

JOINT REVIEW PANEL PUBLIC HEARING

IN THE MATTER OF Application Nos. 1844520, 1902073,  
001-00403427, 001-00403428, 001-00403429, 001-00403430,  
001-00403431, MSL160757, MSL160758, and LOC160842  
to the Alberta Energy Regulator

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GRASSY MOUNTAIN COAL PROJECT - BENGA MINING LIMITED

VOLUME 20

VIA REMOTE VIDEO

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November 20, 2020

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9 AQ#1 - AER - DIRECTIVEDAMCANALSAFETY-DEC11-2018

10 (1) - WATER TOPIC

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1 Proceedings Taken via Remote Video

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3 November 20, 2020 Morning Session

4

5 A. Bolton The Chair

6 D. O'Gorman Hearing Commissioner

7 H. Matthews Hearing Commissioner

8

9 M. LaCasse AER Counsel

10 B. Kapel Holden AER Counsel

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12 K. Lambrecht, QC Joint Review Panel Secretariat  
13 Counsel

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15 T. Utting IAAC Staff

16 E. Arruda AER Staff

17 D. Campbell AER Staff

18 T. Turner AER Staff

19 T. Wheaton AER Staff

20 A. Shukalkina AER Staff

21

22 M. Ignasiak For Benga Mining Limited

23 C. Brinker

24

25 R. Warden For Ktunaxa Nation

26 T. Howard

1	K. Poitras	For Métis Nation of Alberta
2		Region 3
3		
4	Chief B. Cote	For Shuswap Indian Band
5		
6	B. Snow	For Stoney Nakoda Nations
7		
8	R. Drummond	For Government of Canada
9	S. McHugh	
10		
11	A. Gulamhusein	For Municipality of Crowsnest
12		Pass
13		
14	M. Niven, QC	For MD of Ranchland No. 66
15	R. Barata	
16	J. Nijjer	
17		
18	B. McGillivray	For Town of Pincher Creek
19		
20	D. Yewchuk	For Canadian Parks and
21		Wilderness Society, Southern
22		Alberta Chapter
23		
24	R. Secord	For Coalition of Alberta
25	I. Okoye	Wilderness Association, Grassy
26		Mountain Group, Berdina Farms

1		Ltd., Donkersgoed Feeder
2		Limited, Sun Cured Alfalfa
3		Cubes Inc., and Vern Emard
4		
5	R. Cooke	For Crowsnest Conservation
6		Society
7		
8	G. Fitch, QC	For Livingstone Landowners
9	C. Agudelo	Group
10		
11	M. Sawyer	For Timberwolf Wilderness
12		Society and Mike Judd
13		
14	(No Counsel)	For Barbara Janusz
15		
16	(No Counsel)	For Jim Rennie
17		
18	S. Elmeligi	For Alberta Chapter of the
19	A. Morehouse	Wildlife Society and the
20	S. Milligan	Canadian Section of the
21	M. Boyce	Wilderness Society
22		
23	J. Gourlay-Vallance	For Eco-Elders for Climate
24		Action
25		
26	L. Peterson	For Trout Unlimited Canada

1 R. Campbell For Coal Association of Canada  
2  
3 (No Counsel) For Alistair Des Moulins  
4  
5 (No Counsel) For David McIntyre  
6  
7 (No Counsel) For Fred Bradley  
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9 (No Counsel) For Gail Des Moulins  
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11 (No Counsel) For Ken Allred  
12 (Not Present)  
13  
14 (No Counsel) For Monica Field  
15  
16 S. Frank For Oldman Watershed Council  
17 A. Hurly  
18  
19 A. Porco, CSR(A) Official Court Reporter  
20

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21 (PROCEEDINGS COMMENCED AT 9:00 AM)

22 Discussion

23 THE CHAIR: Good morning, everyone.

24 Just a reminder that live audio and video streams  
25 and video recordings of this proceeding are available  
26 to the public through the AER's website and YouTube.

1 Anyone in the virtual hearing room with their camera or  
2 microphone turned on will be captured, and images and  
3 recordings of you and your surroundings will be  
4 broadcast to a publicly available YouTube video. If  
5 you have concerns about this, please contact counsel  
6 well in advance of the time you're scheduled to  
7 participate to explain your concerns. We'll make best  
8 efforts to try and accommodate your concerns  
9 considering the need for an open and transparent public  
10 process.

11 Are there any preliminary matters before we return  
12 to Mr. O'Gorman's questioning?

13 Okay. I'll just note that Benga has filed  
14 responses to Undertaking Number 19 and Number 21.  
15 Undertaking Number 19 was related to confidence  
16 intervals for westslope cutthroat trout, and I don't  
17 know if it's up yet, but it will be posted as CIAR 877.

18 Benga response to Undertaking 21 was a revised  
19 version of the Nautilus report as an outcome of  
20 Mr. O'Gorman's questioning yesterday afternoon, and it  
21 will be posted as CIAR Number 878.

22 With that, Mr. O'Gorman, you can continue.

23 MR. O'GORMAN: Thank you, Mr. Chair.

24 GARY HOUSTON, DANE MCCOY, MIKE YOUL, MIKE BARTLETT,

25 CORY BETTLES, DAVID DEFOREST, SOREN JENSEN,

26 MARTIN DAVIES, LEIF BURGE, DAN BEWLEY, Previously



1 Affirmed

2 STEPHEN DAY, NANCY GRAINGER, Previously Sworn

3 (Water, including surface and groundwater management,  
4 quantity and quality, selenium management and aquatic  
5 resources, including fish and fish habitat and fish  
6 species at risk)

7 Alberta Energy Regulator Staff and Panel Questions

8 Benga Mining Limited

9 Q MR. O'GORMAN: Good morning, everyone.  
10 Mr. Houston.

11 A MR. HOUSTON: Good morning, Mr. O'Gorman.

12 Q I want to say thank you to you guys for really quickly  
13 turning around the updates to the Nautilus study. We  
14 just received it, so I'm going to take a look at it on  
15 the lunch break, and some of my experts are also going  
16 to take a look at it this morning, so we're not going  
17 to come right back to that right now, but I expect I'll  
18 want to ask you about it this afternoon, if that's  
19 okay.

20 So carrying on. We'll start off a little more --  
21 maybe a bit more easy to handle first thing in the  
22 morning.

23 MR. O'GORMAN: Can we please call up CIAR 69.  
24 It's Addendum 5, Zoom Host. And -- oh, sorry. I'm  
25 actually -- sorry. I was on the wrong page. I need to  
26 start with CIAR 42, Section C, and go to PDF 81.

1 Q MR. O'GORMAN: I'm going to have a couple of  
2 quick questions, Mr. Houston, about the project water  
3 demand.

4 MR. O'GORMAN: So it's CIAR 42, Section C,  
5 PDF 81. That's good. Can you scan down to the bottom  
6 of the page, please? Actually, we sort of see it --  
7 sorry. Scan down a bit. That's fine. So right close  
8 to the middle of that page.

