>20 catalogues can be found at</p> <p>21 Exhibit 6.02.</p> <p>22 And then we go to (i), and it says: (as read)</p> <p>23 The widely accepted methods are</p> <p>24 Verdon, Foulger, and Davis.</p> <p>25 Do you see that there?</p> <p>26 A Right.</p>	500	<p>1 Q Okay. Let's move to your evidence -- your</p> <p>2 March 2023 report where you reprised --</p> <p>3 sorry -- your -- your July 2024 report where</p> <p>4 you reprised your work using data up to July</p> <p>5 2024.</p> <p>6 A Right.</p> <p>7 Q Okay. So that's Exhibit 57.1, and we're going</p> <p>8 to go to PDF 49, please. Actually, we'll go to</p> <p>9 PDF 64. And I'm interested in paragraph 13.</p> <p>10 A Right. Yeah. Yeah, I -- I see it. Sorry.</p> <p>11 Q Okay. "Since the initial work" -- you state</p> <p>12 there, and I quote: (as read)</p> <p>13 Since the initial work from Davis and</p> <p>14 Frohlich 1993, additional frameworks</p> <p>15 have been developed to better discern</p> <p>16 the nature of earthquake sequences,</p> <p>17 addressing challenges posed by</p> <p>18 ambiguous and uncertain data. Such</p> <p>19 frameworks like Verdon et al. 2019 and</p> <p>20 Foulger et al. 2023 account for the</p> <p>21 incomplete and ambiguous -- account</p> <p>22 for incomplete and ambiguous datasets,</p> <p>23 which are pertinent for emerging and</p> <p>24 evolving sequences.</p> <p>25 Do you see that there?</p> <p>26 A Yes.</p>

<p style="text-align: right;">501</p> <p>1 Q Now, I took this to mean that, in your view, 2 both the Verdon et al. and Foulger frameworks 3 are better at accounting for incomplete and 4 ambiguous datasets. Fair? 5 A Can you repeat? 6 Q Well, let's do it this way: Let's look -- look 7 back at 13. It says: (as read) 8 Since the initial work from Davis and 9 Frohlich 1993, additional frameworks 10 have been developed to better discern 11 the nature of earthquake sequences, 12 addressing challenges posed by 13 ambiguous and uncertain data -- 14 uncertain data. Such frameworks, like 15 Verdon et al. 2019 and Foulger et al. 16 2023, account for incomplete and 17 ambiguous datasets, which are 18 pertinent for emerging and evolving 19 sequences. 20 That's your evidence. Is it still your 21 evidence? 22 A Yes. Yes. 23 Q Okay. Now, in referring to "emerging and 24 evolving sequences" in paragraph 13, we can 25 agree that in November 2022, at the time of the 26 first large event that occurred in the Reno</p>	<p style="text-align: right;">502</p> <p>1 cluster or sequence, the cluster was emerging. 2 Fair? 3 A Yes. 4 Q And in March 2023, when the second large event 5 occurred in the Reno cluster or sequence, the 6 cluster was evolving at that point? 7 A Yes. 8 Q We can go to PDF 51 of that same exhibit, 9 please. We're interested in paragraph 3, just 10 at the bottom. Thank you. 11 A Yes, I can see it. 12 Q Okay. At paragraph 3, you outline the purpose 13 of this report, which is your July 2024 14 reprisal, is to summarize available data 15 analysis conducted by AGS up to July 2024. And 16 you indicate that since March 2023, when the 17 EPO was issued, AGS had reprocessed the first 18 round of nodal array data to update the 19 velocity model. Do you see that there? 20 A Yes. 21 Q Okay. And you also indicate that since March 22 2023, AGS had processed two additional rounds 23 of nodal array data, some of which was not 24 available when the EPO was issued; correct? 25 A Yes. 26 Q And, finally, you indicate that AGS had used</p>
<p style="text-align: right;">503</p> <p>1 2D seismic data to identify potential 2 basement-rooted faults, which it had not done 3 prior to issuing the EPO; correct? 4 A Can you repeat. 5 Q Finally, you indicate in that paragraph that 6 AGS had used 2D seismic data to identify 7 potential basement-rooted faults, which it had 8 not done prior to issuing the EPO; correct? 9 A We identified basement-rooted faults using the 10 seismic -- using the -- the nodal array data 11 and not using the seismic data. 12 Q Sorry. Not using reflection seismic -- 13 A Not using, no. 14 But we identified those faults in the nodal 15 array. 16 Q So in July 2024, the data, when you did your 17 reprisal, the data you had was less ambiguous 18 than in March 2023. Fair? 19 A Right. It -- it was a reformation of the 20 previous conclusion. 21 Q And you had -- in July 2024, you had a more 22 complete set of data than you did in March? 23 A We processed more rounds of data on the 2D 24 seismic and, as I mentioned, reaffirm our 25 initial conclusion that it wasn't used, and it 26 was related to the disposal into the Leduc, the</p>	<p style="text-align: right;">504</p> <p>1 Obsidian well, yes. 2 Q We can pull up Exhibit 06.02, please. 3 Actually, let's go to 06.0 -- sorry -- 4 Exhibit 06.01. And we're interested in -- go 5 to PDF 6, please. If we go down, please. 6 Okay. And then let's go to PDF 19, please. 7 That's it. Thank you. 8 So -- and, Dr. Canales, we've -- we've 9 discussed this presentation already. It's the 10 one you prepared in January 2023 and the one 11 that you spoke with with Mr. Kuleba; correct? 12 A Can you repeat. Sorry. 13 Q Sure. Yeah. Apologies. 14 This is the presentation that you -- you 15 gave to Mr. Kuleba in March, just prior to the 16 issuance of the EPO? 17 A Yes. 18 Q Okay. Let's move to PDF 12, please. Actually, 19 we'll go to PDF 20. My mistake. Thank you. 20 Here, in this presentation, you refer to 21 "Cluster 3". That's the Reno cluster; correct? 22 A Yes. 23 Q Okay. And I just want to ask you: I don't see 24 reference to "probabilities" here in this 25 presentation. You don't discuss the 26 probabilities of what caused the events in this</p>

<p style="text-align: right;">505</p> <p>1 presentation?</p> <p>2 A No.</p> <p>3 Q And the Davis and Frohlich framework is</p> <p>4 qualitative in nature; correct?</p> <p>5 A Well, it relies on quantitative analysis, so</p> <p>6 there is an qualitative component but a</p> <p>7 quantitative component as well.</p> <p>8 Q And what's the quantitative component?</p> <p>9 A Well, it relies on data like the depth of the</p> <p>10 earthquake. So that's a -- that's something</p> <p>11 quantitative.</p> <p>12 Q So there's qualitative data that you assess,</p> <p>13 and then you look at that qualitative data and</p> <p>14 you answer the questions in the framework;</p> <p>15 correct?</p> <p>16 A Quantitative.</p> <p>17 Q Sorry. Quantitative that you assess; right?</p> <p>18 So the --</p> <p>19 A Yes.</p> <p>20 Q -- nodal array data?</p> <p>21 A Yes.</p> <p>22 Q And you assess that data, and then you -- using</p> <p>23 that data, you answer the questions in the</p> <p>24 framework; correct?</p> <p>25 A Right.</p> <p>26 Q Okay. And the -- the framework -- the output</p>	<p style="text-align: right;">506</p> <p>1 of that framework is qualitative. It doesn't</p> <p>2 come out with a probability, does it?</p> <p>3 A It doesn't, as any of the other questionnaires.</p> <p>4 Q Let's go to Exhibit 06.01, please. I think</p> <p>5 we're in it. And we're going to go to PDF 2.</p> <p>6 Now, I'll ask this -- I'll direct this to</p> <p>7 Mr. Kuleba. This is the announcement the AER</p> <p>8 issued on November 30th, 2022, following the</p> <p>9 seismic event the day prior; correct?</p> <p>10 A E. KULEBA: Yes, I believe so.</p> <p>11 Q And that announcement, as we've talked about</p> <p>12 before, says it's updated on November 30th at</p> <p>13 3:10 PM. Do you see that there?</p> <p>14 A That is what it says, yeah.</p> <p>15 Q Prior to this announcement, did the AER or AGS</p> <p>16 apply any of the Verdon, Foulger, or Davis,</p> <p>17 Frohlich frameworks to assess the cause of</p> <p>18 November 29th, 2022, event?</p> <p>19 A I'll refer to Dr. Canales.</p> <p>20 A M. CANALES: Yes, we were -- we</p> <p>21 were having those in mind, yes.</p> <p>22 Q You had them in mind, or did you apply them?</p> <p>23 A I applied them.</p> <p>24 Q Are they on the record of this proceeding?</p> <p>25 A I don't believe so, no.</p> <p>26 Q Did you apply all three? Did you apply --</p>
<p style="text-align: right;">507</p> <p>1 A No. Just the Davis and Frohlich.</p> <p>2 Although, I think there is -- in the -- in</p> <p>3 the first report, I state that we followed the</p> <p>4 Davis and Frohlich originally. Yes, in</p> <p>5 November 2022, we -- it's in the evidence,</p> <p>6 actually, now that I'm remembering it.</p> <p>7 Q Let's focus on the second bullet point. It</p> <p>8 states that: (as read)</p> <p>9 While there are disposal operations in</p> <p>10 the region, none are in the immediate</p> <p>11 vicinity of the seismic events nor</p> <p>12 have there been changes in the rates</p> <p>13 of fluid disposal for the past year.</p> <p>14 Do you see that there? I'll direct that to</p> <p>15 Mr. Kuleba.</p> <p>16 A E. KULEBA: Yes. That's what it</p> <p>17 says.</p> <p>18 Q Okay. And it says -- just above those bullets</p> <p>19 that I -- I just paraphrased for you, it says:</p> <p>20 (as read)</p> <p>21 This initial finding was based on the</p> <p>22 following factors.</p> <p>23 Agree?</p> <p>24 A Yes.</p> <p>25 Q Okay. And the initial finding was that the</p> <p>26 event was, at that point in time, determined to</p>	<p style="text-align: right;">508</p> <p>1 be natural, but there was assessment going on.</p> <p>2 Fair?</p> <p>3 A Yes, I believe that's fair. Yeah.</p> <p>4 Q Now I'm going to go back to the two bullets.</p> <p>5 There is no act of hydraulic -- sorry:</p> <p>6 (as read)</p> <p>7 While there are fluid disposal</p> <p>8 operations in the region, none are in</p> <p>9 the immediate vicinity of the seismic</p> <p>10 events nor have there been changes in</p> <p>11 the rates of fluid disposal over the</p> <p>12 past year.</p> <p>13 I'm going to put to you, sir, that at this</p> <p>14 point in time, on November 30th, that's an</p> <p>15 incorrect statement.</p> <p>16 A Looking back, it would appear that way, but I</p> <p>17 did not make the statement and provide it here,</p> <p>18 so I don't know what the thinking was.</p> <p>19 Q Okay. If we can go to Exhibit 06.01, PDF 4,</p> <p>20 please. Thank you.</p> <p>21 Now, this is an email from Chris Filewich,</p> <p>22 dated November 30th, at 5:17, so approximately</p> <p>23 two hours after the 3:10 update on the AER's</p> <p>24 notice that we were just talking about. It</p> <p>25 provides an updated map of event locations with</p> <p>26 nearby disposal wells circled in red. Do you</p>

<p style="text-align: right;">509</p> <p>1 see that there?</p> <p>2 A I do, yes.</p> <p>3 Q Yeah. So unlike what was stated in the</p> <p>4 announcement, the internal communication</p> <p>5 identified nearby disposal wells; correct?</p> <p>6 A Yes.</p> <p>7 Q And if we look at the right side of the figure</p> <p>8 in the email, the disposal volumes for each of</p> <p>9 those wells are shown; correct?</p> <p>10 A Yes.</p> <p>11 Q But they're cut off. Do you agree? It looks</p> <p>12 like they're not being -- you can't see the --</p> <p>13 how they continue on past 2017.</p> <p>14 A Yes.</p> <p>15 Q Will you undertake to provide a copy of the --</p> <p>16 this email where that's not cut off?</p> <p>17 A We can, yeah.</p> <p>18 THE CHAIR: So we'll just</p> <p>19 capture that as an undertaking,</p> <p>20 Ms. Kapel Holden.</p> <p>21 B. KAPEL HOLDEN: Yeah. So that will</p> <p>22 be Undertaking Number 1, and that is to provide</p> <p>23 a copy of the email that is in Exhibit 6.01 on</p> <p>24 PDF page 4, the full non-cut-off copy of the</p> <p>25 email.</p> <p>26 D.P. LANGEN: Thank you.</p>	<p style="text-align: right;">510</p> <p>1 UNDERTAKING 1 - To provide the full</p> <p>2 non-cut-off copy of the email that is</p> <p>3 in Exhibit 6.01 on PDF page 4</p> <p>4 Q D.P. LANGEN: Now, Mr. Kuleba, I</p> <p>5 want you to remember what we're looking at</p> <p>6 right now 'cause we're going to move to another</p> <p>7 exhibit and then compare it. So if we can go</p> <p>8 to Exhibit 98, please, PDF 8. Thank you.</p> <p>9 So this is the opening statement you</p> <p>10 provided -- or the PowerPoint presentation you</p> <p>11 provided at the beginning of your appearance</p> <p>12 here on Friday.</p> <p>13 This slide has a similar layout with a map</p> <p>14 and charts showing injection volumes that we</p> <p>15 were just looking at from that email. Fair?</p> <p>16 A E. KULEBA: Yes. It shows</p> <p>17 injection -- injection volumes.</p> <p>18 Q And if we look at the chart for the 6-14 well</p> <p>19 on the right for injection volumes, we can</p> <p>20 agree that it says that the injection volumes</p> <p>21 increased significantly in the first quarter of</p> <p>22 2022; correct?</p> <p>23 A It looks like they increased, yes.</p> <p>24 Q And they -- it looks like they -- they doubled.</p> <p>25 Would you agree?</p> <p>26 A Roughly, yes.</p>
<p style="text-align: right;">511</p> <p>1 Q So the statement in -- so the statement in the</p> <p>2 AER's November 30th public announcements that</p> <p>3 there was no changes to rates of fluid disposal</p> <p>4 for the past year -- and that statement was</p> <p>5 made on November 30th, 2023 -- or, no --</p> <p>6 sorry -- November 30th, 2022, is incorrect?</p> <p>7 Because the first quarter of 2022, the 6-14</p> <p>8 well saw its injection volumes double.</p> <p>9 A Yes. Looking back, the statement may not have</p> <p>10 been correct.</p> <p>11 Q And I take it the AER didn't correct that</p> <p>12 statement?</p> <p>13 A I don't think we would have, yes.</p> <p>14 Q While we're here, we can see that the injection</p> <p>15 rates for the 14-18 well for November 2021 to</p> <p>16 November 2022 were approximately the same;</p> <p>17 correct?</p> <p>18 A Yes. If I was draw -- drawing a line, it would</p> <p>19 be straight across, give or take.</p> <p>20 Q Now, Dr. Canales, we can agree that the AER's</p> <p>21 November 30th announcement in relation to the</p> <p>22 November 29th event was released rather</p> <p>23 rapidly; correct?</p> <p>24 A M. CANALES: Yes.</p> <p>25 Q Let's go to PDF 5 of this exhibit.</p> <p>26 Now, you stepped through this slide on</p>	<p style="text-align: right;">512</p> <p>1 Friday last week in the opening statement. And</p> <p>2 I note the text on the left-hand side of that</p> <p>3 slide comes from Exhibit 57.01. That's your</p> <p>4 reference at the bottom. Agreed?</p> <p>5 A Yes.</p> <p>6 Q Okay. And I took this to mean that this</p> <p>7 portion of the slide and the oral evidence you</p> <p>8 provided on Friday in applying each one of the</p> <p>9 listed criteria is the same evidence as</p> <p>10 outlined in writing in Exhibit 57.01?</p> <p>11 A Yes.</p> <p>12 Q Let's go to that Exhibit 57.01, PDF 32. We're</p> <p>13 interested in paragraph 6. And there,</p> <p>14 you're -- in paragraph 5, you're outlining</p> <p>15 the -- the Davis and Frohlich framework. And</p> <p>16 then you go on and -- in paragraph 6, and you</p> <p>17 reference other aspects or criteria to be</p> <p>18 considered. The first is: (as read)</p> <p>19 Correlation between operational</p> <p>20 parameters and seismicity, rate of</p> <p>21 injection versus earthquakes.</p> <p>22 A Yes. Other aspects that can be considered,</p> <p>23 yes.</p> <p>24 Q Okay. And that's published in a paper by</p> <p>25 Shapiro 2010; correct?</p> <p>26 A Which part? Sorry.</p>

<p style="text-align: right;">513</p> <p>1 Q The part about being concerned about 2 operational aspects. 3 A Well, there's multiple papers about it. 4 Q Okay. Let's talk about swarm behaviour. Is 5 that in a paper by Skoumal 2015? 6 A Yes. 7 Q Okay. Let's go to the page just before this 8 one. Thank you. Let's go down to paragraph 4. 9 Sorry. Thank you. Right there. There you 10 state that the purpose of this document is 11 summarized available information and analysis 12 conducted up to March 2023; correct? 13 A Yes. 14 Q So that's your March 2023 -- that's when you 15 reprised the March 2023 work that you did using 16 the data that was available, but you did it in 17 July 2024; correct? 18 A Yes. 19 Q Okay. And this was meant to -- to 20 demonstrate -- to -- to put more meat on 21 the bones with respect to what was in the 22 additional supplemental information you filed 23 in 06.02. Fair? 24 A Yes. It's part of the analysis. 25 Q But you produced it in July 2024. It didn't 26 exist prior to then; correct?</p>	<p style="text-align: right;">514</p> <p>1 A Right. Right. 2 Q Okay. And if we can go back to the following 3 page, page 32 again. Thank you. 4 You outline the Davis and Frohlich criteria 5 we've been discussing under subheading (a), and 6 then you move to subheading (b) where you talk 7 about initial data available in the analysis. 8 Do you see that there? 9 A Can you repeat. Sorry. 10 Q In -- in subheading (a), you outline the 11 Davis -- 12 A Oh, yes. 13 Q -- and Frohlich -- 14 A Yes. 15 Q -- framework that you were applying; and then 16 (b), you talk about initial data availability 17 analysis that you had in March of 2023? 18 A Although, in this report, I do the exercise of 19 answering the questionnaire in November 2022, 20 and then I asked the same questions. I 21 included the data during the period from 22 November 2022 to March 2023. 23 So I perform the questionnaires twice: In 24 November 2022, which was quite uncertain, as I 25 describe in the report; and then in -- in 26 March 2023, where we have more certainty, given</p>
<p style="text-align: right;">515</p> <p>1 the others -- the -- the data -- essentially 2 the nodal array data and the persistence of the 3 seismicity and all the other parts of the 4 evidence. 5 Q And you used the regional nodal array data in 6 this assessment, right, not the -- 7 A For? 8 Q For this assessment in this report. 9 A No. For that report, I -- again, I have -- 10 I answered the questionnaires twice using the 11 information in November 2022, which is only 12 regional data, and then answering the questions 13 in November -- sorry -- in March 2023, where we 14 have the nodal array data, and we have a better 15 picture of what's happening. So I -- I answer 16 the questions twice in that report. 17 D.P. LANGEN: If I might just have 18 moment, Mr. Chair. 19 THE CHAIR: Certainly. 20 Q D.P. LANGEN: Dr. Canales, we 21 provided your counsel with an Aid to Cross 22 Number 13 on Sunday. I'm wondering if we can 23 pull it up, please. Thank you. 24 Sir, have you had a chance to review this 25 aid? 26 A M. CANALES: Yes.</p>	<p style="text-align: right;">516</p> <p>1 Q Okay. And we can agree, if we go to PDF 2 -- 2 if we can rotate the slide, please. This is an 3 excerpt of Exhibit 98, which was your slide 4 deck on Friday, and this is slide number 5. Do 5 you see that on the bottom right? 6 A Yes. 7 Q We can agree to that? 8 A Yes. 9 Q Yeah. Okay. 10 And you'll see that we provided -- we put 11 some annotations on. The annotations show 12 where in the transcript on Friday you provided 13 the response. 14 A Yes. 15 Q Or where you talked about these questions, as 16 we -- as you stepped through them. And then 17 they also show where in Exhibit 57.1 you also 18 say the same thing. 19 A Yes. 20 Q Okay. 21 A Well -- yes. Can you repeat, actually. 22 Q Sure. 23 A I don't know -- 24 Q That's fine. 25 So the annotations show for each 26 question --</p>