9 Q MR. O'GORMAN: Mr. Houston, this was back in  
10 your original EIS submissions, the CIAR 42.  
11 Originally. Right where we see that dotted --  
12 actually, we see the cursor pointing, we see a line  
13 that says the nominal water makeup requirement for the  
14 coal processing plant is 110 litres per raw metric  
15 tonne; correct?

16 A MR. HOUSTON: I'm having trouble seeing the  
17 cursor.

18 Q It's right where -- I see the -- it's the sentence  
19 where the asterisk is pointing. It's about 60 percent  
20 of it --

21 A Oh, yeah. Okay.

22 Q Sorry. I realize it's now -- it's the sentence where  
23 my pointer is pointing, not the Zoom host. Apologize  
24 for that.

25 A I was questioning my -- my eyesight. I think I'll  
26 change my glasses.

1 Q All right. My bad. It was my pointer.

2 So you see the 110 metres per raw metric tonne  
3 value?

4 A Yes, yes.

5 Q Okay. So that's what we had when you originally  
6 submitted your EIS.

7 MR. O'GORMAN: We'll take that down, please,  
8 Zoom Host, and we'll call up what I asked for the last  
9 time, which is CIAR 69, Addendum 5, and we'll look at  
10 page 250, PDF 250. If we scan down this page a little  
11 bit. Scan down, please. Scan down. Okay. So there  
12 we go. And just below. No. Okay.

13 Q MR. O'GORMAN: Now you see it illustrated.

14 So after we received the original EIS submission,  
15 our water demand and water use folks were looking at  
16 Addendum 2 and then Addendum 5. We did receive some  
17 updated info, and that -- in between those two  
18 documents, you incorporated water recycling and reuse  
19 strategies into the mine's proposed operations as a  
20 measure to reduce operational water requirements --

21 THE COURT REPORTER: Excuse me, Mr. O'Gorman.

22 Q MR. O'GORMAN: -- (INDISCERNIBLE -  
23 OVERLAPPING SPEAKERS) measures with incorporating the  
24 coarse reject centrifuge --

25 THE COURT REPORTER: Excuse me. Excuse me,  
26 Mr. O'Gorman.

1 MR. O'GORMAN: Yes?

2 THE COURT REPORTER: Hi. It's Angela, the court  
3 reporter. I'm having an awful time hearing you this  
4 morning. I can't hear you. Can I just get you to  
5 speak up, please, and maybe start that question  
6 again?

7 MR. O'GORMAN: Okay. Maybe I'll -- I'll try  
8 and project a little bit more. I seem to be having  
9 some sort of problem with this microphone, so I  
10 apologize. How's that?

11 Q MR. O'GORMAN: Okay. So in a nutshell, after  
12 incorporating the plans for the coarse reject  
13 centrifuge into your water requirements, we then, in  
14 this document, found that the CHPP would require  
15 approximately 57 litres per raw metric tonne; is that  
16 right? Compared to the 110 value we had seen early on?

17 A MR. MCCOY: Mr. O'Gorman, it's Dane McCoy  
18 here.

19 Q Hi, Mr. McCoy.

20 A There were -- we'll confirm that, yes, the -- the --  
21 the new value was 57 litres, and it was -- in an -- in  
22 an attempt to make the -- the CHPP more -- more -- have  
23 more water recovery, process changes were made, and --  
24 and with the -- with the additions that we  
25 incorporated, the -- the value went down, that  
26 57 litres per -- per metric tonne.

1 Q Okay. Thanks, Mr. McCoy.

2 I'm going to call up one other document from your  
3 submissions.

4 MR. O'GORMAN: Actually, it's in this  
5 document, Zoom Host. If we can scan down to PDF 329.

6 Q MR. O'GORMAN: I think -- and remember,  
7 gentlemen, we're on Addendum 5.

8 So right in the middle of this diagram --  
9 actually, almost exactly in the middle, we see a -- a  
10 small object called the "coarse reject centrifuge" with  
11 a water flow that comes out of it of 174,000 or million  
12 litres per year? Some people use 'M' as thousands and  
13 some people use 'M' as millions.

14 So can you confirm, Mr. McCoy, or someone, what  
15 you believe that is?

16 A MR. HOUSTON: I believe that's million,  
17 Mr. O'Gorman.

18 Q I think in this figure, someone's using 'M' as  
19 thousand. 174, I think that's thousands, actually.

20 But would it be millions per year?

21 A MR. YOUL: Mr. O'Gorman, Mike Youl here.  
22 I can jump in, if you like.

23 Q A hundred --

24 A Can you hear me okay?

25 Q Yeah.

26 A Right. So we typically talk in megalitres, which is a

1 thousand cubic metres, so 140 -- 174 megalitres of  
2 water --

3 Q Ah, right. You're right.

4 A -- can recycle back in. Okay?

5 Q Okay. You're right, it's megalitres, so it's 100,000  
6 cubic metres?

7 A Yeah.

8 Q Okay. Great. So I guess what we wanted to check with  
9 you is can you clarify or confirm, is that where the  
10 difference arose between the two different values that  
11 were submitted around the CHPP water demand?

12 A It was a combination -- sorry.

13 Q Go ahead.

14 A It was a combination of that plus recycling  
15 approximately, if my memory serves me correct, about  
16 30 megalitres a year of water that we recover that is  
17 free-draining water coming out of the conveyor belt  
18 spinning the reject bin, and also as the reject bin  
19 fills up and the trucks are under it -- under it, you  
20 often get a bit of free water coming out of that that's  
21 separating from the -- the rejects, and we collect that  
22 in a drain, in a sump, and then recycle that back in --  
23 back in, so the reduction is a combination of those two  
24 improvements.

25 Q Okay. Did you just say an extra 30 megalitres? I'm  
26 not sure I heard that.

1 A Yes.

2 Q Okay.

3 A Yes. 30.

4 Q So --

5 A Three zero.

6 Q So most of the reduction, you know, seven-eighths or so  
7 of the reduction, comes from the coarse reject  
8 centrifuge; is that right?

9 A That's correct.

10 Q Yeah, roughly. Okay. That's good.

11 MR. O'GORMAN: Let's call up please, Zoom  
12 Host -- in the same document, let's just go back to  
13 PDF 293.

14 Okay. If we can expand this a little bit, please.

15 And in this page -- then if we can scan down. Oh,  
16 no, sorry we're looking at it. So the -- no, scan back  
17 up a little bit please, Zoom Host.

18 Q MR. O'GORMAN: So the question we -- we had  
19 asked in this information request -- you see it written  
20 there -- was to discuss contingencies that might be  
21 needed in the event of component outages in proposed  
22 dewatering process. And you -- you see that you  
23 responded -- you -- your operating procedures for the  
24 CHPP did have contingency plans. You did say that if  
25 that particular situation occurs, the feed rate will be  
26 either reduced or stopped until the outage is resolved.

1           So is that still correct? Is that still your  
2           thinking, or do you have -- have you revised your plans  
3           on that front?

4    A   MR. YOUL:                   That's still the thinking,  
5           Mr. O'Gorman. If there's not enough water there, we'd  
6           either slow the plant down or stop it altogether.

7    Q   Okay. Great. So now I'm wondering if you can tell us  
8           whether you have yet selected the dewatering system  
9           that you plan to use at the mine? And if you have,  
10          have you studied the reliability of this proposed  
11          system?

12   A   We have, yes. So the actual exact make and model of  
13          components of the dewatering system is still subject to  
14          going out to tender and -- and out to the various  
15          suppliers, but in general terms, the -- the dewatering  
16          through the plant is tried and proven technology.

17          (INDISCERNIBLE), who are our process plant designers,  
18          have built many of these plants, and the plant that  
19          we'll be installing at Grassy Mountain is very similar  
20          to quite a few plants that have been built in recent  
21          years. With the exception -- I will point out -- the  
22          only new piece of gear is the hyperbaric disc filter,  
23          and this was chosen as an alternative to a thermal  
24          dryer.

25   Q   Okay. That's good. And, again, are you -- are you  
26          confident that this system can be relied on to



1 consistently provide the desired recycled water stream  
2 which you are planning for?

3 A Yes, absolutely. The -- the technology being employed  
4 through screens, vibrating centrifuges, belt press  
5 filters, sieve bends, these are all commonly found  
6 throughout processing plants through the world.

7 Q Okay. This particular system, there are other examples  
8 of it --

9 A Yes.

10 Q -- being used in other plants? Okay.

11 A Yes. Yes. As I said, the only exception is the  
12 hyperbaric disc filter, but that's been used in many  
13 other processing installations. Not necessarily in  
14 coal but in concentrates -- metal concentrates dealing  
15 with fine -- fine particles.

16 Q Okay. So let's assume that you do experience some  
17 operational challenges with it and it doesn't perform  
18 as well as you expect, are there any particular other  
19 measures that you could then employ to get that extra  
20 water, other than applying for additional water  
21 allocations?

22 A We -- yeah, we have looked at this. There are  
23 alternatives. Now, what -- I guess the -- the main  
24 increase in water recovery or decrease in water  
25 consumption, as you pointed out, was through the  
26 installation of the centrifuge on the coarse rejects.

1 And -- and I think I mentioned to Ms. -- Ms. Janusz  
2 yesterday that that centrifuge is identical to the  
3 centrifuge we had on the product stream, just on the  
4 reject stream, and that's purely there for water  
5 recovery.

6 Should we need to push further, there's quite a  
7 lot of tweaking we can do with the -- the speed and  
8 pressure the centrifuges operate at. The -- the  
9 downside of that is where, so that's an operational  
10 tradeoff. But if it's all in the name of saving water  
11 and that's -- and that has to be done, that's -- that's  
12 the direction we'll go.

13 Yeah. As I said, the pressures, the dimensions of  
14 the centrifuge. We also -- in the hyperbaric disc  
15 filter there's an option to fit a steam hood to that,  
16 which further increases the internal pressure of that  
17 to reduce water consumption. And we can look at just  
18 larger -- more -- more equipment, which would have an  
19 impact on the plant footprint. But there's quite a few  
20 options there to -- to deal with water recovery.

21 Q Okay. Thank you, Mr. --

22 A MR. HOUSTON: I could --

23 Q Oh, go ahead.

24 A I could just add a little bit, Mr. O'Gorman. It would  
25 be normal during the detailed design to do a  
26 reliability study, and that would drive, you know, the

1 decisions to have standby units, for example, available  
2 to -- to ensure that we do have a reliable operation.  
3 But that -- that would come during the detail design.

4 Q Okay. Thanks. Standby units, not -- not a standby  
5 entire centrifuge, though?

6 A Just -- just -- just to ensure that we have maintenance  
7 capabilities or -- or reliability that would -- would  
8 meet the needs of the -- of the process. So -- because  
9 that would depend on engineering decisions at the time  
10 after a reliability study was done.

11 Q Okay. Thank you, Mr. Houston and Mr. Youl. And, yes,  
12 I should -- actually, I meant to acknowledge before I  
13 started this -- this round of questions, Ms. Janusz  
14 almost beat me to it and managed to take this one out  
15 of my package. She went partway down the road but it  
16 didn't take us all the way home, so finally, I will ask  
17 you my last question in this theme, which is: Can you  
18 confirm whether or not you anticipate the need for  
19 additional water allocations, either during the  
20 operation of the mine, during start-up years, for  
21 example, while you're having the raw water pond fill?

22 A MR. MCCOY: Mr. O'Gorman, it's Dane McCoy  
23 again.

24 I think with the -- with the water allocations  
25 that have been -- with the volumes that are anticipated  
26 and the allocations that are -- have been applied for,

1 we do have a -- a bit of contingency within those  
2 volumes, so we're at -- at this point, you know, with  
3 the -- you know, the reliability of the -- of the  
4 equipment getting -- performing as -- as a --  
5 projected, I think Benga believes that the amount of  
6 water that's been applied for is -- is and will be  
7 sufficient for the -- for the project.

8 Q Okay. Thank you, Mr. McCoy and everyone. That's it  
9 for that group of questions. I appreciate your answers  
10 there.

11 I'm now going to take us to a series of questions  
12 on hydrology. If your hydrologists want to get warmed  
13 up.

14 MR. O'GORMAN: Ms. Porco, how's my volume  
15 now? I'm doing the best I can. Sorry.

16 Okay. So I'm going to go through a bit of a  
17 preamble, but in the meantime, Zoom Host, if you could  
18 please call up CIAR 360, which was Addendum 12, and  
19 take us to page 30. We're going to pop around that --  
20 that document a bit.

21 Q MR. O'GORMAN: And while that's coming up,  
22 I'm going to begin my -- my question for you folks.

23 Mr. Houston, it's up to you who wants to answer  
24 this. It may or may not be considered an overly  
25 technical question. Some parts of it will be, though,  
26 and I think will need your hydrologists to respond.

1           Okay. So let me provide a brief background.  
2   Benga's use of water allocation transfers for this  
3   project is going to carry certain implications. One of  
4   them is a requirement that water conservation  
5   objectives or instream flow objectives on the key  
6   rivers and creeks are going to have to be met. That's  
7   going to imply that you must release water to augment  
8   flows when flows fall below certain critical levels in  
9   the Crowsnest River and Blairmore and Gold Creeks.

10           Now, my good friends our hydrologists at the AER  
11   have been -- have issued questions to you about this  
12   issue, trying to firm up what we need to understand  
13   going back to before the Panel was appointed, so  
14   with -- when you were just responding to staff IRs  
15   before the Panel became involved, but then even with  
16   the Panel, we've issued you a couple of IRs, including  
17   most recently in Addendum 12, which you just responded  
18   to some months ago.