<p style="text-align: right;">517</p> <p>1 A Right.</p> <p>2 Q -- your responses to the -- to the -- to the</p> <p>3 question --</p> <p>4 A Oh, right. Right.</p> <p>5 Q -- as you gave it in the transcript in</p> <p>6 Volume 2, and then it shows where in</p> <p>7 Exhibit 57.1 you give that same -- effectively</p> <p>8 the same answer?</p> <p>9 A Yes. Yes.</p> <p>10 Q Okay.</p> <p>11 A Yeah. I -- I see it.</p> <p>12 Q And would you agree that these annotations are</p> <p>13 correct?</p> <p>14 A Yes.</p> <p>15 Q Okay. And looking at this slide, Slide</p> <p>16 Number 5 -- and this is when you were</p> <p>17 discussing your analysis in -- I believe in</p> <p>18 November.</p> <p>19 A Yes. That's the first time we performed the</p> <p>20 analysis with the limited data we had at the</p> <p>21 time.</p> <p>22 Q Okay. And just to be clear, that analysis</p> <p>23 itself in November, when you sat down and wrote</p> <p>24 that out --</p> <p>25 A Right.</p> <p>26 Q -- is not on the record here today, is it?</p>	<p style="text-align: right;">518</p> <p>1 A Well, it's part of the Exhibit fifty-one --</p> <p>2 57.01.</p> <p>3 Q Right. The reprisal where -- which you wrote</p> <p>4 in July of 2024; correct?</p> <p>5 A Well, I include that in that report, yes.</p> <p>6 Q Yeah. But you wrote that in July 2024;</p> <p>7 correct? You didn't -- you didn't pull out</p> <p>8 the -- the analysis that you did in November</p> <p>9 and attach it to that report. What you did is</p> <p>10 you wrote about it in July 2024?</p> <p>11 A Yes.</p> <p>12 Q Okay. And we can agree that, looking at this</p> <p>13 analysis, you concluded that reaching a</p> <p>14 conclusion about whether or not the November</p> <p>15 twenty -- sorry -- November 2022 seismic event</p> <p>16 was induced would not be appropriate at this</p> <p>17 point in time with this analysis?</p> <p>18 A What it says is that there's -- there's a large</p> <p>19 uncertainty.</p> <p>20 Q Sorry. Can you say that again.</p> <p>21 A There is a large uncertainty. We need more</p> <p>22 data.</p> <p>23 Q Okay. So you did not -- you were unable to</p> <p>24 make a conclusion?</p> <p>25 A Well, at the time, we were inclined it could be</p> <p>26 natural, given the depth of the earthquake.</p>
<p style="text-align: right;">519</p> <p>1 Q Okay.</p> <p>2 A But the point I tried to explain here, if we</p> <p>3 don't have -- if the earthquakes were too deep,</p> <p>4 then there is no potential mechanism or there</p> <p>5 is not a case, essentially.</p> <p>6 Q Okay. So, then, if we -- if we -- now, in</p> <p>7 your -- sorry. In your opening statement</p> <p>8 and in the March 2023 reprisal report,</p> <p>9 Exhibit 57.1, you outline how once you received</p> <p>10 the first round of nodal array data from</p> <p>11 December 2022, you revisited your analysis</p> <p>12 using the Davis and Frohlich criteria?</p> <p>13 A Right.</p> <p>14 Q Right?</p> <p>15 A I had -- I got new data, and then I proceed to</p> <p>16 reassess the analysis. Yes.</p> <p>17 Q Okay. And if we can pull up Exhibit 57.01, and</p> <p>18 we're going to go to PDF 38, please.</p> <p>19 So here, at paragraph 17, you're discussing</p> <p>20 how you revisited the Davis and Frohlich</p> <p>21 framework once you had the nodal array data;</p> <p>22 right?</p> <p>23 A Yes.</p> <p>24 Q Let's go back to the aid, please. We'll go to</p> <p>25 PDF 6, please. Sorry. PDF 3. My mistake.</p> <p>26 And we can agree -- this is, again,</p>	<p style="text-align: right;">520</p> <p>1 Exhibit 98, a slide deck that you presented on</p> <p>2 Friday that you spoke to, and it's Slide</p> <p>3 Number 12 of that slide deck. And in -- like</p> <p>4 the first slide that we talked about, Slide</p> <p>5 Number 5, what we did here is we annotated it,</p> <p>6 and we put your responses both from the</p> <p>7 transcript and then from Exhibit 57.01. You</p> <p>8 see that there?</p> <p>9 A Yes.</p> <p>10 Q And are the annotations consistent with your</p> <p>11 evidence?</p> <p>12 A Yes.</p> <p>13 Q And then here you conclude -- after revisiting</p> <p>14 the criteria from Davis and Frohlich, you</p> <p>15 determined that the Reno cluster was caused by</p> <p>16 injection into the Leduc? And that's right at</p> <p>17 the bottom of the slide.</p> <p>18 A Yes. Yes.</p> <p>19 Q Okay. And just to be clear, if we go back to</p> <p>20 PDF 2, please. Here, looking at the</p> <p>21 annotations, you had two affirmatives, two</p> <p>22 maybes, and a don't know.</p> <p>23 A Well -- yes. That's it, yes.</p> <p>24 Q Yeah. Okay. And that wasn't enough to</p> <p>25 conclude it was induced. Instead you -- you</p> <p>26 went with natural as per the announcement, the</p>



<p style="text-align: right;">521</p> <p>1 November 30th announcement?  2 A Right.  3 Q Okay. And if we go to the next page --  4 sorry -- PDF 3. And so here, obviously you  5 concluded -- you had five yeses, and you  6 concluded that it was induced. And my question  7 to you, sir, is if one of those had been red,  8 it had a "no" or "uncertain" or "unknown",  9 would you have still concluded that it was  10 induced?  11 A It depends which one.  12 Q Okay. Let's go with Number 5.  13 A Are the -- that can be presented. I mean,  14 they're -- this questionnaire, again, it's a  15 guide, and the core of the questionnaire, it's  16 to have an assessment of the situation while  17 you're collecting, essentially, more data. So  18 it's a guide. But, as I mentioned in the  19 presentation on Friday, the key point here,  20 it's understanding the -- the physics and the  21 geology, the mechanisms.  22 So at the end of the day, Question 5 is a  23 critical one. You need to understand the  24 mechanisms or if the mechanisms are feasible to  25 cause the seismicity. If you rule out that  26 there are no physical mechanisms, then it's</p>	<p style="text-align: right;">522</p> <p>1 hard to -- but, again, to rule out that,  2 it's -- it can be complicated. But if you  3 rule -- rule out that component, then it's hard  4 to build a case.  5 Q If it's uncertain, though --  6 A If it's uncertain -- well, if it's uncertain,  7 you cannot rule it out -- rule it out, no.  8 Q Okay.  9 D.P. LANGEN: Now, Mr. Chair, if  10 we can have an aid to cross -- or -- sorry --  11 an exhibit for Aid to Cross Number 13, please.  12 B. KAPEL HOLDEN: Aid to Cross  13 Number 13 from Obsidian is the annotated  14 excerpt of Exhibit 98.01, and it can be marked  15 as Exhibit 104.0.  16 D.P. LANGEN: Thank you.  17 EXHIBIT 104.0 - 2017 article entitled  18 "An Efficient Approach ..." - was  19 Obsidian Aid to Cross 7  20 Q D.P. LANGEN: Now, Dr. Canales, I  21 don't think you need to pull this up, but in  22 addition to your March 2023 reprisal, you  23 completed a July 2024 reprisal, and at that  24 point in time, you used all available data.  25 And that's at -- also in Exhibit 57.1; right?  26 A M. CANALES: Yes.</p>
<p style="text-align: right;">523</p> <p>1 Q Okay. And if we can pull up PDF -- we're in --  2 we'll go to 57.01 and pull up PDF 64, please.  3 And we're interested in paragraph 11. Sorry.  4 Wrong page. Sorry. Paragraph 14. My mistake.  5 You were in the right spot.  6 Now, here you discuss the Verdon et al.  7 framework, and you note that there are seven  8 questions touching on spacial-temporal  9 correlations, focal depths, regional  10 seismicity, and plausible activation mechanism.  11 Do you see that there?  12 A Yes.  13 Q Okay. And you go on to state: (as read)  14 The answers are weighted to express a  15 level of confidence in the data  16 available to answer the questions.  17 Do you see that there?  18 A Yes.  19 Q And if we go to PDF 69, please. We're  20 interested in paragraph 21 right at the top.  21 Thank you.  22 You start to discuss the Foulger et al.  23 framework, indicating it has nine questions,  24 each with four possible responses, and the  25 response selection is dependent on the strength  26 of the information or data that is available;</p>	<p style="text-align: right;">524</p> <p>1 correct?  2 A Yes.  3 Q So like -- and we've already talked about this  4 with respect to Davis and Frohlich, but like  5 the Davis and Frohlich methodology, the Verdon  6 and Foulger frameworks rely on data as an input  7 in order to answer the questions?  8 A Yes.  9 Q Okay. Let's go to Exhibit 57.01 again. So  10 we're in it, and we'll go to PDF 32, please.  11 Let me know once you're there.  12 The first heading on that page is  13 "Determining the Cause of the Sequence and  14 Initial Data Availability". Do you see that  15 there?  16 A Yes.  17 Q And under the second heading, you discuss the  18 use of the Davis and Frohlich framework?  19 A I think it's below.  20 Q If we go down -- if we can scroll down, please.  21 Right there.  22 A Can you repeat.  23 Q Sure. Under the second heading, "Initial Data  24 Availability", you go on to talk about the  25 application of the Davis and Frohlich  26 framework; correct?</p>

<p style="text-align: right;">525</p> <p>1 Keep going. We'll go to paragraph 11.  2 Right there.  3 You're talking about the criteria --  4 A Right.  5 Q -- the Davis and Frohlich criteria?  6 A Right.  7 Q Okay. And the data that you're using here in  8 this portion of the report is all the data up  9 to March that you had?  10 A No. In the report -- again, in the  11 questionnaires, I -- I answered the questions  12 twice, one as having the data from  13 November 2022, which is assumed it's  14 paragraph 11, and then I repeat the same  15 questions using the data available up to  16 March 2023. And that's answered later on in  17 that report.  18 Q So in this paragraph, you're talking about the  19 data that you had in November?  20 A Yes.  21 Q Okay. And then later on, you talk about March?  22 A Yes.  23 Q Okay. Let's go to your July 2024 reprisal.  24 That's at PDF 49. We're actually interested in  25 PDF 50, please.  26 So here is the table of contents for this</p>	<p style="text-align: right;">526</p> <p>1 reprisal. You note additional methods to  2 determine the origin and sequence, and you're  3 referring to Verdon and Foulger; correct?  4 A Yes.  5 Q Let's go to paragraph 13, please. Right there.  6 Thank you. So this is on PDF 64, for the  7 record.  8 In paragraph 13, you discuss how:  9 (as read)  10 Since Davis and Frohlich, additional  11 frameworks have been developed to  12 better discern the nature of  13 earthquakes.  14 Then you go on to cite Verdon and Foulger?  15 A Yes, I can see that.  16 Q Yeah. Okay. And then you go on to discuss and  17 apply both the Verdon and Foulger frameworks;  18 correct?  19 A Yes.  20 Q Let's go to paragraph 3, please, which is on  21 PDF 51.  22 And here you state that the -- paragraph 3:  23 (as read)  24 The purpose of the document is to  25 summarize available information and  26 analyses conducted by AGS up to</p>
<p style="text-align: right;">527</p> <p>1 July 2024.  2 Correct?  3 A Yes.  4 Q And what you do in this report is you take all  5 the data that you had -- you're standing in  6 July 2024, and you take all available data that  7 you have to you -- in July 2024 that you have  8 in your possession?  9 A Right.  10 Q And then you apply the Verdon and Foulger  11 frameworks; correct?  12 A As alternative frameworks, yes.  13 Q Let's continue in this exhibit. We'll go to  14 PDF 52 right there.  15 Right at the bottom of paragraph -- no.  16 That's good. Thank you.  17 We're looking at the paragraph above the  18 heading Roman Numeral 2, which is paragraph 3  19 of exhibit -- or -- sorry -- PDF 52. You'll  20 see there, Dr. Canales, that in the last  21 sentence you state that multiple studies,  22 Schultz et al. --  23 A Can I see it? Oh, where -- oh, yes, I see it.  24 Sorry.  25 Q That's okay. No -- no worries.  26 So I'll restate. In the last sentence on</p>	<p style="text-align: right;">528</p> <p>1 that page -- on that -- in that paragraph, you  2 state that multiple studies, Schultz et al.,  3 Vasyura-Bathke et al., and Li et al. --  4 A Right. And --  5 Q -- as well as Samsonov et al. 2024 had reached  6 similar conclusions to CLM in respect of the  7 causation of the event; correct?  8 A Yes.  9 Q Now, Dr. Canales, did you read the entirety of  10 those papers prior to preparing your evidence?  11 A Yes.  12 Q Do you agree with how each of those studies was  13 conducted?  14 A Can you repeat. If I agree with all of ...  15 Q Do you agree with how each of those studies was  16 conducted?  17 A If I agree if that -- well, I have some  18 differences, actually, particularly because --  19 for instance, the Schultz 2023, which --  20 it's a -- it's a solid paper. They didn't have  21 the data we had. So in the sense that I agree  22 with their -- the data they had and their  23 conclusions, yes. But for their work and for  24 their data that they didn't have, that we had,  25 would have lead to better -- more refined  26 conclusions.</p>

<p style="text-align: right;">529</p> <p>1 Q So you don't agree with the conclusions?</p> <p>2 A I agree with the conclusions.</p> <p>3 Q Well, how -- how do you know? You said they --</p> <p>4 they would be more refined, but you don't</p> <p>5 know --</p> <p>6 A Well, for instance, I think the Schultz paper,</p> <p>7 they don't have high-resolution data. So they</p> <p>8 include, for instance, both the Belloy and the</p> <p>9 Obsidian well because they don't have the</p> <p>10 resolution, whereas, in our analysis, because</p> <p>11 we had nodal array data, we point out the</p> <p>12 proper well, not a low resolution as they did.</p> <p>13 I should say that the Schultz also, well,</p> <p>14 includes the Obsidian well, and they talk about</p> <p>15 the Leduc disposal, and because they didn't</p> <p>16 have this resolution, they include also the</p> <p>17 Belloy.</p> <p>18 Q So I'm going to go back to my question, sir.</p> <p>19 A Right.</p> <p>20 Q Do you agree with the conclusions that are in</p> <p>21 those papers, yes or no?</p> <p>22 A There -- well, there are many conclusions, but</p> <p>23 with respect to pointing out that it was caused</p> <p>24 by disposal activity? Yes.</p> <p>25 Q Okay. So -- so you're selective with --</p> <p>26 with -- with the conclusions? You're -- you're</p>	<p style="text-align: right;">530</p> <p>1 picking the portion that supports your view?</p> <p>2 A No. It's just that there are multiple</p> <p>3 conclusions that I don't -- I don't agree, but</p> <p>4 the main conclusion, if we want to talk about</p> <p>5 it, yes, I agree with that one.</p> <p>6 As I mentioned earlier --</p> <p>7 Q But --</p> <p>8 A -- they have --</p> <p>9 Q -- can I ask you, sir if -- if --</p> <p>10 A Yes.</p> <p>11 D.P. LANGEN: No, no. He answered</p> <p>12 the question, sir.</p> <p>13 P. FITZPATRICK: No. He was still</p> <p>14 talking.</p> <p>15 D.P. LANGEN: No. He answered the</p> <p>16 question.</p> <p>17 P. FITZPATRICK: He was still</p> <p>18 talking. Just let him finish.</p> <p>19 D.P. LANGEN: If he goes into a</p> <p>20 speech, I'll be objecting.</p> <p>21 Q D.P. LANGEN: Go ahead, sir.</p> <p>22 A M. CANALES: Again, they had --</p> <p>23 for -- for instance, the Vasyura-Bathke,</p> <p>24 they -- they come up with multiple folds that</p> <p>25 we don't see. So that conclusion, I wouldn't</p> <p>26 agree.</p>
<p style="text-align: right;">531</p> <p>1 So those minor conclusions, I disagree.</p> <p>2 But the main conclusion, I agree. So I cannot</p> <p>3 say I agree with all conclusions.</p> <p>4 Q But, sir, if you agree with a single</p> <p>5 conclusion, don't the other conclusions perhaps</p> <p>6 influence that single conclusion?</p> <p>7 A Not necessarily. You can have multiple faults</p> <p>8 that got activated.</p> <p>9 Q But they -- but -- but they could influence</p> <p>10 that single conclusion that you agree with.</p> <p>11 You don't know because you're not the authors?</p> <p>12 A No. I -- I don't see the point. But ...</p> <p>13 Q So you accept one conclusion, but you don't</p> <p>14 necessarily agree with other conclusions in</p> <p>15 those papers?</p> <p>16 A Because those are -- those are related to, for</p> <p>17 instance, geological -- not "geological", but</p> <p>18 analysis done by using lower-resolution data in</p> <p>19 one of those papers.</p> <p>20 Q Right. So you're critical of their paper</p> <p>21 because they didn't have the data you had?</p> <p>22 A Right.</p> <p>23 Q Right. And so -- but you don't know what their</p> <p>24 conclusion would be if they had your data, do</p> <p>25 you?</p> <p>26 A I don't know, no.</p>	<p style="text-align: right;">532</p> <p>1 Q No.</p> <p>2 A But I think that they would --</p> <p>3 Q So it's convenient, sir, to pick the conclusion</p> <p>4 that helps you but to reject the other</p> <p>5 conclusions that might influence that</p> <p>6 conclusion that helps you?</p> <p>7 A No. No.</p> <p>8 Q That doesn't make sense, does it?</p> <p>9 A No, because, at the end, those are minor</p> <p>10 things. The big picture shows that it was --</p> <p>11 Q They're minor things?</p> <p>12 A They're minor, yeah.</p> <p>13 Q Oh. So -- so --</p> <p>14 D.P. LANGEN: He raised "minor".</p> <p>15 I'm asking the question.</p> <p>16 THE CHAIR: Mr. Fitzpatrick.</p> <p>17 P. FITZPATRICK: With respect, my</p> <p>18 friend is continually cutting off the witness</p> <p>19 in mid-answer. I would ask him to let the</p> <p>20 witness finish the answer before going on to</p> <p>21 the next question instead of cutting him off</p> <p>22 mid-sentence.</p> <p>23 Q D.P. LANGEN: Dr. Canales, you</p> <p>24 filed a copy of the 2023 Salvage et al. paper</p> <p>25 in response to IR 1.24. If we can go to that</p> <p>26 paper, please. It's in Exhibit 66.1, Tab C,</p>

<p style="text-align: right;">533</p> <p>1 PDF 75. Okay. Just scroll up a bit, please.  2 We're interested in the text under  3 "Introduction". Thank you.  4 Now, Dr. Canales, the -- the authors of  5 this paper state that -- looking at the first  6 sentence, it state -- at the -- in the first  7 sentence, "Introduction", they called the 1993  8 Davis and Frohlich framework a "seminal work".  9 Do you see that there?  10 A M. CANALES: Can -- where again?  11 Sorry.  12 Q First sentence under "Introduction".  13 A Oh, okay. Yes.  14 Q And where did you -- when did you first become  15 aware of the 1993 Davis and Frohlich framework?  16 A Long ago. Perhaps a decade ago.  17 Q If we move to the right-hand column, you'll see  18 that they reference Davis and Frohlich halfway  19 through the paragraph, and they say -- if we go  20 on to the next page, at the very top, it says  21 that: (as read)  22 The Davis and Frohlich methodology is  23 a simple yes or no binary qualitative  24 scheme.  25 Do you see that there?  26 A Yes.</p>	<p style="text-align: right;">534</p> <p>1 Q And is that how you applied it in the opening  2 statement and in your evidence --  3 A Can you repeat.  4 Q Is that how you applied the Davis and Frohlich  5 scheme, the framework? Did you apply it as yes  6 and no?  7 A I also include uncertainty: yes, no, and maybe.  8 Q "And maybe"?  9 A Right.  10 Q So you didn't necessarily apply it the way the  11 authors envisioned it?  12 A Well, that -- right. There was a variation.  13 Q Okay. And then if we move a little -- just  14 say -- we don't need to move the screen. Thank  15 you. But if we just look on the left-hand  16 margin and we move a little further down for  17 your eye -- thank you. Right there -- it  18 states: (as read)  19 More recently, updated qualitative  20 frameworks have been proposed that are  21 nonbinary in nature and, as such,  22 allow the expert a greater degree of  23 freedom when -- when to answer.  24 And the authors directly cite the 2019 Verdon  25 and Foulger frameworks. Do you see that there?  26 A Yes.</p>
<p style="text-align: right;">535</p> <p>1 Q Do you agree with that statement?  2 A I think you can also add a nonbinary approach  3 to the Davis and Frohlich, as I did.  4 Q When did you first become aware of the Foulger  5 et al. framework?  6 A That was last year.  7 Q Last year when?  8 A Yes. Well, as soon as it got published.  9 Q "As soon as it got published." Okay.  10 A I don't recall when it was published, but it  11 was early 2023.  12 Q And, sir, when did you become aware of the  13 Verdon et al. framework?  14 A I don't recall.  15 Q Sir, if we can go to Verdon -- Dr. Verdon's  16 reply evidence. It's Exhibit 81.9. We're  17 going to go to PDF page 48, please.  18 A LUNG: Mr. Langen, can you  19 repeat the exhibit number for us.  20 D.P. LANGEN: Sure. 81.9, PDF 48.  21 A LUNG: Would 81.8 --  22 D.P. LANGEN: Sorry.  23 A LUNG: -- be the public  24 version, if that's correct?  25 D.P. LANGEN: 81.8. Thank you.  26 And we're going to go to PDF 48, please.</p>	<p style="text-align: right;">536</p> <p>1 Q D.P. LANGEN: Dr. Canales, can you  2 tell me what this document is?  3 A M. CANALES: It reads: (as read)  4 A supplement for Bayesian inference,  5 elucidates fault-system anatomy and  6 resurgent earthquake induced by  7 continuing saltwater disposal.  8 Q Have you read this document?  9 A That particular one, I think it's -- skimmed  10 through it, really.  11 Q Sorry. Can you say that again.  12 A Skimmed through it.  13 Q This is the supplemental supplement to the 2023  14 Vasyura-Bathke et al. paper that's cited in  15 your reference?  16 A Right. I -- I read part of it, yes.  17 Q Yeah. When did you read it the first time?  18 A Again, last year.  19 Q Last year?  20 A When it got published. Maybe shortly after.  21 Q So you read the paper and the supplement?  22 A I read the paper; the supplement, some aspects  23 of it.  24 Q Sorry. "The supplement" when?  25 A Some aspects of it.  26 Q Some aspects. So you skimmed it?</p>

<p style="text-align: right;">537</p> <p>1 A I paid more attention to some parts of the 2 supplementary material.</p> <p>3 Q Now, Dr. Canales, you were asked to file a copy 4 of the Vasyura-Bathke paper in response to IR 5 1.25; correct?</p> <p>6 A I recall -- yeah, I guess so. I -- I would 7 have to --</p> <p>8 Q We can pull up the IR, if you'd like.</p> <p>9 A Yes.</p> <p>10 Q Okay. So let's go to Exhibit 66.1, please. 11 And I have to admit, I didn't think I'd 12 have a challenge to this, but if we can go to 13 IR 1.25, please. I don't know what PDF page 14 it's on. You have to go up. There we go. 15 Thank you.</p> <p>16 So you'll see, sir, in 1.25(a): (as read) 17 Please provide a copy of the 18 Vasyura-Bathke et al. 2023 paper. 19 That's the one that you say supports your -- 20 your findings. And then your response is a 21 copy of the Vasyura-Bathke et al 2023 paper, as 22 provided in Tab D.</p> <p>23 And if we can go to the bookmark and go to 24 Tab D, please. Just scroll down. So that's 25 the paper you filed?</p> <p>26 A Yes.</p>	<p style="text-align: right;">538</p> <p>1 Q Okay. And, actually, if we can go to page 102, 2 please. It's the last page. Thank you.</p> <p>3 You'll see on the right -- and this is the 4 last page in the exhibit. On the right side, 5 it says "additional information". It says: 6 (as read) 7 Supplementary information. The online 8 version contains supplemental -- 9 supplementary material available here. 10 Do you see that?</p> <p>11 A Yes.</p> <p>12 Q And you didn't attach the supplement when you 13 filed this paper, did you?</p> <p>14 A I don't recall so, no.</p> <p>15 Q Well, it's not there.</p> <p>16 A Well, no.</p> <p>17 Q Let's go to PDF 93 and 94. Oh. Let's go right 18 there. Thank you. Let's focus on the figure, 19 Figure 2. It says, "Saltwater injection and 20 seismicity". And it shows the first figure at 21 the top. If you can just scroll down a bit. 22 That's good. The first figure on the top shows 23 "stacked monthly injections". Do you see that, 24 sir?</p> <p>25 A Yes.</p> <p>26 Q And it shows three wells; correct?</p>
<p style="text-align: right;">539</p> <p>1 A Yes.</p> <p>2 Q Do you know what those wells are?</p> <p>3 A Yes.</p> <p>4 Q And what are they?</p> <p>5 A One is Obsidian well; the second one, it's the 6 Belloy well; and there is a third well which we 7 have not discussed which is in the same area, 8 but shallower, which is injected into the 9 Paddy-Cadotte Formation. It's around 10 300 metres deep.</p> <p>11 Q And how did you find out that those were those 12 wells? 'Cause they're not shown -- identified 13 in the body of the document.</p> <p>14 A Oh, they -- they have the same volumes as I -- 15 the same volumes that I manage.</p> <p>16 Q And so when Vasyura and Bathke concluded that 17 the events were induced, they did it on the 18 basis of stacked volumes more than the Obsidian 19 volumes; correct? That's what they're -- 20 that's what this shows us?</p> <p>21 A I would provide an alternative view of it. I 22 would say that they didn't have the resolution; 23 therefore, they include everything around it.</p> <p>24 Q Okay. But that's your view. You don't know. 25 You didn't talk to Vasyura and Bathke, did you?</p> <p>26 A No.</p>	<p style="text-align: right;">540</p> <p>1 Q No. So that's just your view. So they relied 2 on stacked volumes, correct, to make the 3 conclusion that they did?</p> <p>4 A No. They made the conclusions based on the 5 fault interpretation, and even in the paper, 6 they clearly say that in that area of the 7 Peace River Arch, there is compelling evidence 8 that suggests that the Leduc is in direct 9 contact with the basement. So there is an 10 implicitly -- an implication that the Obsidian 11 well is part of the story; however --</p> <p>12 Q But that's -- that's your view. You're -- 13 you're reading behind their pages?</p> <p>14 A No. They clearly say that in that area, the 15 Leduc Formation, it's in direct contact --</p> <p>16 Q No, but you're -- you're referring to the 17 Obsidian well, and they're referring to three 18 wells on injection volumes.</p> <p>19 A Oh, right. Right. Yes.</p> <p>20 Q You're reading behind when you start labelling 21 them, saying that the Obsidian well caused the 22 event.</p> <p>23 A The --</p> <p>24 Q The Obsidian well is included in the data.</p> <p>25 A Right.</p> <p>26 Q We can't disagree with that; right?</p>

<p style="text-align: right;">541</p> <p>1 A Right.</p> <p>2 Q So they -- they do not say the Obsidian well</p> <p>3 caused the event --</p> <p>4 A Not explicitly.</p> <p>5 Q -- they said "water injection".</p> <p>6 A Not explicitly, no.</p> <p>7 Q They don't say it implicitly. That's your</p> <p>8 view.</p> <p>9 A Well, implicitly, they say they're injecting</p> <p>10 into the Leduc; it's Obsidian well that's</p> <p>11 injecting into the Leduc.</p> <p>12 Q But they also include the Belloy well?</p> <p>13 A Again, my view is because they didn't have the</p> <p>14 high-resolution data, so they include</p> <p>15 everything. Both the Belloy and the other</p> <p>16 well, which is the Paddy-Cadotte, is just</p> <p>17 300 metres deep.</p> <p>18 Q So they relied on volumes that were being</p> <p>19 injected from 800 metres down to the depth of</p> <p>20 the Leduc?</p> <p>21 A Can you repeat. Sorry.</p> <p>22 Q In publishing their paper and concluding that</p> <p>23 the events were induced --</p> <p>24 A Right.</p> <p>25 Q -- they relied on injection volumes that were</p> <p>26 injected from 700 metres to the -- to the</p>	<p style="text-align: right;">542</p> <p>1 Leduc?</p> <p>2 A Again, the -- the view is that I think they</p> <p>3 didn't have the resolution.</p> <p>4 Q No. That's -- that's your view, and I'm just</p> <p>5 asking you what they said. They -- their paper</p> <p>6 says they stacked volumes, and they assessed</p> <p>7 those volumes to make their conclusions;</p> <p>8 correct? And they used three wells from</p> <p>9 700 metres to the Leduc; correct?</p> <p>10 A Yes.</p> <p>11 Q Okay. Mr. Kuleba. We'll get you to pull up</p> <p>12 Exhibit 57.01, please. I'm going to go to</p> <p>13 PDF 5. We'll go down to the bottom of the</p> <p>14 page, please. And we're interested in</p> <p>15 Footnote 3.</p> <p>16 And it says there that, in the course of</p> <p>17 considering the information provided to you,</p> <p>18 you asked whether the 13-11 well could have</p> <p>19 caused the seismic events at issue, and the</p> <p>20 information that was provided to you is</p> <p>21 entirely contained in the Decision Exhibit</p> <p>22 06.01; correct?</p> <p>23 A E. KULEBA: Yes, the answer</p> <p>24 provided to me is in 6.01.</p> <p>25 Q And from that footnote, it appears that you</p> <p>26 were told that a breadcrumb trail was required</p>
<p style="text-align: right;">543</p> <p>1 in order to attribute causation to the 13-11</p> <p>2 well; correct?</p> <p>3 A Yes. That's how it was explained to me.</p> <p>4 Q And it was Dr. Canales who explained it to you</p> <p>5 on March -- in the March 21st meeting. Fair?</p> <p>6 A Yes.</p> <p>7 Q And, Mr. Kuleba, at the time that you met with</p> <p>8 Dr. Canales on March 21st, two days before the</p> <p>9 EPO was issued, at that time there were members</p> <p>10 of the AER and AGS that were of the view that</p> <p>11 the 13-11 well should be included in the EPO;</p> <p>12 correct?</p> <p>13 A I'm not aware of those opinions.</p> <p>14 Q Let's pull up Exhibit 06.01, please. And we're</p> <p>15 going to go to PDF 15. Just scroll down a bit</p> <p>16 so -- there we go.</p> <p>17 So you'll recollect this exhibit,</p> <p>18 Mr. Kuleba, because we've been in it before.</p> <p>19 A Yes.</p> <p>20 Q So this is an email sent to you on March 21st,</p> <p>21 2023, at 8:48 from Ms. Cabot; correct?</p> <p>22 A Yes.</p> <p>23 Q And Ms. Cabot works for you?</p> <p>24 A Yes. She did at the time.</p> <p>25 Q She did. Okay.</p> <p>26 Now, if we move to -- if we move to the</p>	<p style="text-align: right;">544</p> <p>1 next page, please. Just go down a little bit</p> <p>2 more, please. Right there. Okay.</p> <p>3 There are some bullet points, and the very</p> <p>4 first one mentions the CNRL well. And we can</p> <p>5 agree that the CNRL well is the 13-11 well;</p> <p>6 correct?</p> <p>7 A Correct.</p> <p>8 Q And if we move to the fourth bullet, it states</p> <p>9 that: (as read)</p> <p>10 There are two additional Leduc wells</p> <p>11 within 25 kilometres.</p> <p>12 And that's within 25 kilometres of the Reno</p> <p>13 cluster; correct?</p> <p>14 A I believe that's what it means, yes.</p> <p>15 Q And those two Leduc wells are not the 13-11</p> <p>16 well nor the 14-18 well; correct?</p> <p>17 A Yes.</p> <p>18 Q So they're different wells?</p> <p>19 A Yes.</p> <p>20 Q And it says there that CLM was requesting data</p> <p>21 or information from the operators of those</p> <p>22 wells. Do you see that there?</p> <p>23 A Yes.</p> <p>24 Q And do you know that the data -- the data that</p> <p>25 was being requested, was it injection volumes?</p> <p>26 A I wouldn't be able to speak to exactly what</p>

<p style="text-align: right;">545</p> <p>1 data we requested.</p> <p>2 Q And the CLM was looking for that data within --</p> <p>3 for wells within 25 kilometres because they</p> <p>4 were concerned that perhaps those wells</p> <p>5 contributed? Is that a fair -- is that fair?</p> <p>6 A I don't have the additional context behind this</p> <p>7 bullet point. I wasn't in this meeting. So...</p> <p>8 Q Well, Dr. Canales, you were at this meeting.</p> <p>9 A M. CANALES: Can I see --</p> <p>10 Q Sure. We'll scroll up. Sorry. Other way.</p> <p>11 Stop there, please.</p> <p>12 You're referenced in one of these bullet</p> <p>13 points.</p> <p>14 Let's do it this way: Mr. Kuleba, can you</p> <p>15 undertake to tell us which two wells you were</p> <p>16 interested in, at 25 kilometres, in this email,</p> <p>17 and tell us whether at the time you thought --</p> <p>18 or AGS thought they were seismogenic?</p> <p>19 A E. KULEBA: I can -- yes, I can</p> <p>20 certainly look into further information on that</p> <p>21 bullet point.</p> <p>22 THE CHAIR: Okay. Can we</p> <p>23 capture that as Undertaking Number 2.</p> <p>24 B. KAPEL HOLDEN: Yes. So that will</p> <p>25 be Undertaking Number 2.</p> <p>26 And, Mr. Langen, can you just repeat what</p>	<p style="text-align: right;">546</p> <p>1 you said. I got --</p> <p>2 D.P. LANGEN: Sure.</p> <p>3 B. KAPEL HOLDEN: You're asking</p> <p>4 Mr. Kuleba --</p> <p>5 D.P. LANGEN: So in Exhibit 57 --</p> <p>6 sorry -- 06.01, at PDF page 16, fourth bullet,</p> <p>7 there's reference to two additional Leduc wells</p> <p>8 within 25 kilometres, and Mr. Kuleba has</p> <p>9 confirmed that those are within 25 kilometres</p> <p>10 of the Reno cluster, and they're not the 14-18</p> <p>11 well or the 13-11 well. And I'm asking him to</p> <p>12 confirm which wells they were and whether at</p> <p>13 the time they were considered to be</p> <p>14 seismogenic.</p> <p>15 B. KAPEL HOLDEN: Thank you. As</p> <p>16 mentioned, that will be Undertaking Number 2.</p> <p>17 D.P. LANGEN: Thank you.</p> <p>18 UNDERTAKING 2 - To review the</p> <p>19 reference to two additional Leduc</p> <p>20 wells within 25 kilometres in Exhibit</p> <p>21 06.01, PDF page 16, fourth bullet,</p> <p>22 and confirm which wells they were and</p> <p>23 whether at the time they were</p> <p>24 considered to be seismogenic</p> <p>25 Q D.P. LANGEN: Let's move on,</p> <p>26 Mr. Kuleba. Moving to the last bullet on that</p>
<p style="text-align: right;">547</p> <p>1 page. You'll see that the AER or AGS is</p> <p>2 questioning whether the 13-11 well contributed</p> <p>3 to the events in the EPO. Do you see that</p> <p>4 there? Do you agree?</p> <p>5 A E. KULEBA: Yes. It says:</p> <p>6 (as read)</p> <p>7 How confident are you that CNRL didn't</p> <p>8 contribute?</p> <p>9 Q So we can agree that at the time that CLM had</p> <p>10 not -- at that time, being on March 20th, 2023,</p> <p>11 we can agree that CLM had not ruled out</p> <p>12 determining that the 13-11 well and the 14-18</p> <p>13 well contributed to the events in the EPO;</p> <p>14 correct?</p> <p>15 A Yes, it comes that way.</p> <p>16 Q And there, actually, Dr. Canales, is the</p> <p>17 reference to you, that same bullet. You're</p> <p>18 attributed with the view that the 13-11 well is</p> <p>19 causing seismicity and that something should be</p> <p>20 done to prevent large events from happening as</p> <p>21 a result of the 13-11 well; correct?</p> <p>22 A We knew that that well was seismogenic, yes.</p> <p>23 It was causing the cluster around the well.</p> <p>24 Q And you were concerned about it?</p> <p>25 A Well, given that we got two 5s in Reno, I was</p> <p>26 concerned that that cluster would come up with</p>	<p style="text-align: right;">548</p> <p>1 something large as well.</p> <p>2 Q At that time, did you undertake a Davis and</p> <p>3 Frohlich assessment of the 13-11 well?</p> <p>4 A It was earlier. Earlier. We knew about that</p> <p>5 well before.</p> <p>6 Q But at that time, you didn't?</p> <p>7 A We -- we did it. We already assessed that well</p> <p>8 as seismogenic. We -- we knew it was already</p> <p>9 seismogenic.</p> <p>10 Q Let's move to the next page. If we just scroll</p> <p>11 up a little bit. Stop right there. Thank you.</p> <p>12 We're interested in the second bullet,</p> <p>13 starting with "Kelsey". That bullet states --</p> <p>14 and I quote: (as read)</p> <p>15 It's a long distance. 20 kilometres</p> <p>16 is significant. However, fluids can</p> <p>17 flow throughout these reefs and can</p> <p>18 flow without creating any of these</p> <p>19 nodal circles, but 20 kilometres seems</p> <p>20 like a long way to.</p> <p>21 Do you see that there?</p> <p>22 A I'm sorry, sir. Are you asking?</p> <p>23 Q I'll go with you, Mr. Kuleba, since you were</p> <p>24 the first to speak. Do you see that there?</p> <p>25 A Yes, it's there.</p> <p>26 Q And I understand in the statement, the</p>