19           So in this Addendum 12, which I've asked -- we  
20   will be taking a closer look at, you did finally give  
21   us a couple of the key -- a couple of the numbers that  
22   we need to cross the finish line on this one. We saw  
23   some of these critical flows that we need to understand  
24   for both Crowsnest River and Blairmore Creek. We --  
25   I'll point out, and this was explained --

26   MR. O'GORMAN:                   If we want to scroll up a bit,

1 please, Zoom Host, so we show -- it was IR 7.3. Just  
2 go to the beginning of our ask where we -- just, you  
3 know, scroll up pages. Yeah. And there, if you go a  
4 bit farther up, you'll see where the IR itself begins.  
5 Go up one more page. Okay. That's where your response  
6 begins, so that's fine.

7 Actually, leave it on -- that's -- that's good.

8 Q MR. O'GORMAN: So there are a couple of  
9 different approaches that one could take to identify  
10 the critical flows and the release requirements. We  
11 discussed several of them, and when we issued this IR,  
12 we provided some detailed calculation guidelines to  
13 attempt to steer you in the direction of producing the  
14 numbers that we need.

15 You, in your response -- which I won't show on the  
16 screen right now -- but you adopted essentially an  
17 approach in which you tied the critical flows to be  
18 based on avoiding a greater than 10 percent loss in  
19 area-weighted suitability habitat in Blairmore and Gold  
20 Creeks, and that includes maintaining certain minimum  
21 monthly discharges for key bio periods. You fleshed  
22 that it in your response. I'm sure you remember that,  
23 Mr. Houston.

24 I'm going to point out that when, Mr. Houston, you  
25 and I spoke, what -- what feels like a year ago in the  
26 climate change section of questions, and I pointed --

1       you know, we had some -- I think "disagreement" is too  
2       strong a word, but we had a different interpretation,  
3       maybe, of what we had asked you in this IR; and in  
4       rereading it, it seems that you, Benga, interpreted the  
5       IR to really focus on the scenario we proposed in here  
6       about a shutdown of the SBZ.

7               And in your response -- so to be clear, we put the  
8       scenario of the shutdown in the SBZ to motivate you to  
9       why we needed the numbers for Blairmore Creek. The  
10      Gold Creek request in here had nothing to do with a  
11      shutdown in the SBZ. So when you responded, No flow  
12      augmentation to Gold Creek will be undertaken, we  
13      were -- interpreted that as, oh, you're not -- you're  
14      not augmenting Gold Creek, and you were -- I think were  
15      saying you're not augmenting Gold Creek just because  
16      there's an SBZ shutdown. That explains our -- you're  
17      nodding your head so I see you're --

18    A   MR. HOUSTON:                Yeah. I agree. I remember  
19      the discussion. And you can imagine immediately after  
20      that, during a break I went back and read the entire  
21      IR, so I'm -- I'm with you.

22    Q   Okay. Okay. So that's my preamble. Let's begin. In  
23      your IR response that we're looking at, you did provide  
24      us with a flow-mitigation plan. I don't think we need  
25      to look at a particular -- we can go to PDF 30 in here,  
26      five pages later, please, near the bottom of the page.

1           Okay. So in the proposed mitigation plan that you  
2 provided us, you did provide a rationale for  
3 explaining: (as read)

4           Where project impacts on fish habitat in  
5 Blairmore Creek would be more than 10 percent  
6 if flows were below .07 cubic metres per  
7 second from August to April and .19 cubic  
8 metres per second from May to July.

9           You -- does that make -- do you remember that? You see  
10 those numbers?

11   A    Yes. Yes, I'm following.

12   Q    Okay. Okay. You proposed that you would supplement  
13 flows to Blairmore Creek by up to .07 cubic metres per  
14 second from sediment ponds and pit seepage. This is  
15 described over the next couple of pages. Does that  
16 sound right still?

17   A    Yes.

18   Q    Okay. So let's scroll up, please, to PDF 26, four  
19 pages before this one. Okay. And if we scan down.  
20 Scan down. Where did we say this? If I scan down a  
21 little bit farther, please. I did write -- oh, second  
22 paragraph from the bottom. EBFs using -- there we go.  
23 The final sentence in that paragraph, second paragraph  
24 from the bottom, that says that: (as read)

25           The EBF [environmental base flow] minimum  
26 release rate will likely be required to be



1           proportional to the project footprint in each  
2           creek's watershed as illustrated in sample  
3           calculations that we'll give a little bit  
4           later.

5           So I want to clarify something with you, please. In  
6           your response here, and going forward, are you  
7           committing that you, Benga, will supplement the full  
8           flow shortfall below -- in -- in Blairmore Creek below  
9           the critical thresholds of .07, .19 cubic metres per  
10          seconds irrespective of the magnitude and duration of  
11          that shortfall.

12        A    Give us a minute, Mr. O'Gorman, to formulate a good  
13            answer.

14        Q    Sure. By all means.

15        A    DR. BEWLEY:                    Hi, Mr. O'Gorman. This is  
16            Dan Bewley. Nice to meet you.

17        Q    Hi, Mr. Bewley.

18        A    How are you doing?

19        Q    Good. How are you this morning?

20        A    Good. I've only had one coffee, so I'm still waking  
21            up. I --

22        Q    I've had five.

23        A    You are far ahead of me, sir.

24            Okay. So I was involved in this particular  
25            response from a point of view of instream flow needs in  
26            some of the calculations that you see here. It's --

1 it's definitely an important question. If we get into  
2 kind of questions related to mitigation scenarios and  
3 kind of water volumes in those different scenarios, I  
4 may divert to someone else, but I can just talk from a  
5 kind of instream flow needs as a protection level for  
6 the fish aspect on this.

7 I'm going to try a slightly unusual tactic here to  
8 begin. I just want to -- a minute or two for some  
9 preamble.

10 Zoom Host, can we bring up CIAR 543, page 141.

11 And I should just kind of add some context here.  
12 Myself and Mr. Bettles were responsible for writing the  
13 instream flow assessment, and this instream flow  
14 assessment was critically reviewed by Mr. Allan Locke.  
15 And just for context, Mr. Allan Locke was one of the --  
16 the authors of the Alberta desktop method, and I really  
17 appreciate his contributions to the review and the  
18 discussion that we're having today.

19 Once we get there, we'll kind of home in on one of  
20 his recommendations, and I fully agree with this  
21 recommendation. So this is CIAR 553 and -- 553,  
22 page 141. That's right. Top paragraph.

23 So just for some context, when we -- when we deal  
24 with instream flow needs, there's various ways of doing  
25 this. There is a coarse level way of doing it, just on  
26 a desktop basis. There's no fieldwork involved. There

1 is also a very detailed way of doing it with field  
2 measurements, and that's the route that we ultimately  
3 went down.

4 In terms of a coarse level assessment, there's  
5 various thresholds out there. Mr. O'Gorman, you  
6 introduced one this morning, a 10 percent significant  
7 loss of habitat over a particular period. There are  
8 other thresholds out there at various jurisdictions.  
9 So one is the -- the federal threshold, and it's --  
10 it's in much of the documentation. The federal -- DFO  
11 threshold is essentially once you go below the  
12 30 percent mean annual discharge level, then  
13 essentially any project-related impacts have to be  
14 mitigated for.

15 There is also the provincial level --  
16 environmental base-flow cutoff level, which basically  
17 is -- originates from the Alberta desktop method. And  
18 basically what the Alberta desktop method says is in  
19 your driest 20 percent of conditions for any given week  
20 or year, if there are project impacts on flow in that  
21 driest 20 percent of the year, then those losses due to  
22 the project must be mitigated. Okay? There's --  
23 there's all these various different thresholds.

24 And Mr. Locke's good recommendation is that we  
25 need to -- we need to have a discussion on what is that  
26 best or most optimal environmental base flow or cutoff

1 for this project, given that there are different  
2 jurisdictions and they each have their own protection  
3 level at that very low-flow level.

4 The one -- the one reason why we did a detailed  
5 assessment is because, you know, these -- these desktop  
6 methods are great if you don't have much data. But if  
7 we're dealing with something of high significance -- in  
8 our case, the trout -- then we really need to dial into  
9 a detailed flow assessment. Right? And just really  
10 get the most amount of information as to what the flows  
11 are and all the different reaches and what are the life  
12 stages and the fish suitability for those life stages.

13 So our scope was to identify the residual impacts  
14 on each life stage of the trout for each reach, and you  
15 see that in some of the calculations. That supersedes  
16 any kind of desktop-level method that we're dealing  
17 with. So where -- we want to be careful when we're,  
18 you know, saying that we're -- we're using these  
19 coarse-level desktop methods in this discussion.

20 I should also note that Mr. Locke -- also, one of  
21 his great recommendations was to point us to an updated  
22 version of the Alberta desktop method that has just  
23 come out in the last 12 months. I believe it's called  
24 the Alberta Water Directive Guidelines. So sorry for  
25 the long preamble. Just to kind of add that to the --  
26 the discussion, Mr. O'Gorman.

1           So I guess just to kind of carry the question on.  
2       Yeah. So there is the scenario that the SBZ shuts down  
3       and our calculations were to, you know, figure out  
4       using these coarse-level thresholds that we believe  
5       should be improved using our detailed method, yes,  
6       essentially, the -- the folks here at Benga crunched  
7       the maths and they basically said there's this water  
8       available in the ponds that, you know, over a given  
9       amount of time -- I think it's -- it's 50-something  
10      days maximum period worst case ever that this saturated  
11      backfill zone may shut down and flows in Blairmore  
12      Creek need to be supplemented, that they would meet  
13      that 30 percent MAD level in Blairmore to satisfy  
14      the -- the base component of the instream flow needs  
15      using that desktop method that we think should be  
16      updated with our detailed assessment. Okay?

17   Q   Okay.

18   A   Yeah. Do you want to guide me on to ...

19   Q   Well, I mean I'll take you back to the question. In  
20      the IR response -- and so first I'll acknowledge  
21      everything that you just said are things that have been  
22      discussed on the record. We understand there are  
23      desktop methods. We understand, instead, you're  
24      proposing something based on your instream flow  
25      assessment. I'm not really at this point challenging  
26      you on that. We acknowledge those are different

1 approaches that -- we've said you've proposed that  
2 approach, so I'm just going with that approach.

3 And in the -- in the response that you gave us you  
4 did say that you would supplement flows up to the .07  
5 and .19 metres cubed per second. And I just wanted to  
6 confirm, are you committing to doing that irrespective  
7 of the magnitude of duration, or are you not?

8 A MR. HOUSTON: So the answer's: Yes,  
9 Mr. O'Gorman, we are committing to do that. We -- of  
10 course, if the saturated backfill zone isn't shut down,  
11 we need to recognize that that is in respect of  
12 Blairmore Creek.

13 Q Yes.

14 A That saturated backfill zone is a huge water storage  
15 element in the water management plan and -- and so one  
16 can draw that down. It -- if it's out of service, then  
17 I -- I think the -- the limitations on how long one can  
18 tolerate that -- that situation are -- are limited, but  
19 we would commit to providing the .07 flow rate during  
20 that time.

21 Q Okay. Thank you, Mr. Houston.

22 And the higher value at the different times of the  
23 year, which was .19, as I recall?

24 A It -- yes, I'm -- I'm sorry. We would -- we would meet  
25 the requirements.

26 Q Okay.

1 A Yeah.

2 Q Okay. Thanks, Mr. Houston.

3 Let's move on to a slightly different aspect of  
4 this question. So as I think I alluded to in my long  
5 preamble, we still need -- I think I said we were  
6 two-thirds of the way home. We had critical flows for  
7 Crowsnest, and there just was a lot of conservation  
8 objective there that you addressed. We had -- now had  
9 critical flows for Blairmore, but we still don't have  
10 this critical flow information we need for Gold Creek.  
11 In fact, we interpreted your response as saying you  
12 weren't going to augment flows to Gold Creek as -- that  
13 you didn't have that for us.

14 So I did note, Mr. Houston, several times, and I'm  
15 not going to try and -- and I won't try and find the  
16 transcript references, but you have spoke through this  
17 process about your plans -- small 'P' plans, not  
18 capital 'P' plans -- but your plans, your ability to  
19 augment flows from the sedimentation ponds into Gold  
20 Creek at times when flows were low. So you've spoken  
21 to that in a general sense, but what we need to  
22 understand is for -- again, motivated by your use of  
23 these water transfers, what the critical flows are and  
24 the potential flow augmentation that you will do into  
25 Gold Creek, and we actually need some detailed -- a  
26 sense of how you're going to do that.

1           So if I scan down in my notes -- sorry. I have a  
2 lot of notes on this.

3           MR. O'GORMAN:                   Let's call up, please, Zoom  
4 Host, CIAR 44, which is -- and we're going to look at  
5 your instream flow assessment. We're going to go to  
6 PDF page 84. That's several pages nearby. Great. If  
7 you can just expand just as an illustration that  
8 graph -- that figure at the bottom.

9   Q   MR. O'GORMAN:                   We won't look at this other  
10 series of tables here. Actually, it's Dr. Bewley; is  
11 that right?

12   A   DR. BEWLEY:                    Sure. Or Mr., whichever you  
13 prefer.

14   Q   Okay. Did you prepare these?

15   A   Yes.

16   Q   Okay. Great.

17           So we have a series of figures that relate the AWS  
18 habitat to flow for different life stages of the  
19 westslope cutthroat trout. We have five different  
20 figures, one for a bunch -- you know, five different  
21 reaches on Gold Creek. We won't look at the others.