<p style="text-align: right;">549</p> <p>1 reference to "nodal circles" means events that  2 would constitute breadcrumb -- a breadcrumb  3 trail. Is that fair?  4 A That would be my interpretation of it.  5 Q And this bullet is discussing fluid flow or  6 communication across the Leduc Formation from  7 the 13-11 well towards the location of the Reno  8 cluster; correct?  9 A Yes. This is -- was -- was captured in the  10 discussion.  11 Q Yeah. Let's move to the third-last bullet.  12 The text makes reference to pressure  13 associations between the 13-11 well and the  14 14-18 well. So at the time, the AER was  15 considering that there would be fluid flow or  16 pressure communication between these two wells;  17 correct? You wanted to measure bottomhole  18 pressures between the -- the CNRL or the 13-11  19 well and the Obsidian well, and you're  20 commenting -- someone is commenting about the  21 effectiveness of that. Fair?  22 A Someone is commenting, yes, about the  23 effectiveness of measuring bottomhole  24 pressures.  25 Q Between the two wells?  26 A Yes. It states "CNRL" and "Obsidian".</p>	<p style="text-align: right;">550</p> <p>1 Q Okay. And you would agree that that seems to  2 indicate that whoever was commenting there  3 thought there was communication between the two  4 wells. Fair?  5 A I -- I -- I cannot comment whether they thought  6 there was communication. They may have been  7 raising it as a question as part of scientific  8 debate as part of this meeting.  9 Q (As read)  10 Measuring bottomhole pressures and  11 associations between CNRL and Obsidian  12 wells may not be effective because  13 they have been injecting for such a  14 long time.  15 But it suggests that the idea, measuring  16 associations, may be helpful; correct?  17 A That may be what it's going to, yes.  18 Q Okay. And then let's look at -- let's look at  19 the bullet -- the front part of that bullet,  20 actually. So that's the two -- fourth bullet  21 up from the bottom. It says "Tyler says  22 include CNRL". Do you see that there?  23 A Yes, it says that.  24 Q That's Tyler Hauck?  25 A I'm guessing so, because his name is on the --  26 the --</p>
<p style="text-align: right;">551</p> <p>1 Q So we'll take --  2 A -- the top.  3 Q We'll take that subject to check?  4 A Yes.  5 Q Mr. Galloway, Mr. Hauck is one of the  6 co-authors of your papers; right?  7 A E. GALLOWAY: That's correct.  8 Q That same bullet goes on to say: (as read)  9 They are injecting into the Leduc.  10 There is seismicity. The model  11 includes it.  12 Do you see that there?  13 A That is what it says.  14 Q And we can assume that "they" are CNRL because  15 Tyler was referring to CNRL, the 13-11 well,  16 and the 13-11 well injects into the Leduc?  17 A Yes. I believe that's safe to assume there.  18 Q And the seismicity referenced there is in both  19 the Reno cluster and the north Heart cluster?  20 A I'm not sure what seismicity you're referring  21 to specifically.  22 Q The model referenced there is the model that  23 you relied on to issue the EPO?  24 A I don't know what model you're speaking to,  25 sir.  26 Q Well, if you look at that bullet again, and</p>	<p style="text-align: right;">552</p> <p>1 I'll read it out loud again: (as read)  2 Tyler says include CNRL. They are  3 injecting into the Leduc. There is  4 seismicity. The model includes it.  5 And I'm asking you what model that is. Is that  6 the same model that you used to issue the EPO?  7 A I did not use a model to use the EPO -- to  8 issue the EPO, sir.  9 Q So you don't know what model it is?  10 A T. SHIPMAN: I'm not -- I'm not  11 positive of this, what he's referring to, but  12 it might be the geologic model, the geologic  13 framework model.  14 Q Can I ask you this, Mr. Kuleba: At the time  15 that this discussion was happening, on  16 March 20th, 2023, just three days, two and a  17 half days before you issued the EPO, did the  18 AER or AGS contemplate issuing a regional order  19 to all disposal operators in the vicinity of  20 the Reno cluster or the three clusters that are  21 in debate in this proceeding?  22 A E. KULEBA: When I started  23 looking into what regulatory interventions  24 there could be when it was noted that the  25 seismic events may be induced on an email from  26 the 17th, I did contemplate what it would look</p>



553	<p>1 like if there was not clarity as to who was the 2 responsible party. 3 D.P. LANGEN: Mr. Chair, I note 4 the time. My eyes aren't very good. It's 5 12:10. Now would be a good time to break. 6 THE CHAIR: Okay. We'll take 7 our break now. 8 Before we break, just a reminder, 9 Mr. Fitzpatrick, while your panel is in 10 cross-examination, you can't be discussing 11 matters with them. It's more for their benefit 12 than yours. I know you know that. 13 We will resume at ten after 1:00. Thank 14 you, everybody. 15 (WITNESSES STAND DOWN) 16 17 PROCEEDINGS ADJOURNED UNTIL 1:10 PM 18 19 20 21 22 23 24 25 26</p>	554	<p>1 Proceedings taken at the Govier Hall, Calgary, 2 Alberta 3 4 December 2, 2024 Afternoon Session 5 6 A. Bolton The Chair 7 B. Zaitlin Hearing Commissioner 8 T. Stock Hearing Commissioner 9 10 B. Kapel Holden AER Counsel 11 O. Chijioke AER Counsel 12 A. Huxley AER Counsel 13 (Via Videocast) 14 A. Lung AER Staff 15 N. Hymers AER Staff 16 M. Rahimabadi AER Staff 17 18 P. Fitzpatrick For Regulatory Compliance 19 Branch 20 J. Allison For Regulatory Compliance 21 Branch 22 A. Hall For Regulatory Compliance 23 Branch 24 25 D.P. Langen For Obsidian Energy Ltd. 26 A. Barrington For Obsidian Energy Ltd.</p>
555	<p>1 A. Porco, CSR(A) Official Court Reporter 2 3 (PROCEEDINGS COMMENCED AT 1:11 PM) 4 THE CHAIR: Thank you. Please 5 be seated. 6 Whenever you're ready, Mr. Langen. 7 D.P. LANGEN: Thank you, 8 Mr. Chair. 9 ERIK KULEBA, CLAUDIO VIRUES, Previously 10 Affirmed 11 TODD SHIPMAN, MAURICIO CANALES, ELWYN GALLOWAY, 12 Previously Sworn 13 D.P. Langen Cross-examines the Regulatory 14 Compliance Branch Witnesses 15 Q D.P. LANGEN: Mr. Kuleba -- 16 A E. KULEBA: Yes. 17 Q -- during the CLM's opening statement, you 18 mentioned the new Directive 65. Do you 19 recollect that? 20 A Yes, I mentioned it. 21 Q And we provided you with an excerpt of 22 Directive 65 -- or to your counsel yesterday 23 morning. It's Aid Number 12, and I'm hoping to 24 discuss that with you. You've had time to 25 review this aid? 26 A Yes, I've looked through it. Directive 65 just</p>	556	<p>1 came out about three weeks ago, so I've gone 2 through what it is now. 3 Q Okay. Let's go to PDF page 4, please, of the 4 aid. If we can scroll down, please. Keep 5 going. Keep going. There we go. Right there. 6 Thank you. 7 So this is Hard Copy 423 of Directive 65, 8 and you'll see there's a title "4.1.8 Induced 9 Seismicity Potentially Related to Disposal 10 Wells". Do you see that there? 11 A Yes, I do. 12 Q And if we move to the next page. Right there. 13 Thank you. 14 There is a heading "4.1.8.1 General 15 Requirements". Do you see that there? 16 A Yes, I do. 17 Q Now, I'll focus you on the first sentence just 18 below that heading, and there it states, and I 19 quote: (as read) 20 The AER may, at its discretion, and 21 based on a review and analysis of data 22 associated with the observed seismic 23 events, determine an operating 24 disposal well to be seismogenic. The 25 seismogenic determination is initiated 26 either by the operator or the AER.</p>

<p style="text-align: right;">557</p> <p>1 Do you see that there?</p> <p>2 A Yes, I do.</p> <p>3 Q Now, clearly, given the EPO, the AER is of the</p> <p>4 view that Obsidian's 14-18 well is seismogenic,</p> <p>5 and the requirements I just pointed out in</p> <p>6 Directive 65 or that follow would apply to that</p> <p>7 well; correct?</p> <p>8 A It would apply to that well if we transferred</p> <p>9 the well under -- under -- to this new</p> <p>10 regulation, basically.</p> <p>11 Q Okay. And given the evidence on the record of</p> <p>12 this proceeding with respect to the 13-11 well,</p> <p>13 it's seismogenic, and so Directive 65 would</p> <p>14 apply to it; correct?</p> <p>15 A That is correct.</p> <p>16 Q Now, given the AER's evidence on the record in</p> <p>17 this proceeding, the 16-14 water disposal well,</p> <p>18 which injects to the Belloy Formation, is not</p> <p>19 seismogenic, and the requirements I just</p> <p>20 point -- the requirements in Directive 65 would</p> <p>21 not would apply to that well; is that correct?</p> <p>22 A I'm going to refer to Dr. Canales right away,</p> <p>23 but my understanding is, yes, the evidence we</p> <p>24 have and that was used in the appeal</p> <p>25 should -- has that -- the Belloy well is not</p> <p>26 seismogenic. So ...</p>	<p style="text-align: right;">558</p> <p>1 Q So Directive 65 would not apply to it?</p> <p>2 A Yes. At this time, yeah.</p> <p>3 Q Let's look at Bullets 3 and 4 on that page,</p> <p>4 Hard Copy 424. Those bullets indicate that:</p> <p>5 (as read)</p> <p>6 Any application for new fluid disposal</p> <p>7 wells or to amend the operating</p> <p>8 conditions of an existing disposal</p> <p>9 well requires an adduced seismic</p> <p>10 hazard assessment.</p> <p>11 Do you see that there?</p> <p>12 A Yes, that's what it says.</p> <p>13 Q And if we go to the next page, please. Just a</p> <p>14 little further down. Thank you.</p> <p>15 I'll direct you to Heading 4.1.8.2 titled</p> <p>16 "Seismic Hazard and Risk Assessments". Do you</p> <p>17 see that there?</p> <p>18 A Yes.</p> <p>19 Q You'll see, just above Bullet 10, it says:</p> <p>20 (as read)</p> <p>21 The goal of a seismic hazard</p> <p>22 assessment is to determine whether the</p> <p>23 proposed operation --</p> <p>24 THE COURT REPORTER: Sorry. Can you slow</p> <p>25 down, please.</p> <p>26 D.P. LANGEN: Sure. Sorry.</p>
<p style="text-align: right;">559</p> <p>1 THE COURT REPORTER: Thank you.</p> <p>2 Q D.P. LANGEN: It states there,</p> <p>3 just under the heading: (as read)</p> <p>4 The goal of a seismic hazard</p> <p>5 assessment is to determine whether the</p> <p>6 proposed operation will contribute to</p> <p>7 seismicity.</p> <p>8 Do you see that there?</p> <p>9 A E. KULEBA: Yes, that's what it</p> <p>10 says.</p> <p>11 Q And Bullet Number 10 says that: (as read)</p> <p>12 A seismic hazard assessment must be</p> <p>13 conducted within a 10-kilometre radius</p> <p>14 around the disposal well or a wider</p> <p>15 radius if directed by the AER.</p> <p>16 Correct?</p> <p>17 A Yeah, that's what it says.</p> <p>18 Q And that's regardless of if -- that's</p> <p>19 regardless of if the well itself has been</p> <p>20 determined to be seismogenic; correct?</p> <p>21 A Yes. If they're -- as per this regulation, if</p> <p>22 they're submitting an amendment -- or it</p> <p>23 wouldn't be a new application. Basically,</p> <p>24 because it's an existing well, they would need</p> <p>25 to do this assessment.</p> <p>26 D.P. LANGEN: Can I have an</p>	<p style="text-align: right;">560</p> <p>1 exhibit number, please, Mr. Chair.</p> <p>2 P. FITZPATRICK: With respect to</p> <p>3 that, Mr. Chair, my friend and I had some</p> <p>4 communication prior to today's proceedings</p> <p>5 about this exhibit as well. The portion</p> <p>6 of -- of 4.1.8 that's been provided actually is</p> <p>7 not complete. There's one or two pages that</p> <p>8 are missing. So, similarly, I'd ask my friend</p> <p>9 to -- to, in due course, provide a complete</p> <p>10 copy.</p> <p>11 D.P. LANGEN: Did you want a</p> <p>12 complete copy of 4 point -- the section that I</p> <p>13 didn't provide him?</p> <p>14 P. FITZPATRICK: Yeah. Just the</p> <p>15 portions of 4.1.8 that aren't in there.</p> <p>16 D.P. LANGEN: Happy to do that,</p> <p>17 sir. What we'll do, we'll get an exhibit</p> <p>18 number, and then we'll get Mr. Lung an amended</p> <p>19 aid with that section that Mr. Fitzpatrick</p> <p>20 wants added.</p> <p>21 THE CHAIR: Okay. Thank you.</p> <p>22 Ms. Kapel Holden, does that work for us? I</p> <p>23 think so.</p> <p>24 B. KAPEL HOLDEN: It does.</p> <p>25 So Aid to Cross Number 12 from Obsidian is</p> <p>26 the AER Directive 65, "Resource Applications</p>

<p style="text-align: right;">561</p> <p>1 for Oil &amp; Gas Reservoirs", release date of  2 effective -- release and effective date is  3 November 12th, 2024. And the excerpt for that  4 document is Section 4.1.8, and the exhibit  5 number for that will be 105.0.  6 D.P. LANGEN: Thank you.  7 EXHIBIT 105.0 - Section 4.1.8 of AER  8 Directive 065 - was Obsidian aid to  9 cross 12  10 Q D.P. LANGEN: If we can pull up  11 Exhibit 104, which was Aid to Cross Number 13  12 that I spoke with the Panel about earlier,  13 please. And we'll go down to PDF 2, please.  14 So, Dr. Canales, we had a conversation  15 about this exhibit. Do you remember?  16 A M. CANALES: Yes.  17 Q Okay. And -- and I apologize. I didn't have  18 time to look at the transcripts from Friday. I  19 just want to see if -- if you can confirm  20 something for me.  21 So if we look at this -- this slide, so  22 PDF 2 of the exhibit, which is the annotated  23 Slide 5 from Exhibit 98, and I look -- direct  24 your attention to Questions 1 and 2 --  25 A Right.  26 Q -- you responded "maybe"?</p>	<p style="text-align: right;">562</p> <p>1 A Right.  2 Q If we -- and this is from your assessment in  3 November 2022; correct?  4 A Yes.  5 Q Okay. Thank you.  6 And if we can go to PDF -- the next PDF,  7 PDF 3, which is Slide 12 of Exhibit 98 but  8 annotated. And when we look back at 1 and 2  9 again, now they're "yes", and my understanding  10 is that the primary reason, if not the only  11 reason, they are "yes" is because you had the  12 nodal -- the first tranche of nodal array data;  13 is that fair?  14 A Let me read the question.  15 Q Sure.  16 A So the first question: (as read)  17 Are the events in an area where  18 earthquakes are not typically  19 frequent? [Which is related with the  20 second one.] Has there been an  21 increase in the frequency of  22 earthquakes in this region?  23 The nodal array was critical, but the other  24 critical piece was the persistency of  25 seismicity by March 2023. We recorded over  26 245 events, if that's the number. That was the</p>
<p style="text-align: right;">563</p> <p>1 piece of evidence that before even getting the  2 nodal -- nodal array data made us believe that  3 it was an induced case.  4 Q Okay. Thank you.  5 Dr. Canales, we'll pull up Exhibit 06.02,  6 which is the supplemental information of CLM.  7 We'll go to PDF 6, please. PDF 7. Apologies.  8 Thank you.  9 Now, this shows the three earthquake  10 clusters in the Peace River area; correct?  11 A Yes.  12 Q Okay. And to get our bearings, Cluster 3 is  13 the Reno cluster; correct?  14 A Yes.  15 Q And Cluster 2 is the North Heart cluster, which  16 is in proximity to the 13-11 Leduc well;  17 correct?  18 A Yes.  19 Q Okay. And Cluster 1 is known as the North  20 Peace River cluster; correct?  21 A Yes.  22 Q And in November 2022, at the time of the first  23 event, the Reno cluster, the first event in the  24 Reno cluster, AGS assumed Cluster 1 to be of  25 natural origin; correct?  26 A Yes.</p>	<p style="text-align: right;">564</p> <p>1 Q And when AGS says it "assumed", I take that to  2 mean that it had not analyzed the cluster to  3 determine it was not induced?  4 A Can you repeat?  5 Q Sure. When you say that you assumed that  6 Cluster 1 was not induced, I take that to mean  7 that you had not analyzed the cluster to  8 determine if it was -- was or was not induced?  9 A The initial data from that cluster was -- was  10 not sufficient. Given that in that tectonic  11 setting there has been natural seismicity, it  12 was assumed that it was natural; however,  13 we -- after that, right, all of the seismicity,  14 we're conducting research on that cluster.  15 Q You say now you're conducting research on that  16 cluster?  17 A Yes.  18 Q And why did AGS -- actually, when did you start  19 that research on that cluster?  20 A Well, we had some -- we had some initial  21 thoughts about it before the Reno cluster in  22 November 2022; however, the most proactive, I  23 would say, research started in the summer of  24 2023.  25 Q And what was the prompt for that analysis?  26 A Well, we wanted to understand if that was not</p>