22           I will note that in the response you gave us to  
23 IR 73 -- 7.3 that we've been talking about earlier, you  
24 did illustrate one or two of these diagrams for the --  
25 relating the AWS habitat to flow for Blairmore Creek.  
26 So that would -- this was -- this type of figure is an



1 important motivator, I think, in your -- your proposed  
2 approach.

3 And we're going -- so knowing that these exist,  
4 we're going to -- now go to, in the same document,  
5 PDF 252, please. Table A1.

6 So if we look at -- I think we wanted to look at  
7 GC-09.

8 MR. O'GORMAN: And blow it up a little bit,  
9 please, Zoom Host.

10 Q MR. O'GORMAN: So GC-09 -- and this is a  
11 projection you gave us for the maximum percent change  
12 in flow forecasted due to the project -- no, that's  
13 not -- not -- there. During operations.

14 MR. O'GORMAN: That's good. That's good,  
15 Zoom Host. Stay there.

16 Q MR. O'GORMAN: So you projected during  
17 operations at GC-09 the biggest percent change flow  
18 would be a decrease of 9 percent at -- at that station  
19 in Gold Creek. Is that right, Mr. Bewley? I think --  
20 and I understand that that is in Reach 7, GC-09.

21 A DR. BEWLEY: Sorry. Which -- which page is  
22 this of this document?

23 Q It's PDF 252.

24 A I believe this is in the water temperature section. We  
25 have -- we have predicted changes in stream flow, and  
26 they show in page 26 of this PDF, I believe.

1 Q Let's take a look.

2 A So, yes, this shows the changes on Gold Creek at those  
3 various nodes. This is in average hydrological  
4 conditions, I believe. There's a corresponding table  
5 for dry hydrological conditions. But, yes, this is  
6 the -- kind of changes in flow predicted --

7 Q Okay.

8 A -- along Gold Creek.

9 MR. O'GORMAN: Can we scan down a little bit,  
10 Zoom Host, please, to see the time frame we're looking  
11 at here? This -- so -- you see -- okay. That's fine.

12 Q MR. O'GORMAN: So this starts in 2017 and  
13 goes to 2041, and then you see those sorts of  
14 fluctuations.

15 I'll -- I'll tell you what I'm getting at,  
16 Mr. Bewley, is what we wanted to see were actual  
17 numbers -- this figure, of course, we'd have to eyeball  
18 and guess what the number is. Actual numbers for your  
19 projected mean reduction in flow in Gold Creek. You --  
20 in that table we looked at a minute ago -- and I  
21 recognize we were looking at the dry year column. But  
22 I think the normal year column on the other side of it  
23 also will show the same maximum reduction in flow at  
24 that station in Reach 7 in Gold Creek.

25 But we wanted to know what your mean percent  
26 change in reduction and flow due to the project is

1           during operations. And if I look at this figure, what  
2           I interpret you're saying, it decreases --

3    A    DR. BEWLEY:                    Sure.

4    Q    -- on a pretty steady path down to, actually, dropping  
5           the flow to more than 10 percent reduction at that --

6    A    Yeah.

7    Q    -- station, which is CO2?

8    A    Essentially, you know, through operations as -- as the  
9           mine develops, water is increasingly lost through to  
10          the end of operations and then into this kind of  
11          two-year window of decommissioning in the early to  
12          mid-2040s, and then we get into that kind of closure  
13          phase thereon.

14                 So, yeah, like, part of my discussion with  
15          Mr. Sawyer is getting into the -- the losses of habitat  
16          that are predicted based on these flow changes and the  
17          relationship of that to the kind of baseline amount of  
18          habitat available.

19    Q    Right. And, of course, that's what we are interested  
20          in for this calculation as well. So that's  
21          interesting, but do you -- do you have -- do you have a  
22          table of numbers that would support this ?

23    A    Of these flow values?

24    Q    Yes.

25    A    So this was obtained from SRK, and I would defer to  
26          Mr. Jensen to -- you know, if these values are

1 tabulated.

2 Q Mr. Jensen?

3 A MR. JENSEN: Yes. Hello, Mr. O'Gorman.

4 Q Hello.

5 A I'm trying to -- I'm trying recall if we did tabulate  
6 these, and I would probably say no. I -- I don't  
7 recall tabulating these numbers. I -- I think all we  
8 did was show them in an illustration like this.

9 Q Okay. Well, I'll pull back from looking at these  
10 specific numbers. Although I will ask -- maybe what we  
11 should do is --

12 MR. O'GORMAN: Let's go back to the AWS curve  
13 again, which is page 84, PDF 84, Zoom Host.

14 Q MR. O'GORMAN: So here what we're really  
15 looking for -- what we would like is for each reach to  
16 understand --

17 MR. O'GORMAN: Scan down a little bit,  
18 please, Zoom Host.

19 Q MR. O'GORMAN: What we would like to do is  
20 understand for each reach on Gold Creek what the  
21 percentage change in flow is that we can expect due to  
22 the project and, you know, a -- a graph that we have to  
23 eyeball where it -- the points might line up over on  
24 the -- on the y-axis makes that a challenge for our  
25 hydrologists.

26 When you gave us your response to IR 7.3, you did

1 sort of demonstrate that you do have a good sense  
2 through your -- your modelling and your instream flow  
3 assessment how habitat varies with flow for the  
4 different reaches and for different life stages. So  
5 this is what I'm going to ask you whether you can  
6 provide: If you can provide it -- I expect it would  
7 require an undertaking -- but I expect you're going to  
8 need to think, you know, is this something that you are  
9 able to provide for us? 'Cause this is the information  
10 that we need.

11 Can you please -- I'll read it out to be -- make  
12 sure I don't get -- get it wrong. Can you please  
13 provide for each reach and life stage during operations  
14 what is the flow below which the predicted change in  
15 flow due to your project will reduce habitat by more  
16 than 10 percent? And if you like, I can actually offer  
17 you a suggested formula for that calculation to guide  
18 your work. But the idea is here if you know what the  
19 average flows are and you know on average how your  
20 project is going to impact those flows, how -- at what  
21 point in reducing those flows from -- due to your  
22 project are you impacting the AWS habitat for the  
23 different reaches and bio periods to a degree that's  
24 greater than 10 percent. And that would be  
25 fundamentally, I think, related to this question I want  
26 to know of what is the critical flow?

1 A DR. BEWLEY: Okay. So I think I understand  
2 the question. Just to -- let's try this. Can we go to  
3 page 94, please, of this document. There we go. Okay.  
4 Let's just scroll along to the operations phase.

5 So what I think you're asking, Mr. O'Gorman, is we  
6 have columns in there that say "mean percent AWS",  
7 okay, and anything negative means that there is a  
8 residual impact on habitat due to the flow losses that  
9 have been predicted.