<p style="text-align: right;">565</p> <p>1 natural and if it was induced, right, then  2 there are some implications, certainly.  3 Q Okay. And who's performing the analysis?  4 A Our team at the AGS.  5 Q Okay. So you're heavily involved?  6 A Yes.  7 Q Okay. And when do you anticipate that analysis  8 is going to be complete?  9 A Next year. Early next year.  10 Q So just so I understand the timeline, you  11 commenced your analysis when exactly?  12 A Well, we started the high-resolution data  13 collection in -- in the summer, the  14 collection -- just the -- the collection of  15 data in November 2023 -- sorry. November --  16 no, summer 2023.  17 Q Summer 2023 collecting --  18 A Right.  19 Q -- data. So -- and then have you got some of  20 that data already?  21 A We collected it, yes. We have it.  22 Q And now you're analyzing it?  23 A We're processing it, yes.  24 Q Okay. So summer 2023 you got the data?  25 A Right.  26 Q And when -- we're now past summer 2024. You're</p>	<p style="text-align: right;">566</p> <p>1 analyzing it?  2 A Yes.  3 Q So it's going to take you 16 months, 18 months  4 to analyze that data and --  5 A Considering that we have other work, yes.  6 Q Okay. Let's -- looking at the map again that's  7 on the screen, Exhibit 06.02, PDF 7. What's  8 the industrial activity that's close to  9 Cluster 1?  10 A You have -- the closest is water disposal. I  11 think there are also some abandoned wells. But  12 the close -- the closest, what I would say is  13 suspected, would be disposal, yes.  14 Q Disposal wells?  15 A Right.  16 Q Okay. And those disposal wells are 20,  17 25 kilometres away?  18 A Not precisely. The periphery of that cluster,  19 just using the regional data, put those wells  20 close to 10 kilometres.  21 Q 10 kilometres?  22 A However -- however, we believe that all of the  23 regional data is displaced towards the  24 southwest. So if we have higher resolution  25 data, I believe those earthquakes are going to  26 be closer to those disposal wells, but --</p>
<p style="text-align: right;">567</p> <p>1 Q But -- but you don't know?  2 A I don't know. But I -- I have compelling  3 reasons to believe they're going to move.  4 Q But they haven't moved yet?  5 A Well, we're doing the analysis.  6 Q But they have not moved yet?  7 A Those particular ones, no.  8 Q Okay.  9 A The other ones, they did.  10 Q And so you said the periphery is within 10, but  11 if we go to where the dense events are  12 happening, what's the distance, 20 kilometres?  13 A Yeah. They're about 15 kilometres. Yeah.  14 Maybe 20.  15 Q Okay. So 20? If we --  16 A Yeah.  17 Q -- look at the screen here -- this is your  18 evidence.  19 A Yeah. You --  20 Q The closest disposal activity, 20 kilometres  21 away.  22 A From the centroid.  23 Q So the range is -- from the centre of the  24 quake?  25 THE COURT REPORTER: Sorry. One at a  26 time, please.</p>	<p style="text-align: right;">568</p> <p>1 D.P. LANGEN: Sorry.  2 Q D.P. LANGEN: From the centre of  3 the quake is 20 kilometres?  4 A M. CANALES: From the centroid,  5 yes.  6 Q Okay. Now, Dr. Canales, in your evidence you  7 cite the 2023 Schultz paper indicating that it  8 supports your conclusions in reaching -- in  9 concluding that the Reno cluster is induced;  10 correct?  11 A Can you repeat the -- what paper? Sorry.  12 Q The Schultz 2023 paper.  13 A Yes.  14 Q Yeah. And your -- you cite it as -- as  15 supporting your conclusions about the Reno  16 cluster --  17 A Right.  18 Q -- correct?  19 A Yes.  20 Q And you would agree that the authors of the  21 2023 Schultz paperwork are of the view that the  22 North Peace River cluster, or Cluster Number 1,  23 that's on the screen is induced; correct?  24 A Yes.  25 Q And their view is that it's induced by water  26 disposal; correct?</p>

<p style="text-align: right;">569</p> <p>1 A Yes.</p> <p>2 Q So when the authors of the Schultz paper in</p> <p>3 2023 that you rely on conclude that the North</p> <p>4 Peace River cluster is induced, are they</p> <p>5 speculating?</p> <p>6 A They did an analysis, and they reached a</p> <p>7 conclusion.</p> <p>8 Q And do you accept that analysis and their</p> <p>9 conclusions?</p> <p>10 A I think it can be refined. That's what we're</p> <p>11 doing.</p> <p>12 Q You're aware, Dr. Canales, that in 2016,</p> <p>13 Anderson and Eaton published a paper indicating</p> <p>14 that the North Peace River cluster was induced;</p> <p>15 correct?</p> <p>16 A I think it was not a paper. It was a</p> <p>17 presentation.</p> <p>18 Q Okay. My -- I stand corrected.</p> <p>19 A I learned about that after.</p> <p>20 Q You've heard about that after?</p> <p>21 A After all of the ...</p> <p>22 Q After the evidence?</p> <p>23 A Not after the evidence. After March 2023. I</p> <p>24 learn about that presentation after.</p> <p>25 Q So when you embark on an assessment of whether</p> <p>26 or not seismicity is induced or not, do</p>	<p style="text-align: right;">570</p> <p>1 you -- do you do a literature search? Do</p> <p>2 you --</p> <p>3 A I do, yes.</p> <p>4 Q Okay. Now, when Anderson and Eaton in 2016</p> <p>5 concluded that the North Peace River cluster</p> <p>6 was induced, were they speculating?</p> <p>7 A Again, that was not a paper. It was a</p> <p>8 presentation.</p> <p>9 Q Sure, presentation. When they reached that</p> <p>10 conclusion --</p> <p>11 A I --</p> <p>12 Q -- were they speculating?</p> <p>13 A I would like to see the presentation, which I</p> <p>14 didn't see --</p> <p>15 Q So --</p> <p>16 A -- to have a better idea of what they did.</p> <p>17 Q Okay.</p> <p>18 A I mean, what they show in that abstract was not</p> <p>19 the entire presentation, which -- I would like</p> <p>20 to see it before ...</p> <p>21 Q Now, Mr. Kuleba, if -- if you can pull up</p> <p>22 Exhibit 6 -- 06.01, the record of</p> <p>23 decision-maker. That's the present -- we're</p> <p>24 going to go to PDF 19 initially just so we can</p> <p>25 get our bearings. Thank you.</p> <p>26 So this is the presentation again. We've</p>
<p style="text-align: right;">571</p> <p>1 been here many times. But just to confirm,</p> <p>2 this is the one that -- that Dr. Canales</p> <p>3 presented to you in the meeting on March 20th,</p> <p>4 I think, or 21st. I might not have the right</p> <p>5 date, but in or around there.</p> <p>6 A E. KULEBA: Yes.</p> <p>7 Q Okay. Thank you.</p> <p>8 Let's go to PDF 27, please.</p> <p>9 Now, on this page, it outlines that in</p> <p>10 December 2022, after the November event, AGS</p> <p>11 deployed a seismic nodal array to collect data</p> <p>12 over 35 days. Do you see that there?</p> <p>13 A Yes.</p> <p>14 Q And that's the first round of nodal array data</p> <p>15 that you're referring to in your evidence,</p> <p>16 Dr. Canales?</p> <p>17 A M. CANALES: Can you repeat.</p> <p>18 Sorry.</p> <p>19 Q Sure. The nodal array data that's referred to</p> <p>20 in the first bullet --</p> <p>21 A Yes, is the first round.</p> <p>22 Q That's the first round? Okay.</p> <p>23 A Yes.</p> <p>24 Q Thank you.</p> <p>25 The slide goes on to say, Mr. Kuleba, and</p> <p>26 state that the main goal of using the seismic</p>	<p style="text-align: right;">572</p> <p>1 node area was to obtain high-resolution data to</p> <p>2 map, and I quote: (as read)</p> <p>3 Any potential link between the</p> <p>4 disposal activity in the area and the</p> <p>5 mainshock events in the basement.</p> <p>6 Do you see that there?</p> <p>7 A E. KULEBA: Yes, that's what it</p> <p>8 says.</p> <p>9 Q And that was your understanding when it was</p> <p>10 presented to you?</p> <p>11 A Yes. My understanding was that the nodal array</p> <p>12 was to provide, potentially, evidence as to if</p> <p>13 there was a -- a link to an activity in the</p> <p>14 area.</p> <p>15 Q And the slide goes on to state that: (as read)</p> <p>16 The nodal array data has been used</p> <p>17 successfully -- that nodal array data</p> <p>18 generally has been used successfully</p> <p>19 to link injection activity to seismic</p> <p>20 events and to confirm induced</p> <p>21 seismicity.</p> <p>22 Do you see that there?</p> <p>23 A Yes, I do.</p> <p>24 Q Finally, it's -- the slide says that</p> <p>25 Nanometrics is a third party processing the</p> <p>26 first round of seismic nodal array. Do you see</p>

<p style="text-align: right;">573</p> <p>1 that there?</p> <p>2 A Yes.</p> <p>3 Q Let's go to the next page, please. It's PDF</p> <p>4 28. And it's titled "High-Resolution</p> <p>5 Catalogue". Do you see that there?</p> <p>6 A Yes.</p> <p>7 Q And the figures that are shown on that page are</p> <p>8 based on the processing work that Nanometrics</p> <p>9 did on the first round of nodal array data;</p> <p>10 correct?</p> <p>11 A M. CANALES: If I may clarify,</p> <p>12 it's the one on the right.</p> <p>13 Q The one on the right. Okay. Thank you.</p> <p>14 A Yes. The one on the left is a regional array.</p> <p>15 Q Okay. Thank you, sir.</p> <p>16 Now, the one on the right, the Nanometrics</p> <p>17 data you got in -- on March 16th, 2023 -- does</p> <p>18 that sound --</p> <p>19 A We got the results, yes, in -- March 17th.</p> <p>20 Yes.</p> <p>21 Q 17th. Okay.</p> <p>22 Let's move to the next page. This is PDF</p> <p>23 29. The title is "Model 1: Results Using Grid</p> <p>24 Search Method (Reno Velocity Model)". Do you</p> <p>25 see that there, Mr. Kuleba?</p> <p>26 A E. KULEBA: Yes, I do.</p>	<p style="text-align: right;">574</p> <p>1 Q And the figures that are shown on that page are</p> <p>2 based on the processing work that Nanometrics</p> <p>3 did for the first round of nodal array data;</p> <p>4 correct?</p> <p>5 A Yes, that's my understanding.</p> <p>6 Q And the first figure on the left shows a map</p> <p>7 using the locations and the events using long</p> <p>8 and lat, longitude and latitude. Agreed?</p> <p>9 A Yes, the map view on the left.</p> <p>10 Q And the two figures on the right show the</p> <p>11 depths of the events; correct?</p> <p>12 A Yeah.</p> <p>13 Q Let's move to PDF 30. Next page, please.</p> <p>14 Thank you.</p> <p>15 This has the same title as the earlier</p> <p>16 slide, and the figures are -- that are shown on</p> <p>17 that page are based on the processing work that</p> <p>18 Nanometrics did on the first round of nodal</p> <p>19 array data; correct?</p> <p>20 A Yes, that's my understanding.</p> <p>21 Q And these two figures are 3D views of the</p> <p>22 events using both longitude and latitude and</p> <p>23 depth; correct?</p> <p>24 A Yes.</p> <p>25 Q And, Dr. Canales, the figures that we've been</p> <p>26 discussing show the locations of the seismic</p>
<p style="text-align: right;">575</p> <p>1 event -- events, or hypocentres, recorded by</p> <p>2 the nodal array; correct?</p> <p>3 A M. CANALES: Yes.</p> <p>4 Q Okay. Now, Mr. Kuleba, if we look at this</p> <p>5 page, PDF 30, do you see two clusters there?</p> <p>6 A E. KULEBA: Yes, it appears that</p> <p>7 way, specifically more on the view on the</p> <p>8 right.</p> <p>9 Q The view on the right. Fair.</p> <p>10 And the clusters are structures, east and</p> <p>11 west as labelled?</p> <p>12 A Yes, as on -- as on -- on the left there, yeah.</p> <p>13 Q Now, Mr. Kuleba, if you can pull up your notes</p> <p>14 from that meeting where Dr. Canales presented</p> <p>15 this presentation to you. That's at PDF 37 of</p> <p>16 this exhibit, 06.01, please.</p> <p>17 You'll see in the fourth bullet down -- so,</p> <p>18 actually, we'll just take a step back just to</p> <p>19 help everyone in the room. These are your</p> <p>20 notes that you typed after or during the</p> <p>21 meeting with Dr. Canales; is that fair?</p> <p>22 A Yes.</p> <p>23 Q Okay. And the time stamp is 9:49 AM. Is that</p> <p>24 the time that you -- you wrote these notes, or</p> <p>25 is that the time you met with Dr. Canales?</p> <p>26 A At -- that captures the time I create the tab</p>	<p style="text-align: right;">576</p> <p>1 in the OneNote. So ...</p> <p>2 Q I'm chuckling, sir, because I admire</p> <p>3 your -- you can see I'm using paper. So good</p> <p>4 on you. You might have -- be able to teach me</p> <p>5 a few things.</p> <p>6 So if we focus on the fourth bullet, you</p> <p>7 state, and I quote: (as read)</p> <p>8 Nodal data showed two structures.</p> <p>9 See that there?</p> <p>10 A Yes.</p> <p>11 Q And those are the two clusters or structures we</p> <p>12 were just discussing, west and east; correct?</p> <p>13 A Yes, I believe that's what I had.</p> <p>14 Q And the next bullet states: (as read)</p> <p>15 Nodal array key evidence locations and</p> <p>16 depth align with the Leduc formation</p> <p>17 well at 18-082-17 W5.</p> <p>18 Do you see that there?</p> <p>19 A Yes, I do.</p> <p>20 Q And you state in the next bullet that the nodal</p> <p>21 array data points to one licensee, Obsidian.</p> <p>22 Do you see that there?</p> <p>23 A Yes.</p> <p>24 Q And the nodal array data obviously is the data</p> <p>25 that we were just discussing in those charts.</p> <p>26 Fair?</p>

<p style="text-align: right;">577</p> <p>1 A Yeah. The -- the pictures, yeah.</p> <p>2 Q Yeah.</p> <p>3 A Yeah.</p> <p>4 Q If we can go to Exhibit 06.02, please. And</p> <p>5 we're interested in PDF 44. Yeah. We're where</p> <p>6 we need to be.</p> <p>7 Now, Dr. Canales, I'll direct you to the</p> <p>8 email that's in the centre of the page. You've</p> <p>9 just got to scroll up a little bit, actually.</p> <p>10 Scroll up a little bit, please. That's good.</p> <p>11 Thank you. Actually, a little down. I just</p> <p>12 want to get the date. Thank you.</p> <p>13 So you'll see that there's an email dated</p> <p>14 March 13th, 2023, at 2:22 PM from -- and I'm</p> <p>15 not going to attempt to pronounce it -- and I</p> <p>16 apologize to this individual -- this person's</p> <p>17 name, but it's spelled E-S-M-A-E-L-I-Z-A-D-E-H.</p> <p>18 Do you see that there?</p> <p>19 A M. CANALES: Yes, I see the</p> <p>20 email.</p> <p>21 Q And that individual works for Nanometrics and</p> <p>22 was involved in the Nanometrics processing of</p> <p>23 the first round of nodal data?</p> <p>24 A Yes.</p> <p>25 Q Okay. And in this email, Nanometrics is</p> <p>26 outlining how they did an investigation of the</p>	<p style="text-align: right;">578</p> <p>1 first round of nodal data -- data provided to</p> <p>2 them, and they had some concerns. Do you see</p> <p>3 that there?</p> <p>4 A Yes.</p> <p>5 Q If we can move to PDF 42. Now, the email</p> <p>6 thread continues, and there's an email dated</p> <p>7 March 16th right at the top of the page at</p> <p>8 11:03 AM from Mr. Javad Yusifbayov of the AGS.</p> <p>9 Do you see that there? Just if we scroll down</p> <p>10 a little bit. Right there. Thank you.</p> <p>11 Do you see that there?</p> <p>12 A Yes, I see it.</p> <p>13 Q And do you work with Mr. Yusifbayov?</p> <p>14 A Yes.</p> <p>15 Q And in that mail -- email -- sorry -- he</p> <p>16 requests that Nanometrics provide the catalogue</p> <p>17 containing the first round of nodal array data,</p> <p>18 and I quote: (as read)</p> <p>19 Even with the wrong magnitudes and not</p> <p>20 very accurate locations and depth, it</p> <p>21 would be nice to get some preliminary</p> <p>22 data.</p> <p>23 Do you see that there?</p> <p>24 A I see it, yes. I should mention, though, that</p> <p>25 when the catalogue was provided, there were</p> <p>26 issues with the magnitudes that were after</p>
<p style="text-align: right;">579</p> <p>1 solved, but the depths -- well, after -- it was</p> <p>2 clear that the depth was appropriate given the</p> <p>3 multiple models they show at the time.</p> <p>4 Q Now, this is the same date as the second</p> <p>5 seismic event in the --</p> <p>6 A Right.</p> <p>7 Q -- 14-18 well; correct? Okay.</p> <p>8 A Right.</p> <p>9 Q So clearly something happened. You guys wanted</p> <p>10 to get the nodal data to do an analysis. Fair?</p> <p>11 A They promised us -- to give us the data by</p> <p>12 early March. So it was mid-March, and we were</p> <p>13 still waiting for it. I think it was the same</p> <p>14 day -- yes, the same day the 5.1 happened. And</p> <p>15 we reached them back, just asking for giving us</p> <p>16 the data that was promised earlier -- the</p> <p>17 process data, I should say.</p> <p>18 Q Okay. And if we move to the next page, please.</p> <p>19 If we can just scroll up a little bit more.</p> <p>20 Sorry. We'll go to 41. My mistake. Right</p> <p>21 there. Thank you. That's perfect.</p> <p>22 There's an email there dated March 17th at</p> <p>23 1:46 from Marc Lambert of Nanometrics to</p> <p>24 Mr. Yusifbayov of the AGS. Do you see that</p> <p>25 there?</p> <p>26 A Yes.</p>	<p style="text-align: right;">580</p> <p>1 Q And, in this email, Mr. Lambert attached the</p> <p>2 catalogues that Mr. Yusifbayov requested the</p> <p>3 day prior; correct?</p> <p>4 A Yes.</p> <p>5 Q And he also attached a PowerPoint presentation</p> <p>6 prepared by Nanometrics; correct?</p> <p>7 A Right.</p> <p>8 Q And in the second paragraph of this email, he</p> <p>9 states -- Mr. Lambert states, first sentence:</p> <p>10 (as read)</p> <p>11 We also computed event magnitudes and</p> <p>12 ground motion parameters. Note that</p> <p>13 these values are not expected to be</p> <p>14 accurate because of the issues we</p> <p>15 encountered with the sensor response</p> <p>16 information.</p> <p>17 Do you see that there?</p> <p>18 A Yes. They also mentioned that the: (as read)</p> <p>19 Amplitude issues do not affect event</p> <p>20 location.</p> <p>21 And we were aware of that.</p> <p>22 Q You -- sorry. You're -- you're anticipating</p> <p>23 where I'm going, and that's okay. But I just</p> <p>24 want to be clear. He does indicate. He says:</p> <p>25 (as read)</p> <p>26 However, these amplitude issues do not</p>