10 What I think you're asking is what are the flows  
11 that would cause those numbers that you see there, like  
12 negative 2 percent, 2 percent, 2 percent, 1 percent,  
13 1 percent, what would be those change in flows that  
14 bring us to that 10 percent significance level. Okay?  
15 Is that the question?

16 Q I believe that it is. I do want to make sure my  
17 hydrologists agree with me, so they will get back to  
18 me, but I -- yeah, I mean, the whole point is at what  
19 point are you reducing the flows so you -- is your  
20 project reducing the flows so the AWS decreases by this  
21 critical -- as you've suggested, is the critical amount  
22 of loss of 10 percent. So, yes, we think that what you  
23 just said would get us to where we -- we need to be to  
24 come up with the critical flow.

25 A Okay. So I think we're on the same page. Just give me  
26 one moment, please.

1 A MR. HOUSTON: So -- so, Mr. O'Gorman, we're  
2 just discussing what we think you're asking for, and  
3 we're -- we're thinking this may be a -- a couple of  
4 days of work to -- to get back to you on this.

5 Is this fundamental for ongoing questions or --

6 Q Yeah. I'll jump in and respond to that, Mr. Houston.  
7 So, yes, this will require an undertaking. It would  
8 require some number crunching but not sort of months or  
9 weeks of remodelling or anything like that. It would  
10 just take some -- we think some elbow grease from your  
11 experts. It is not information I need to ask you more  
12 questions about.

13 So as -- if we could get this -- you know, like  
14 the other information request I had, I did want to ask  
15 you more questions about. This is just information  
16 that we are going to need going forward in the future  
17 to be able to evaluate if we have enough information  
18 about your flow augmentation strategy.

19 So if you could be -- put some folks to try and --  
20 to work it out and submit it before the close of the  
21 evidentiary period, I think that would be sufficient  
22 for our purposes.

23 A I -- I think we can commit to that. I'm just going to  
24 check with Dr. Bewley to make sure that he's crystal  
25 clear on the request.

26 Q Well, I could -- I could clarify a bit more.

1 A Okay.

2 Q Let me -- let me just try and clarify again. I'll give  
3 it to you a couple ways.

4 In Gold Creek for each reach and life stage -- so  
5 those are, you know, broken down in those categories  
6 for everything they say -- we want to understand --  
7 here's a couple of ways you could think about it.  
8 Given an 'X' percentage change in flow due to the  
9 project under what flows -- so below what flows, then,  
10 are the project impacts more than 10 percent impact to  
11 the AWS habitat?

12 A DR. BEWLEY: Just to be clear,  
13 Mr. O'Gorman, you're referring to the mean bio period  
14 that we see in the columns here, or do you mean the  
15 one-month maximum? They're slightly different.

16 Q Can we scan over to -- a bit, please, to the left side  
17 so I can see.

18 A I can -- I can clarify what that difference is, if you  
19 want me to.

20 Q Please do.

21 Yeah. So we were looking for each bio period --  
22 each region bio period.

23 A So can we just --

24 Q On the bio stage.

25 A Yeah. Can we just scroll over to the decommission?

26 And this is the easiest one to explain. Sorry,



1 decommission. That's right.

2 So there's -- there's two thresholds or metrics  
3 that we've used. There's a mean, and there's a  
4 one-month maximum. Mean is the more chronic, kind of  
5 long term, and the one-month maximum is more acute. So  
6 decommissioning 2043 to 2044.

7 And let's just take spawning as an example.  
8 Spawning occurs in May, June, July; okay? So that  
9 means that in May, June, and July of 2043 and 2044, we  
10 are calculating the habitat reductions in each of those  
11 six months, and we're calculating the mean in the mean  
12 column that you see here. The one-month maximum  
13 basically means in those six months of calculations,  
14 what is the one month with the highest loss of habitat;  
15 right? As an acute level of habitat -- residual  
16 habitat impact. So it's -- for this particular window,  
17 it's the one-month value versus, in this case, six  
18 months of values that are averaged, which you see in  
19 that mean column.

20 So, yeah, it's over to you whether you -- which --  
21 which metric would you like?

22 Q The metric we'd like you to apply, Mr. Bewley, to the  
23 AWS figures is not the column we're looking at there,  
24 but the mean impacts on flow from the project during  
25 operations.

26 A Okay. So it's the -- the flow reduction that brings

1           you to the 10 percent level of mean habitat reduction.  
2           Okay.

3                     And it's going to be five numbers per reach that  
4           we see here. I guess five flow reduction numbers per  
5           reach that give you that 10 percent.

6    Q    Yeah, we want it by reach and by -- and by -- by life  
7           stage, yes.

8    A    Okay.

9    Q    So, yeah. That -- that would work for us.

10                    And because this is obviously a confusing and  
11           technical calculation for all involved, we would like  
12           you, please, to be very explicit in explaining to us  
13           the methodology you use in coming up with these numbers  
14           and make sure -- I suppose it's obvious -- that you use  
15           real data with numbers as opposed to a -- a figure that  
16           we have to try and interpret.

17   A    Okay. And the last question I have is: You indicated  
18           you had a formula that was available to help in these  
19           calculations?

20   Q    Well, we sort of had a general sort of formula. Why  
21           don't I, you know, share the one I suggested to you?

22   A    Sure.

23   Q    Unless my hydrologist says not to. Okay. I'm going to  
24           go the -- if it helps to clarify, the idea we're  
25           thinking of -- and, obviously, I'm going to have to say  
26           this out, so -- I can't show it to you. But we're

1 talking about a percent reduction in habitat, right,  
2 for reduction in flow due to the project.

3 So if we think about the numerator of that  
4 equation for -- in the percent reduction, your AWS  
5 curves show a habitat -- you know, a habitat amount as  
6 a function of 'Q', as a function of the flow?

7 A Yeah.

8 Q So if you have your 'H' as a function of 'Q', where 'H'  
9 is habitat area and 'Q' is flow, and you subtract  
10 'H' -- I'm from Newfoundland, and so I call it as  
11 "haitch" [phonetic], you'll have to forgive me -- 'H'  
12 is a function of 'Q' to the 1 minus 'K', where 'K' is  
13 the reduction in flow due to your project. Right?

14 So what's the -- what's the delta between the  
15 habitat number as a function of 'Q', subtract the  
16 habitat number as a function of the reduction in 'Q'  
17 due to your project, divide that by your denominator of  
18 the habitat as a function of 'Q', and you get the  
19 percent reduction in 'H' that we're looking for? And  
20 where does that take us to exceed 10 percent? And that  
21 will tell us something interesting, we think, about the  
22 critical flows in Gold Creek.