<p style="text-align: right;">581</p> <p>1 affect event location, so long -- lon, 2 lat, depth, and origin times of events 3 are accurate. 4 Do you see that there? 5 A Yes. 6 Q So there were issues -- amplitude issues, but 7 the location -- the hypocentre locations 8 according to Nanometrics were accurate? 9 A Yes. 10 Q Okay. Now, Mr. Kuleba, when you met with 11 Dr. Canales on March 21st, and he stepped 12 through the presentation that I just went to 13 with those graphics which showed the locations 14 and the hypocentres of the seismic events in 15 the first round of nodal array data, did he 16 tell you that there were amplitude issues with 17 the data? 18 A E. KULEBA: I don't recall that, 19 no, and it's not in my notes. 20 Q Did he tell you there were any problems with 21 the Nanometrics data before you issued the EPO? 22 A No, not that I'm -- not that I'm aware of or 23 recall. 24 Q Now, Dr. Canales, there were other issues with 25 the Nanometrics' processing of the first round 26 of nodal data beyond just amplitude issues;</p>	<p style="text-align: right;">582</p> <p>1 correct? 2 A M. CANALES: The issue was that 3 the amplitude that the nodes provide are volts, 4 and they assume they were merely volts. So the 5 issue with the amplitude is that they were 6 calculating the wrong magnitude, but everything 7 else, the location was appropriate -- was 8 appropriate. 9 There were other issues with the results, 10 but not related to the data, per se, but to the 11 velocity model that caused some artifacts that 12 are mentioned in the -- in the reports. 13 Q But the velocity models are used to develop the 14 depth of those -- the locations of those 15 hypocentres; correct? 16 A Right. Right. 17 Q And those velocity models then -- sorry -- and 18 we -- we're splitting hairs, and that's fine, 19 but the reality is that the figures that you 20 had presented showed hypocentres that were not 21 in the locations that they were actually 22 because of the velocity model; correct? 23 A They are -- in the big picture, they are right. 24 There are some -- okay. A velocity model has 25 many layers. It seems that a layer where we 26 had a drastic change was causing issues but</p>
<p style="text-align: right;">583</p> <p>1 just that particular layer where we see the 2 linear -- the linear planes. Otherwise, 3 ignoring the linear planes, the rest of the 4 data seems to be right. 5 Q Okay. I think we're two ships passing in the 6 night, sir. The hypocentres that were 7 shown -- let's -- let's do it this way. If we 8 can have -- if we can go back to PDF 29, 9 please -- sorry -- 06.01, 29. 10 So these are the figures we're talking 11 about earlier? 12 A Yes. 13 Q This is in the presentation you gave Mr. Kuleba 14 on March 21st -- 15 A Yes. 16 Q -- 2023? 17 A Yes. 18 Q Okay. This data is the Nanometrics' first 19 round process nodal data shown here? 20 A Yes. 21 Q Using a velocity model that was flawed; 22 correct? 23 A It was not flaw. It was -- it has some minor 24 issues. 25 Q Had some artifacts; correct? 26 A Right.</p>	<p style="text-align: right;">584</p> <p>1 Q Okay. And as a result of those artifacts, you 2 reprocessed that data, and the depths changed; 3 correct? 4 A What changed was that the linear planes were 5 not there anymore. 6 Q And what are you referring to when you say 7 "linear planes"? 8 A Well, if you see -- for instance, the figure on 9 the middle, you see that around, maybe, 1.8 10 kilometres, there is a lineament -- like, a 11 plane that we knew right away was an artifact. 12 Q So you -- you're saying that you knew that this 13 linear plane that's shown here is not correct 14 at -- in -- on March 21st? 15 A Yeah. It should collapse. It should -- it 16 should not be a line. It should be something 17 that follows the same pattern of the other 18 clusters. 19 Q And then you had that data ultimately 20 reprocessed. So this is March 21st, 2023 -- 21 A Right. 22 Q -- right? 23 And you had it reprocessed, and you got it 24 done in July -- it was finally done in 25 July 2024; correct? 26 A I would have to recall -- yeah. The latest one</p>



<p style="text-align: right;">585</p> <p>1 was -- we got all of the information in 2 July 2024. 3 Q July 2024. 4 A From Nanometrics. From our -- okay. The AGS 5 started to reprocess the data as well, and that 6 might have been earlier, late 2023, that we 7 solved that issue of the -- of the artifact. 8 Q Late 2023, you solved it? 9 A Right. 10 Q Okay. 11 A Right. 12 Q Mr. Kuleba, when Dr. Canales presented these 13 figures to you, did he tell you that there was 14 a problem with them with respect to the linear 15 feature that's shown? 16 A E. KULEBA: I don't recall or 17 have anything in my notes. 18 Q If he had told you that there was a problem, 19 would you have suspected perhaps that the data 20 wasn't -- you know, you would question whether 21 the data was accurate and perhaps you shouldn't 22 move forward? 23 A Yes, I likely would have asked further 24 questions. 25 Q Okay. And you didn't ask those further 26 questions. Fair?</p>	<p style="text-align: right;">586</p> <p>1 A It -- 2 Q 'Cause you have no recollection. So I'm 3 assuming you would have -- this is a pretty 4 serious issue, isn't it, Mr. Kuleba? You're 5 about -- 6 A Yes. 7 Q -- to issue an EPO. Serious issue -- 8 A Yeah. 9 Q -- in the public interest? 10 A Yeah. I would have asked further questions. 11 Q Okay. And so you would have asked. So that 12 probably gets you to the point that you weren't 13 aware that there were problems with the data. 14 Fair? 15 A Fair. 16 Q You'll agree -- now, Mr. Kuleba, you're aware 17 that CLM's evidence extensively cites a 2023 18 paper authored by Ryan Schultz and other 19 supported -- for the proposition that it 20 supports CLM's conclusions in respect to the 21 cause of the induced seismicity in the Reno 22 cluster. You're aware of that? 23 A Sorry. Pardon? Could you -- 24 Q Sure. 25 A -- ask that again. It's a lengthy question. 26 Sorry.</p>
<p style="text-align: right;">587</p> <p>1 Q So the CLM evidence references a Ryan Schultz 2 paper published in 2023. 3 A Yes, it -- it does. We talked about it 4 earlier. 5 Q Yeah. Okay. 6 A Yeah. 7 Q In the days leading up to the AER's decision to 8 issue the EPO, were you aware that Dr. Schultz 9 was working on a paper? 10 A No. 11 Q Let's go to Exhibit 50.02, which is Obsidian's 12 company evidence, please. And we're interested 13 in PDF page 46, please. 14 You'll see here that there's a news 15 article. It's a copy of a news article 16 published online by CTV on March 23rd, 2023, 17 and it references the same date of the EPO. Do 18 you see that there, Mr. Kuleba? 19 A Yes, I would -- 20 Q We can scroll down -- 21 A -- judging by the title. 22 Q Yeah. We can scroll down. Go to PDF 47. And 23 we're -- just got to go a little lower, please. 24 That's good. Thank you. 25 Now, if we go to -- we'll see that in the 26 paragraph just below the heading "4.2-Magnitude</p>	<p style="text-align: right;">588</p> <p>1 Quake Recorded South of Grande Prairie", 2 there's a reference to Ryan Schultz, the author 3 of the 2023 paper. Do you see that? 4 A Yes, I do. 5 Q And we can see that that -- in that reference, 6 it indicates that the paper was published that 7 morning? 8 A Sorry. Could you point that out specifically. 9 I'm trying -- I read this, but just trying to 10 read it closer now. 11 Q It says in the -- in the first paragraph that 12 we were talking about, last line -- second-last 13 line. 14 A Oh, yes. Yeah, I see that. Yes, it's there. 15 Q So it was published just hours before the EPO 16 was issued? It was published in the morning. 17 The EPO was issued 3-ish? 18 A I think's 2:29, yeah. 19 Q 2.29. Okay. Yeah. You know it better than 20 me. You lived it. 21 A Yeah. 22 Q And it states that: (as read) 23 Ryan Schultz is a Canadian 24 seismologist who helped conduct 25 research outlined in the paper while 26 at Stanford.</p>

<p style="text-align: right;">589</p> <p>1 Do you see that there?</p> <p>2 A That's what it says.</p> <p>3 Q Yeah. Okay. And Ryan Schultz used to work at</p> <p>4 the AER; correct?</p> <p>5 A Yes, that's my understanding.</p> <p>6 Q And if we move a little lower down -- actually,</p> <p>7 we'll just move on.</p> <p>8 When did you become aware of the Schultz</p> <p>9 paper, sir?</p> <p>10 A That morning, right in the midst of trying to</p> <p>11 get a number to call the executive at Obsidian</p> <p>12 to schedule a due process.</p> <p>13 Q Okay. And did your advisors indicate to you at</p> <p>14 any point -- clearly they didn't -- at any</p> <p>15 point that that paper was coming out?</p> <p>16 A No. That was an unpleasant surprise while I</p> <p>17 was in midst of, like I said, trying to</p> <p>18 schedule a due process.</p> <p>19 Q Now, Mr. Kuleba, we previously discussed how,</p> <p>20 in issuing the EPO, the AER was exercising its</p> <p>21 public-interest mandate; and in doing so, we</p> <p>22 can agree that the CLM was of the view that the</p> <p>23 14-18 well was caused -- had caused the seismic</p> <p>24 events identified in the EPO; correct?</p> <p>25 A Yes.</p> <p>26 Q And in issuing the EPO, the AER wanted to</p>	<p style="text-align: right;">590</p> <p>1 implement steps to mitigate future induced</p> <p>2 seismic events, so to protect the public and</p> <p>3 the environment; correct?</p> <p>4 A Yes, by reducing the frequency and magnitude,</p> <p>5 hopefully.</p> <p>6 Q Mr. Kuleba, in exercising its public-interest</p> <p>7 mandate, so as to protect the public and the</p> <p>8 environment, you would agree it's incumbent on</p> <p>9 the AER to get it right?</p> <p>10 A Yes. I just want to make the correct decision.</p> <p>11 Q If the AER is not right, then the risk to the</p> <p>12 public and the environment goes unmitigated;</p> <p>13 correct?</p> <p>14 A That would be correct, yes.</p> <p>15 Q The risk remains?</p> <p>16 A Yes, it would remain.</p> <p>17 Q If we can pull up Exhibit 57.01. We're going</p> <p>18 to go to PDF 22, please.</p> <p>19 And the paragraph at the top of the page is</p> <p>20 paragraph 59 that comes from -- wraps over onto</p> <p>21 this page. I'll direct you to the first full</p> <p>22 sentence that states, and I quote: (as read)</p> <p>23 The issuance of the EPO to Obsidian,</p> <p>24 and not to the operators of the Belloy</p> <p>25 well or the operators of the 13-11</p> <p>26 well or the other nine northwest</p>
<p style="text-align: right;">591</p> <p>1 wells, is wholly consistent with the</p> <p>2 director's reasonable exercise of</p> <p>3 discretion.</p> <p>4 Do you see that there?</p> <p>5 A Yes. And there's additional context above and</p> <p>6 below, obviously, before you get to this.</p> <p>7 Q That's -- that's fine, sir.</p> <p>8 A Yeah.</p> <p>9 Q Now, Mr. Kuleba, using the ordinary meaning of</p> <p>10 the word "reasonable" and not the legal</p> <p>11 meaning, you would agree that if the AER was</p> <p>12 wrong in concluding that the 14-18 well was the</p> <p>13 cause of the induced events, that would not be</p> <p>14 reasonable; correct?</p> <p>15 A Yes. If we -- if the evidence was not there,</p> <p>16 and we were wrong, it would not be reasonable.</p> <p>17 Q And you would agree, sir, again, using the</p> <p>18 ordinary meaning of the word "reasonable" and</p> <p>19 not the legal meaning, you would agree that if</p> <p>20 there were two or more causes for the induced</p> <p>21 events, it would not be reasonable to only</p> <p>22 issue an EPO in respect of only one of those</p> <p>23 causes; correct?</p> <p>24 A Yes, and if there was evidence provided to me</p> <p>25 that there was others that contributed, I</p> <p>26 would've considered it appropriately.</p>	<p style="text-align: right;">592</p> <p>1 D.P. LANGEN: I'll just have a</p> <p>2 moment, Mr. Chair.</p> <p>3 THE CHAIR: Certainly.</p> <p>4 D.P. LANGEN: Now, Mr. Chair, that</p> <p>5 concludes Obsidian's cross-examination of the</p> <p>6 witness panel. Thank you very much.</p> <p>7 Q D.P. LANGEN: Thank you very much,</p> <p>8 witnesses.</p> <p>9 THE CHAIR: Okay. Thank you</p> <p>10 very much.</p> <p>11 So you have no questions in camera?</p> <p>12 You're ...</p> <p>13 D.P. LANGEN: You are correct,</p> <p>14 sir.</p> <p>15 THE CHAIR: Okay. Thank you.</p> <p>16 The Panel will -- let's see. It's 2:00.</p> <p>17 Let's -- let's proceed with the Panel</p> <p>18 questions. Is that okay? We'll start with</p> <p>19 Mr. Zaitlin.</p> <p>20 The Panel Questions the Regulatory Compliance</p> <p>21 Branch Witnesses</p> <p>22 Q COMMISSIONER ZAITLIN: Okay. Thank you.</p> <p>23 Thank you very much.</p> <p>24 The first question would be on the</p> <p>25 availability of the data and when the data came</p> <p>26 in. Obsidian has shown that it has a 3D --</p>

<p style="text-align: right;">593</p> <p>1 called a Harmon Valley 3D over the 14-18 well,  2 and the CLM is utilizing a 2D seismic grid that  3 they got available from Pulse. When did the  4 CLM get access to that 2D seismic grid?  5 A E. GALLOWAY: So I believe this is  6 answered in one of the responses to the  7 information requests from Obsidian. Let me  8 pull up the exact dates. Not that one.  9 Okay. So the reference is in Exhibit 71.1,  10 and it's in response to IR 1.20. My response  11 is on page -- PDF page 30. So response (a)  12 near the bottom of the page. The AGS gained  13 access to most of the 2D data on February 22nd,  14 2023. We regained access to additional data on  15 April 20th, 2023, after a request for  16 additional 2D seismic lines.  17 Q Okay. So both groups have a slightly different  18 dataset in which -- geophysical dataset in  19 which they're doing their interpretation on.  20 Obsidian has its 3D dataset. CLM has its 2D  21 dataset.  22 There are a number of different types of  23 techniques that I'm aware of that people can  24 use to understand fracture geometries and fault  25 geometries in datasets, things like delta T  26 analysis or different types of curvature</p>	<p style="text-align: right;">594</p> <p>1 analysis or semblance analysis. Those types of  2 analysis steps, are they possible to do on 2D  3 datasets?  4 A Yes. So some of those are available on 2D  5 datasets. You can run, for instance, coherence  6 or similarity -- excuse me -- analysis to  7 generate coherence or similarity attribute  8 versions of the -- the seismic data. I pursued  9 that on the 2D dataset that I had access to and  10 found that it did highlight some of the  11 faults -- or highlighted some faults.  12 As I mentioned in my direct evidence,  13 trying to correlate those faults from line to  14 line was extremely difficult, and so, instead,  15 I've -- I've presented an analysis where I've  16 analyzed the -- the variability of the  17 Precambrian basement reflector to -- to  18 highlight areas where there's enhanced -- or  19 appear to be enhanced structural complexity in  20 that -- on that reflector and -- which I've  21 interpreted to mean enhanced structural  22 complexity of the Precambrian basement itself.  23 Q So based on the 2D data alone, how would you  24 interpret the structural complexity of the  25 basement in and around the 14-18 well based on  26 the 2D data and that type of analysis?</p>
<p style="text-align: right;">595</p> <p>1 A I will refer to -- one moment, please. So it's  2 Exhibit 57.01 and page -- PDF page 63. I'm  3 referring back to the attribute map that I  4 generated by analyzing the variability of the  5 Precambrian reflector.  6 So in the area of Obsidian's injection  7 well, there is relative to the areas around it  8 a considerable amount of elevation variability  9 which I believe indicates a -- a density of  10 faults as well as an enhanced -- a greater  11 degree of vertical offset of those faults. And  12 that's relative to the -- the other areas  13 depicted in this map.  14 Q So when you say vertical variation, what would  15 the topography be, or how much change would you  16 have in that area?  17 A Well, based on the 2D, we -- we saw it  18 from -- from the results on a 3D data that the  19 2D was not capturing the degree of -- of  20 faulting that might be observed on the 2D  21 alone, and based on what I have in -- in  22 evidence here, there's -- there's -- there's  23 nothing I can point to to say the degree  24 of -- of offset on the basement faults that  25 are -- are presented in this interpretation.  26 Q But you would interpret there to be certain</p>	<p style="text-align: right;">596</p> <p>1 bounding faults that would cause -- that would  2 be on each side of a block that has been raised  3 up in that area?  4 A Yes, though I haven't indicated that on  5 the -- on either of the -- well, so if  6 we -- sorry -- scroll -- I can do this. I can  7 scroll up if that makes it easier.  8 So on the -- so looking at Figure 8, which  9 is on PDF page 62 of Exhibit 57.01. So  10 Figure D shows a -- one of the 2D lines that I  11 interpreted. If we focus on the -- the  12 lower-most red horizon, the Precambrian  13 horizon, we can see some variability on that  14 horizon very near to Well 14-18.  15 Though I haven't indicated fault locations  16 on this interpretation, these variations  17 in -- variations in elevation are attributed to  18 faults, though, as I mentioned on this  19 interpretation, I haven't indicated the amount  20 of throw on these faults or the amount of  21 vertical offset that could be seen on them.  22 Q And how high -- if you would take a look at the  23 bounding features to that structure, how high  24 would they propagate up through the  25 stratigraphic section?  26 A Right. So on -- I'll refer to this section</p>

<p style="text-align: right;">597</p> <p>1 again in Figure 8D. We see some correlation in  2 the variability of the horizon, so the  3 variability in the Precambrian horizon,  4 extending up into Leduc by -- the Leduc  5 horizon.  6 What I mean by that is that the -- there is  7 variability in the same area -- variability on  8 the Leduc horizon in the same area that we see  9 variability in the Precambrian horizon, which,  10 to me, is a strong indicator that the sum, at  11 least of the faults that are affecting the  12 elevation to the Precambrian reflector, are  13 also affecting the elevation of the Leduc  14 reflector.  15 So, to summarize, some of those faults that  16 are in the Precambrian would extend into and  17 through the Leduc Formation.  18 Q And going in the opposite direction, how far  19 would those features propagate downwards, and  20 would they potentially intersect a fault -- a  21 fault that released -- that's associated with  22 the interpretation of the nodal array -- from  23 the nodal array?  24 A Based on what we can see in this section, it is  25 difficult to say how far into the Precambrian  26 any faults might go. The -- as was mentioned</p>	<p style="text-align: right;">598</p> <p>1 previously, the lack of reflectivity, so the  2 lack of seismic impedance contrast in the  3 basement, means that we won't have any seismic  4 reflectors in the basement along which we could  5 recognize fault presence by offset of  6 some -- some degree.  7 So there -- based on the 2D seismic, we do  8 not know how far into the Precambrian the  9 faults might extend.  10 Q If one had access to the 3D, would you be  11 able -- would -- would someone be able to do  12 that type of interpretation?  13 A If one had access to 3D, you would still be  14 faced with the problem with -- of a lack of  15 reflectivity in the basement; however, the  16 vertical extent above in -- in the  17 stratigraphic column would be much more  18 confident, as would the orientation of the  19 fault, and by that I mean the strike  20 orientation but also the dip angle.  21 And the -- from -- from that information,  22 one could project faults into the basement some  23 distance and understand where they might  24 intersect the activated fault plane that we've  25 detected on the nodal array data.  26 Q What other type of data that's available in the</p>
<p style="text-align: right;">599</p> <p>1 area would allow one to be able to interpret  2 whether there was fracture or faulting through  3 the section?  4 A There are some advanced 3D seismic analysis  5 techniques that can reveal variations in  6 velocity related to, as, and with of data  7 acquisition. To my knowledge, that has not  8 been -- has not been completed in this case.  9 In terms of other geophysical data, some  10 would point to aeromagnetic data to indicate  11 some -- indicate some trends or features in the  12 underlying basement that could be interpreted  13 as -- as faults.  14 Q When -- there's been a lot of discussion over  15 the last few days about the velocity model that  16 went into -- into -- into the modelling and the  17 data that underscores that. Would I be correct  18 to say that comes from the sonic logs from the  19 petrophysical data?  20 A That's correct.  21 Q When you're taking a look at the Delta T log,  22 the sonic logs, through that area, was there  23 any analysis done to see if there was chatter  24 or cycle skipping associated with the sonic  25 data?  26 A Not to my knowledge.</p>	<p style="text-align: right;">600</p> <p>1 Q Was there any -- did anyone look at the FMI  2 log -- are there any FMI logs in the area?  3 A Not to my knowledge.  4 Q Okay. And I -- I gather there's no core data  5 that one would be able to see if there was  6 fractures or faulting in the Leduc section in  7 the immediate area?  8 A Not to my knowledge.  9 Q So it's not to your knowledge.  10 Who would be responsible for evaluating  11 whether that data, in fact, existed?  12 A We believe there is a reference to some of that  13 information in the evidence, and we're seeking  14 the exact location now.  15 A M. CANALES: Yes. If we find the  16 Evidence 57.01, page 787.  17 Yes. There you have the subsurface  18 geological data from wells penetrating the  19 Leduc. Includes the downhole data, and they  20 interpret pics.  21 And the next page. Yeah. In that, that  22 shows the cores available in that region.  23 And in the next pages, includes -- well,  24 let's zoom in on one of the oil fields in the  25 south of the area, but in the area, per se,  26 there is an absence of cores.</p>

<p style="text-align: right;">601</p> <p>1 In the next page. Sorry. Yeah. That's 2 the type of logs that we have in that specific 3 pool, the Normandville. 4 And the next -- next slide or next page. 5 Yeah, that's the -- in the area north of the 6 reef where we have the more powerful 7 seismicity. The next -- 8 THE COURT REPORTER: "We have the" what? 9 A M. CANALES: Pardon me? 10 THE COURT REPORTER: (by reading) 11 That's in the area north of the reef 12 where we have to ... 13 A M. CANALES: Where we have the 14 induced seismicity. 15 THE COURT REPORTER: "New seismicity"? 16 A M. CANALES: Induced. Induced. 17 Induced. 18 THE COURT REPORTER: Thank you. 19 A M. CANALES: The next page. This 20 is the south -- southern part of the reef. 21 Next page. And, yeah, this is the shape of 22 the Leduc reef. 23 Next page. This is the well control for 24 the Leduc. 25 And next page. The -- can you go down. 26 Yeah, the -- these are the wells that reach the</p>	<p style="text-align: right;">602</p> <p>1 Precambrian basement. 2 Q COMMISSIONER ZAITLIN: Okay. Thank you. 3 So if we can bring up the Aid to Cross 4 Number 13. I just didn't catch the -- the 5 exhibit number that -- that was there, but on 6 page 3 was the last time we -- that's right. 7 Perfect. 8 The -- the diagram on the right-hand side, 9 that came -- that came from the CLM dataset. 10 It shows that the 14-18 well does not hit the 11 Precambrian basement at that point in time. 12 It -- it stopped shallow of -- of the 13 Precambrian through there, and that on either 14 side of -- of what looks like a structure, you 15 had granite wash deposits -- 16 A Right. 17 Q -- on-lapping onto the Precambrian basement. 18 A Right. 19 Q So most people would call that a bald high, 20 based on that structure. What would you term 21 that structure to be? 22 A Looks like a sort of horst, right. 23 THE COURT REPORTER: I can't hear you. 24 A M. CANALES: Sorry. It looks 25 like a horst. Yeah. 26 Q COMMISSIONER ZAITLIN: And from the</p>
<p style="text-align: right;">603</p> <p>1 schematic, you have the bounding faults going 2 down into the basement? 3 A Right. 4 Q Is it possible for those bounding faults to 5 intersect with the Belloy fault? 6 A I would say it's possible, yes. 7 Q And would that act as a communication or a 8 conduit for fluids being disposed into the 9 14-18 well? 10 A Yes. 11 COMMISSIONER ZAITLIN: Thank you. 12 That's all the questions I have for the 13 public portion of it. 14 THE CHAIR: Mr. Stock, do you 15 have any questions? 16 COMMISSIONER STOCK: Thank you, 17 Mr. Chair. 18 Q COMMISSIONER STOCK: To CLM -- I'm not 19 sure which individual to name, but I'm just 20 interested in Reno cluster seismic activity 21 that's been observed since the EPO. Do you 22 have information on that? 23 A M. CANALES: Yes. 24 What's -- could you elaborate? Sorry. 25 Q What -- what have you been tracking or 26 observing since the EPO was issued, and can you</p>	<p style="text-align: right;">604</p> <p>1 provide that -- or have you provided that 2 information? 3 A Yes. That information is provided in one of 4 the reports. We still see persistent 5 seismicity; however, it seems that 6 larger -- large events as the one we observed 7 in March or before March has not been repeated. 8 To my knowledge, the -- the latest event larger 9 than 3 occur in mid-2023. I cannot remember 10 the date, but the seismicity persist. 11 Q Thank you. 12 And in issuing the EPO -- at page 2 of the 13 EPO, which appears at Exhibit 50.02, page 15, 14 CLM states that it was not aware of any adverse 15 effects resulting from the seismic events to 16 date, the date that the EPO was issued. 17 As CLM was not aware of any adverse effects 18 resulting from the seismic events at that time, 19 how is it not speculative for CLM at the time 20 to state in the EPO that the vibrations and/or 21 the release of energy into the environment -- 22 defined as "substances" -- may cause adverse 23 effects, which is part of the EPO? 24 A E. KULEBA: Yes, it has that 25 statement that we were not aware of any adverse 26 effects. We, of course, did not go canvas to</p>

<p style="text-align: right;">605</p> <p>1 find any. Given the magnitudes that occurred, 2 though, it would be reasonable to assume that 3 there certainly could be. 4 Since we set our traffic light protocols -- 5 and Todd might have to talk about this and the 6 risk of the magnitudes, or Mauricio -- I think 7 the highest one in the province is at 4, and 8 it's to prevent adverse effects and new sense 9 in other. 10 Todd can maybe -- can you elaborate on the 11 magnitude? 12 A T. SHIPMAN: Sure. The 13 thresholds that we set for our red lights 14 aren't at damage. They're pre-damage to 15 prevent it from occurring. The -- we don't 16 want to react when damage happens; we want to 17 react to prevent damage from happening. So the 18 concern was that that was within the threshold 19 of potential damage. So... 20 A M. CANALES: If I -- if I may add 21 something else. The first point is that an 22 earthquake of that magnitude in another 23 location could -- could cause damage. 24 The second point is that earthquakes, they 25 have algorithmic behaviour in the sense that 26 for every -- and this is an estimation. For</p>	<p style="text-align: right;">606</p> <p>1 every ten earthquakes Magnitude 3, you have one 2 Magnitude 4. So our concern is that by having 3 more earthquakes Magnitude 4, you could have a 4 5; or more 5, and if you -- there's no 5 mitigation, right, you can escalate to 6 something larger. That was part of our concern 7 as well. 8 COMMISSIONER STOCK: Thank you. 9 No more questions. 10 THE CHAIR: Thank you, 11 Mr. Stock. 12 Q THE CHAIR: I'll just follow up 13 on some questions that were asked about 14 Cluster 1. Most of my questions have been 15 answered. But in Obsidian's reply evidence, 16 there's a statement, and I have a reference for 17 it, but I don't know that you need to pull it 18 up. I'll read it, and if you want to pull it 19 up, we can. 20 The statement is: (as read) 21 The AER initially concluded that the 22 North Peace River sequence is natural, 23 but a conclusion that the three 24 clusters, North Peace River, North 25 Heart, and Reno, have different causes 26 (one natural, two induced) is</p>
<p style="text-align: right;">607</p> <p>1 difficult to support. Obsidian argues 2 that all three clusters are either 3 natural or all three clusters are 4 induced. 5 Does CLM agree with Obsidian's statement that 6 all three clusters must have the same 7 causation, natural or induced, and, if not, why 8 not? 9 A M. CANALES: What I would say is 10 that you would like to perform a proper 11 analysis to reach a conclusion for each 12 cluster. As I mentioned earlier, we reached 13 that conclusion, that it was induced for the 14 Reno cluster, the North Heart cluster. We're 15 currently working on the North Peace River. 16 The question -- there are two questions, 17 one, if it's natural, but we also -- or 18 induced, and the second question, what is -- 19 where are the mechanisms? What is the 20 activity? We are in that process. 21 Q Okay. Thank you. 22 So I think I understand from your evidence 23 that CLM is of the view that the seismic events 24 in the North Heart cluster, Cluster 2, are the 25 result of disposal activities and specifically 26 those related to disposal in the Leduc -- at</p>	<p style="text-align: right;">608</p> <p>1 the 13-11 well. 2 So for Mr. Kuleba, has the AER issued any 3 orders to the operator of the 13-11 disposal 4 well or operators of any other wells in the 5 vicinity of the North Heart cluster because of 6 induced seismicity in the area, and, if not, 7 why not? 8 A E. KULEBA: So, to my knowledge, 9 we have not issued orders to any of those 10 others in -- in the area there. The CNRL one 11 was noted to be seismogenic with the -- the 12 previous seismicity around it prior to the 13 magnitudes in the Reno area; however, 14 when -- when that was raised to myself -- so I 15 can't speak to others -- that the highest 16 magnitude so far recorded was 3.2. 17 So, yes, it's certainly getting to the 18 point in terms of -- of risk and priority that 19 we would take action, but, again, due to 20 priority, one was dealt with first. And I'm 21 not saying that we would not deal with the 22 other one in the future, but I believe that's 23 the intent. We would. So ... 24 Q Okay. Just a follow-up question. So apart 25 from an enforcement order, has the AER required 26 the operator of the 13-11 well to take any</p>

<p style="text-align: right;">609</p> <p>1 specific mitigation measures or response  2 in -- in response to the induced seismicity?  3 A Sorry. Could you ask that again. I hit -- if  4 I hit my microphone, it makes yours --  5 Q Okay. Okay. Yeah. No. I was just asking  6 if -- so no enforcement orders have been  7 issued. I'm just wondering if there had been  8 any direction from the AER to the operator of  9 the 13-11 -- 13-11 well to take any specific  10 mitigation or remedial measures due to the  11 induced seismicity.  12 A So, yeah, you're correct. No order has been  13 issued. We did not give them direction, and --  14 but Todd can explain. I believe after we  15 shared information with them, that their well  16 was seismogenic, as we -- as there was meetings  17 with the three operators in the area, they have  18 undertaken a voluntary MMR, and Todd may be  19 able to speak more to it.  20 A T. SHIPMAN: I -- I think you  21 covered it, but they voluntarily are monitoring  22 and took on an MMR and shared it with us.  23 Q Okay. And so are they subject to a traffic  24 light protocol voluntarily?  25 A Sorry. Yes. MMR is monitoring mitigation  26 response plan, which also requires a traffic</p>	<p style="text-align: right;">610</p> <p>1 light and monitoring. So they're paying for  2 monitoring as well.  3 Q Okay. Thank you.  4 For Dr. Canales, I'm not sure anything  5 turns on this, but I'm just curious with  6 respect to the velocity model that was used.  7 We've talked about the -- the artifacts. The  8 other issue is a bit of a depth discrepancy  9 between where the AGS events plot and where the  10 Outer Limits plots the same events. There's  11 about a 500-metre --  12 A M. CANALES: Yeah.  13 Q -- difference. So just a couple questions on  14 that.  15 Outer Limits uses a VPVS ratio of 1.85. I  16 think initially the AER used 1.73, although I  17 think I saw in there a sensitive analysis you  18 did using 1.85. How does that VPVS ratio  19 affect the depth, and what's the AGS's view as  20 to what the preferred or optimal ratio is?  21 A Right. We initially work on using the  22 1.73 value. Then we did a sensitivity analysis  23 where we work with different ranges, and we  24 took the one that shows the -- the minimal  25 error in the event location. We found that --  26 that VPVS for this particular case was not as</p>
<p style="text-align: right;">611</p> <p>1 critical, and we still -- we're still thinking  2 of the potential reasons between the  3 discrepancy between the AGS results and the  4 Outer Limits results.  5 I believe that there are two potential  6 reasons. The first one is that they might have  7 a different velocity model. We have refined  8 the velocity model over time. So that could be  9 a reason for the difference. And, yeah, I  10 think that's a critical point, the velocity  11 model. I think they might be using something  12 different.  13 And the second part, which I haven't been  14 able to check, it's how they are dealing with  15 the peakings, the peaking of the events, the  16 P&amp;S waves. I -- I -- I don't have that  17 information. That might be also part of a  18 discrepancy.  19 Q Okay. Thank you.  20 Just a follow-up question, then. So we had  21 a discussion around the linear planar  22 horizontal artifacts in the initial dataset.  23 You had some questions from Mr. Langen on that.  24 Despite observing those artifacts, I guess  25 you were confident enough that the -- the event  26 locations were accurate enough to proceed with</p>	<p style="text-align: right;">612</p> <p>1 the order to -- that there was a link between  2 the activities and the disposal event.  3 So could you just explain for me a little  4 bit more about -- when you see those kind of  5 linear artifacts and you know there's an issue  6 with the velocity model, what other effects on  7 event location are you worried about, and how  8 did you convince yourself that those weren't a  9 concern in terms of acting on that data?  10 A Right. When I see that issue, I -- I thought  11 it was related to a drastic change in the  12 velocity model, and I knew it was particular to  13 those events in that -- that layer. We know --  14 and through experience, we know that by  15 improving or refining the velocity model, we're  16 able to -- and performing relocation that comes  17 after, we can't -- we can get rid of those  18 linear artifacts, but the trend remains the  19 same.  20 So what happens is that that linear  21 artifact will -- will collapse in a -- in that  22 plane, that it's the dominant plane. So it's  23 like deleting those, sort of speaking.  24 Q Okay. Thank you.  25 Mr. Virues, a couple of questions for you.  26 I'm just thinking about how to ask this or</p>

<p style="text-align: right;">613</p> <p>1 whether to ask it in camera or not. So, as we  2 learned this morning, we have some exhibits  3 that we only have confidential versions of, but  4 there's only a small portion of the evidence in  5 those that are confidential. So I'm going to  6 ask you about something that's in a  7 confidential exhibit but is not marked as  8 confidential. And I think I'm on safe ground  9 here, but if somebody objects, please do.  10 So in your report, Exhibit 57.03 -- and I  11 don't want this pulled up -- PDF page 4.9, you  12 made the following comment with respect to  13 MDP's analysis of the 4-18 falloff test. You  14 said: (as read)  15 Interpretation analysis of the falloff  16 could provide a multiplicity of  17 outcomes. The constant pressure  18 boundary condition should be verified.  19 And if I understood Dr. Pooladi-Darvish's  20 evidence, he interprets the presence of a  21 constant pressure boundary near the Obsidian  22 well to be evidence of pressure support from  23 wells farther away. I think that's what I took  24 from his evidence.  25 So my question to you, based on your  26 comment, is are there other interpretations of</p>	<p style="text-align: right;">614</p> <p>1 the test results that are possible? Like, do  2 you agree from what you've seen that there is a  3 constant pressure boundary, and if you don't  4 agree with that interpretation, what other  5 interpretations are possible?  6 A C. VIRUES: Yes. Thank you for  7 the question. There are two other models, a  8 leaky fault, that -- it was not performed in  9 the report, which can give an understanding  10 whether there is a fault there. And the second  11 model is a vertical interference model that can  12 provide the same derivative response, and it's  13 also intersection of faults.  14 Q Okay. And then maybe just a follow-up  15 clarification question. Are there other  16 methods that are available to verify whether or  17 not a constant boundary pressure is present?  18 Are there different kinds of tests? You talked  19 about the models. Is that what you're  20 referring to?  21 A So there are ways to make the interpretation  22 from these tests. There are several analytical  23 models. So those two that I mentioned are  24 potential models that -- that were not used in  25 the report.  26 Q Okay. Thank you.</p>
<p style="text-align: right;">615</p> <p>1 So in your report, you also make the  2 following comment, and it's with respect to the  3 minus 1,000-metre subsurface datum that was  4 used in MDP's model. And your statement was:  5 (as read)  6 We disagree with this statement. The  7 initial Leduc pressure should be  8 identified in different points of the  9 Leduc reservoir given how wide and  10 extensive the area of the study is.  11 Can you elaborate on your concern and why you  12 disagree with the datum approach that was used.  13 A My concern was, like, the only method that was  14 used for initial pressure was DST; however,  15 there are study gradients, and there are  16 falloff tests that can be used to get the same  17 information. However, there is a lack of data  18 in the whole area of Peace River.  19 Q Okay. Thank you.  20 So, Mr. Canales, for you -- possibly  21 others, actually, could answer this question.  22 But in its reply evidence, Obsidian, and  23 specifically Enlighten, provides some  24 additional evidence that it argues supports the  25 presence of an open fault from the Belloy to  26 the Precambrian, and it lists a number and goes</p>	<p style="text-align: right;">616</p> <p>1 through a few different things, including how  2 to gauge boreholes, anomalous pressure  3 measurements, lost circulation issues. Do you  4 find that any of that evidence changes your  5 view about the possibility of an open fault?  6 A M. CANALES: No.  7 Q And why not?  8 A Well, first of all, it's a standard in cases of  9 induced seismicity that you see -- and many of  10 the cases Outer Limits' reports mention, in  11 most of those cases, you have seismicity  12 reaching the target formation. For instance,  13 in the Duvernay or the Montney, in those cases,  14 you see the fault reaching the depths of that  15 formation, but that fault is activated so that  16 there is a clear connection with that fault and  17 the -- usually, the picture you get is that you  18 have earthquakes at the target formation, and  19 it propagates down and up. That propagation  20 could be a result of the self-propagating  21 nature of earthquakes or it could be a  22 consequence of hydraulic conductivity.  23 We noticed that they point out one fault,  24 but we don't see any evidence that that fault  25 has been activated, so that's the first flack  26 to be concerned about, that potential</p>



<p style="text-align: right;">617</p> <p>1 conductivity.</p> <p>2 The second reason -- and as we mentioned in</p> <p>3 the reports, there is no evidence -- or</p> <p>4 geological evidence that that particular fault</p> <p>5 could act as a conduit. And for us, it has</p> <p>6 been challenging to imagine how that fault</p> <p>7 would be able to allow fluids over 1.2</p> <p>8 kilometres without any sealing component or</p> <p>9 without any dispersion component.</p> <p>10 We know that there are other cases where</p> <p>11 you have earthquakes that are not right at the</p> <p>12 target, but there is compelling geological</p> <p>13 evidence.</p> <p>14 Maybe, Elwyn, do you want to add more?</p> <p>15 A E. GALLOWAY: Yes. I think what</p> <p>16 Dr. Canales is referring to, we could -- if we</p> <p>17 can bring up -- it was Aid to Cross Number 5</p> <p>18 that Obsidian provided. I don't recall the</p> <p>19 exhibit number. Yes. Sorry. Maybe we'll go</p> <p>20 to page number 9, please. Yeah. Oh. You</p> <p>21 can't type. Very good. Thank you.</p> <p>22 So this is the paper on which I was lead</p> <p>23 author re -- I was referring to a case of</p> <p>24 induced seismicity in Southern Alberta. And</p> <p>25 this figure summarizes our findings based on</p> <p>26 a -- a suite of different geoscience</p>	<p style="text-align: right;">618</p> <p>1 information where we were able to arrive at</p> <p>2 some conclusions by integrating that data.</p> <p>3 Of relevance here, we had identified faults</p> <p>4 that were basement rooted that connected the</p> <p>5 hydraulic fracturing induced seismicity -- or</p> <p>6 demonstrated hydraulic fracturing induced</p> <p>7 seismicity which was facilitated by a near</p> <p>8 vertical fault conduit that extended from the</p> <p>9 interval and injection downward into the</p> <p>10 basement.</p> <p>11 In this case, we -- using evidence from a</p> <p>12 variety of -- of sources, we identified a past</p> <p>13 history of fluid -- or identified that the</p> <p>14 faults in question was a fluid conduit in the</p> <p>15 past, and we -- from that, we believe that it</p> <p>16 could continue as a fault conduit into present</p> <p>17 day.</p> <p>18 The evidence that we had was that at a time</p> <p>19 in the past -- and this would be -- well, to</p> <p>20 walk you through the -- the process here</p> <p>21 illustrated by Figure 8.</p> <p>22 So at a time near -- after deposition, we</p> <p>23 identified that there were some -- some karst</p> <p>24 that occurred, which is removal of sediment by</p> <p>25 a fluid movement, and it created some void</p> <p>26 space which allowed -- and so that void space</p>
<p style="text-align: right;">619</p> <p>1 is illustrated in Figure 8B. That void space</p> <p>2 was then filled by that karst to collapse</p> <p>3 creating local accommodation features, which</p> <p>4 were subsequently infilled. So the</p> <p>5 accommodation features are illustrated in</p> <p>6 Figure C, and into D, those features are</p> <p>7 infilled.</p> <p>8 So the -- the fault that we identified was</p> <p>9 a fluid conduit and -- in -- in the past, and</p> <p>10 then we interpret it as available to provide a</p> <p>11 conduit in the present.</p> <p>12 A M. CANALES: If I may add two</p> <p>13 other things. That fault that was identified</p> <p>14 as conduit is a fault that got activated.</p> <p>15 And, second, is it possible that that</p> <p>16 Belloy fault allows for conduit? It's</p> <p>17 possible, but we don't see the evidence.</p> <p>18 THE CHAIR: Okay. Thank you. I</p> <p>19 might have a follow-up question, but it might</p> <p>20 be in camera.</p> <p>21 So a few questions about the application of</p> <p>22 induced seismicity frameworks. I think I</p> <p>23 understand from your evidence that you applied</p> <p>24 the Frohlich and Davis 1993 framework prior to</p> <p>25 issuing the order, and that was really the only</p> <p>26 one prior to issuing the order.</p>	<p style="text-align: right;">620</p> <p>1 After the order was issued, you also</p> <p>2 applied the Verdon 2019 and the Foulger et al.</p> <p>3 2023 frameworks; is that correct?</p> <p>4 A Yes.</p> <p>5 Q Okay. So my first question is just really</p> <p>6 about why wouldn't you have used or didn't use</p> <p>7 the more recent Verdon 2019 paper as the basis</p> <p>8 for the initial analysis prior to issuing the</p> <p>9 order.</p> <p>10 A I was not really -- well, there are two</p> <p>11 reasons. I was aware of that framework, but I</p> <p>12 knew that at the end of the day, the relevant</p> <p>13 point was to understand the physical mechanisms</p> <p>14 that -- and the depth, right? I know that -- I</p> <p>15 knew that independently of the framework what</p> <p>16 really -- what was really important was to</p> <p>17 understand the physics behind and see the</p> <p>18 visibility of this case of being induced.</p> <p>19 In other words, where was the depth and if</p> <p>20 that mapped structure that got delineated with</p> <p>21 the nodal array data had any geological</p> <p>22 and -- and physical connection with one of</p> <p>23 the -- of the known activities.</p> <p>24 So part of it is that I was not familiar</p> <p>25 with that. I mean, I knew about the -- the</p> <p>26 framework, but I didn't use it as often. I was</p>

<p style="text-align: right;">621</p> <p>1 still relying on the Davis and Frohlich, but I  2 knew that even if I use another framework, the  3 questions were more about how to refine the  4 quantitative information.  5 Q Okay. And what is CLM's view of the most  6 appropriate framework or frameworks to use  7 given the three different frameworks that were  8 deployed here? What do you -- what do you  9 think are the key strengths or limitations  10 of -- of the frameworks?  11 A I -- I will still keep using them but just as a  12 guidance, a reference. And, as I mentioned on  13 Friday, what we really need to understand, it's  14 the mechanisms and the geology to -- to make a  15 robust assessment. I think we can use still  16 the three of them but just as a guide, really.  17 Q Okay.  18 A T. SHIPMAN: Yeah. Just a point  19 on that. We would be open for any use, but it  20 would only be one component. It wouldn't be  21 the deciding factor. Those questionnaires are  22 just simply guides and aids, but you would  23 still need the suite of other information  24 for -- for that.  25 Q Okay. Thank you.  26 So in CLM's hearing submission, it uses the</p>	<p style="text-align: right;">622</p> <p>1 Verdon 2019 framework to assess the potential  2 of the Belloy and the high-volume Leduc wells  3 to be the source of the Reno seismicity, and  4 for the Belloy well, you came up with an ESR  5 between 91 and a hundred percent and an induced  6 assessment ratio between 21 and 48 percent.  7 And that was for the Belloy well.  8 And then for the high-volume Leduc wells,  9 the ESR, you came up with a range from 85 to a  10 hundred percent, and the induced assessment  11 ratio ranged from minus 12 to plus 35.  12 So I guess my observation is although those  13 assessments are not as high as the AER or 50 or  14 51 that you calculated for the Obsidian well,  15 they do seem to suggest a possible linkage  16 between the Belloy well and the high-volume  17 northern and central Leduc disposal wells, and  18 I understand the comments about other sources  19 of information.  20 So my question, really, is given these  21 results, is CLM still of the view that the  22 Obsidian 14-18 well and only this well caused  23 and -- or contributed to the induced seismicity  24 in the Reno area and, if so, why?  25 A M. CANALES: Okay. Given that --  26 that analysis, the possibility exists, but we</p>
<p style="text-align: right;">623</p> <p>1 don't have the evidence to -- that point out  2 that the other wells -- the Belloy well or the  3 other wells could have contributed. It's a  4 possibility, but we need to find compelling  5 evidence that supports that.  6 Q Okay. A couple more questions in the final  7 stretch here.  8 So for you, Mr. Kuleba. So I guess my  9 question is -- and you -- I think somebody  10 spoke to this a little bit earlier in the  11 cross-examination, but given the data -- and I  12 guess you were maybe not aware of some of the  13 issues around the linear artifacts and -- and  14 other issues associated with the data, but I  15 guess the question is why did you decide to  16 proceed with issuing the order at the time you  17 did rather than waiting for more data, more  18 processing, more refinement?  19 A E. KULEBA: The subject matter  20 experts that provided their conclusion to me  21 for -- for my consideration, through advice,  22 they were confident in their conclusion, and  23 given the risk with the magnitudes and the fact  24 that it occurred above 5 twice within  25 three-and-a-half months and uncertainty as to  26 when it may happen again, it was prudent on me</p>	<p style="text-align: right;">624</p> <p>1 to act on the information presented to me to  2 reduce the risk.  3 Q Okay. Thank you.  4 And just a follow-up question for  5 Dr. Canales and/or Dr. Shipman. Although no  6 damage was identified because of the initial  7 5.6 event and the subsequent 5.09 event, what  8 type of damaged infrastructure or risk to  9 public safety might be expected from a  10 magnitude 5 to 6 seismic event?  11 A M. CANALES: It would really  12 depend where it happens. In this particular  13 case, it was in an area with low population  14 density. In another place, as we know, that a  15 5 can cause damage.  16 On top of my mind, there was an induced  17 seismicity case. The one in the -- Pohang in  18 South Korea. Right. It's more population,  19 more infrastructure. It caused over  20 \$20 million in damage. And the other one, the  21 Oklahoma, the Pawnee, and the Prague, also  22 magnitude 5, they caused damage to private  23 property. It -- it depends on the location.  24 And -- and the other factor is -- well,  25 there are other factors like depth, how -- how  26 shallow is the earthquake. The shallow --</p>

<p style="text-align: right;">625</p> <p>1 shallower it is, the less attenuation, the more 2 damage. The type of soil, the site 3 amplification conditions. As I mentioned -- 4 and this earthquake in another location would 5 have caused damage, I'm afraid. 6 A T. SHIPMAN: And I would point 7 out that some -- there's been some 8 communication from First Nations about their 9 concerns about feeling the events and 10 some -- there's been unverified damage reported 11 but not -- no evidence or anything tied to 12 that. 13 But other concerns are critical 14 infrastructure that might be in place, 15 hospitals, dams, and gas plants too where we've 16 had evidence in the past from a much lower 17 magnitude event in Red Deer, south of Sylvan 18 Lake, in 2019 March, I believe, where a gas 19 turbine power plant had to shut down because 20 of -- the vibrations and movement went beyond 21 its threshold and capacity to take. 22 And so there -- there's lots of concerns 23 that don't necessarily reach the threshold of 24 damage that can create social concern but also 25 potentially crack foundations, et cetera. 26 Q Okay. Thank you.</p>	<p style="text-align: right;">626</p> <p>1 Mr. Kuleba, in your direct evidence, you 2 indicated that you had previously issued an 3 enforcement order in response to an induced 4 seismic event. What -- what event are you 5 referring to, and what were the circumstances 6 that required an order in that -- in that 7 instance? 8 A E. KULEBA: Yes. That was the 9 Red Deer one that Todd just alluded to in March 10 or April of 2019 where there was hydraulic 11 fracturing that induced -- I think it was a 12 4.3. Sorry if I get it wrong. 13 A T. SHIPMAN: 4.1. 14 A E. KULEBA: 4.1. There was a 15 lot of numbers at the time. 16 And in that case, the action I had to take 17 was a little bit more harmful to -- to the 18 licensee, as I had to shut down their fracking 19 operations within 50 kilometres of the Red Deer 20 area 'cause there was concern -- an overall 21 concern that it could be from their -- how they 22 were fracking or unknown as to the geological 23 setting in the area that could have induced 24 this. So ... 25 A T. SHIPMAN: And also the -- the 26 dam that was close to -- the Dixon Dam, which</p>
<p style="text-align: right;">627</p> <p>1 is proximal to -- to those operations. 2 Q Okay. Thank you. 3 The last set of questions. Mr. Langen 4 asked you about the new Directive 65 5 requirements. And so what does CLM see as the 6 implications of the new requirements in 7 Directive 65 for both this enforcement order 8 and the 11-18 Obsidian disposal well? 9 A E. KULEBA: Sorry. I -- I can 10 speak to the 14-18. You mentioned another one, 11 the 11-18? You might have meant the 13-11. 12 Q No. I meant the enforcement order. So we have 13 an enforcement order. 14 And so my follow-up question is -- and I'll 15 say it now -- is really around -- given 16 Obsidian's compliance with the order to date 17 and the new requirements for seismogenic wells 18 that are in the directive, is there still a 19 need for the order? What is the need for the 20 order? 21 A Yeah, and I believe it's -- we can pull it up, 22 but it's -- I think it's Clause 12 in there 23 where I knew we were, as an organization, going 24 to be looking at our regulations and at that 25 time hopefully putting something in place. 26 And with Directive 65 coming into place</p>	<p style="text-align: right;">628</p> <p>1 now, the intent was to essentially transfer the 2 14-18 well over to the Directive 65 regime. 3 As part of this proceeding, because 4 Directive 65 came out three weeks ago, there 5 was some back and forth between the AER and 6 Obsidian. We elected and volunteered to pause 7 that while we went through the proceeding. 8 Q Okay. Thank you. 9 Okay. Just kind of a couple wrap-up 10 questions. So considering all the evidence 11 that you've heard that's on the record of this 12 proceeding, does CLM believe that fluid 13 disposal in the vicinity of the Peace River 14 Arch is associated generally with an increased 15 risk of induced seismicity activity? We seem 16 to have multiple clusters, a variety of 17 different causes. So is this a broader, more 18 systemic issue in the Peace River Arch area? 19 A M. CANALES: Yes. What we have 20 found so far is that the water disposal into 21 the Leduc formation has been associated with 22 clusters of seismicity in the Peace River Arch. 23 I should also mention that we have also found 24 cases of disposal into the Leduc, but in other 25 areas south of Grande Prairie, two clusters, 26 the Gold Creek and the Kakwa, are related to</p>



629

1 disposal-induced seismicity.  
 2 And there is another one in the middle, the  
 3 Musreau Lake. It's not Leduc. It's in the  
 4 Winterburn group. But, again, it's another  
 5 case of disposal-induced seismicity. It's  
 6 becoming a recurrent issue in the last five  
 7 years or so.  
 8 Q Okay. So does this suggest the need for a  
 9 broader regional approach to assessing both the  
 10 potential for and mitigating the effects of  
 11 induced seismicity in the Peace River Arch  
 12 region?  
 13 A T. SHIPMAN: That's what the  
 14 purpose of Directive 65 amendment was. But  
 15 because the surface risk varies, if you're  
 16 going to have a mitigation plan or a traffic  
 17 light protocol, it can't just be broad: This  
 18 magnitude is acceptable.  
 19 The surface risk is variable throughout the  
 20 province, and the subsurface amplification of  
 21 that magnitude is also variable. So we  
 22 approached it with some modelling of ISO  
 23 nuisance work, and that's a guide -- help  
 24 guiding on setting thresholds individually for  
 25 operations.  
 26 And then, subsequent to setting that

630

1 threshold, you would have a conversation and do  
 2 a risk assessment surrounding the surface to  
 3 make sure -- if you're within proximity to any  
 4 kind of surface critical infrastructure,  
 5 et cetera.  
 6 Q Okay. Thank you.  
 7 THE CHAIR: Just give me a  
 8 minute.  
 9 The Panel only has one or two confidential  
 10 questions, but we are past our time for a  
 11 break. So I think we'll take a quick break  
 12 now, and when we come back, we'll be in camera  
 13 probably for no more than 5 or 10 minutes, and  
 14 then we'll be done the Panel's questions.  
 15 So it is five to 3:00. So we'll come  
 16 back at ten after 3:00, and we'll be in camera.  
 17 Thank you.  
 18 (PUBLIC PROCEEDINGS ADJOURNED)  
 19 \_\_\_\_\_  
 20  
 21  
 22  
 23  
 24  
 25  
 26

631

1 CERTIFICATE OF TRANSCRIPT:  
 2  
 3 We, A. Porco and K. Di Rocco, certify that  
 4 the foregoing pages are a complete and accurate  
 5 transcript of the proceedings taken down by us  
 6 in shorthand and transcribed from our shorthand  
 7 notes to the best of our skill and ability.  
 8 Dated at the City of Calgary, Province of  
 9 Alberta, this 2nd day of December 2024.  
 10  
 11   
 12 \_\_\_\_\_  
 13 A. Porco, CSR(A)  
 14 Official Court Reporter  
 15 Commissioner for Oaths Appointee No. 0734405  
 16 ASRA Membership No. 185  
 17  
 18   
 19 \_\_\_\_\_  
 20 K. Di Rocco, CSR(A)  
 21 Official Court Reporter  
 22 Commissioner for Oaths Appointee No. 0728318  
 23 ASRA Membership No. 57  
 24  
 25  
 26

1  
 2  
 3  
 4  
 5  
 6  
 7  
 8  
 9  
 10  
 11  
 12  
 13  
 14  
 15  
 16  
 17  
 18  
 19  
 20  
 21  
 22  
 23  
 24  
 25  
 26