23 A Okay. Yeah. I will look into that and get some  
24 numbers.

25 A MR. HOUSTON: Okay. Well -- so am I correct  
26 that we're looking for delta 'Q' for the --

1 Q Delta 'H'.

2 A Delta 'Q' or delta 'H'?

3 Q Delta 'H' is a function of the change in 'Q'.

4 A DR. BEWLEY: So you're after the delta 'Q',  
5 I'm understanding?

6 Q Well, we do -- we want it for the two different 'Q's.  
7 We've got 'H' of Q1 and 'H' of Q2; right? Where Q1,  
8 right, is the -- the -- the flow, and Q2 is the  
9 reduction in flow the -- the reduced flow due to your  
10 project. That delta divided by your starting point,  
11 your 'H' of Q1.

12 A MR. HOUSTON: Okay.

13 Q We want to know, most importantly, obviously, when does  
14 the result of that calculation take you to greater than  
15 a 10 percent loss in 'H', or "haitch" as I call it?

16 A 'H' or "haitch"?

17 Q Either one will work.

18 A Okay.

19 Q But I'm the -- I'm the only person that will understand  
20 if you call it "haitch".

21 A Okay. I used to have a calculus professor who called  
22 it "haitch" too, so I'm used to that.

23 But I'm looking over at Dan here to see if 'H' is  
24 a characteristic of the reach, or is that something  
25 that varies on a smaller scale? 'Q' is a function of  
26 reach; I can understand that.

1 A DR. BEWLEY: Habitat varies between all the  
2 individual means or habitats, and this -- this approach  
3 basically uses sampling at a number of those  
4 representative meso habitats; okay?

5 These -- these calculations that you see here are  
6 essentially averaged over the -- the reach, but they --  
7 they're weighted for the proportion of meso habitats.  
8 So if you have a riffle-dominated reach, then the loss  
9 of habitat will -- will essentially be weighted by what  
10 is the loss of habitat at our riffle-specific transects  
11 in a given reach; okay?

12 So -- but the numbers you see here are averaged  
13 over the reach, but they -- they weight what the reach  
14 looks like in terms of meso habitat composition.

15 Q Well, Mr. Bewley, we might need you to, you know,  
16 unaggre -- disaggregate them to do that calculation, so  
17 that's why we're hoping -- it'll take a little bit of  
18 elbow grease, we acknowledge, from you folks, but it is  
19 information that our hydrologists have been trying to  
20 understand for some time. And here we are at the  
21 hearing. We don't need to ask more questions about it,  
22 but we would appreciate it.

23 And, Mr. Houston, I'll ask you to confirm if you  
24 can commit to an undertaking to submit these numbers  
25 before the end of the evidentiary portion?

26 A MR. HOUSTON: I --

1 A DR. BEWLEY: Sorry. From a nonlegal  
2 background, what is that date, actually?

3 A MR. HOUSTON: The end of the month, roughly.

4 A DR. BEWLEY: That, I think, we can make  
5 work, yeah.

6 A MR. HOUSTON: Okay. We'll commit to that,  
7 Mr. O'Gorman, and we'll try to exceed your  
8 expectations, just in case there is some tweaking to  
9 the tables that is required.

10 Q That's great.

11 MR. O'GORMAN: Mr. Chair?

12 THE CHAIR: Okay. Can we get an  
13 undertaking number?

14 MS. UTTING: Mr. Chair, Tracy Utting, Panel  
15 manager. That would be CI -- oh, sorry. Undertaking  
16 Number 22.

17 THE CHAIR: Thank you.

18 Q MR. O'GORMAN: I'm going to -- I mean, I'm  
19 going to just incorporate in that, please, a detailed  
20 explanation of your calculation methodology.

21 A DR. BEWLEY: Sure. Yeah.

22 Q Okay. Okay. Thank you for that, Mr. Bewley and  
23 Mr. Houston.

24 So let's carry on with some more hydrology  
25 questions, but those -- that should be the -- that was  
26 the most number-intensive one.

1 MR. O'GORMAN: Okay. Can we please take this  
2 down, Zoom Host, and call up -- and we will go back to  
3 in -- a lot of these questions. Go back to CIAR 360.  
4 It's Addendum 12, and PDF page 36. We're still in the  
5 information request response to information -- IR 7.3.  
6 Yeah. That's good. Right there in the middle.

7 Q MR. O'GORMAN: The Crowsnest Pass -- the  
8 Crowsnest River water conservation objective.

9 So in this IR response, in this part, you did  
10 provide a minimal release rate of 500 -- about 500  
11 cubic metres per day from the site to help satisfy the  
12 water conservation objective for the Crowsnest River.  
13 However, in this response, you didn't provide us with a  
14 mention of how this was going to be handled during the  
15 winter period when the water -- the WSC hydrometrics  
16 station, affectionally known as "05AA008", and that  
17 information is in here somewhere. Those in the know  
18 know that station. It does not, in the winter, have  
19 near real-time data, so it's not reporting flow data in  
20 here real time, which is a familiar concept, I think,  
21 to Alberta hydrologists.

22 So I will ask you a question: Can you tell me how  
23 you're going to monitor the water conservation  
24 objective in Crowsnest River at the Frank -- at the  
25 Frank station during the winter when that Water Survey  
26 of Canada station does not report on a near real-time

1 basis?

2 A MR. HOUSTON: That -- that's a good  
3 question, Mr. O'Gorman. I'm wondering because that --  
4 the issue must be live today with or without this.

5 Are you on mute?

6 Must be live today with -- without our project,  
7 and -- and so I'm wondering how that is done today  
8 and -- and, you know, how -- how is that managed today.  
9 That -- that's what's going through my head. This is  
10 an issue with or without the project is, I guess, what  
11 I'm thinking.

12 Q I do know the answer to your question, Mr. Houston, but  
13 I'm not, I don't think, allowed to answer it for you.

14 A Okay.

15 Q So I'm wondering whether you might turn to your  
16 colleagues.

17 So as a starting point, you folks have not  
18 explicitly thought through -- you may -- you did commit  
19 to meeting that WCO objective in the Crowsnest River,  
20 and you have to, because you're -- if you -- if you are  
21 successful in getting the transfers you've asked for,  
22 for the Crown in particular -- licence in particular,  
23 but during the winter when there's no real-time data to  
24 evaluate it, we need to know how you plan or -- to --  
25 to meet that WCO during the winter in the Crowsnest  
26 River.



1 A DR. BEWLEY: Hi, Mr. O'Gorman. Sorry for  
2 the wait.

3 Yes. What we can offer, I think, is to begin  
4 winter sampling on the Crowsnest to fill in the data  
5 that the Water Survey of Canada collects at the same  
6 station through the open-water months.

7 We -- we do have experience of this for a similar  
8 kind of -- similar kind of analyses that are called for  
9 in terms of -- the water survey have their seasonal  
10 gauges, but we need year-round data. And this is  
11 important data for any kind of hydrological annual  
12 statistics; right? In this case, it's to assess  
13 whether the flows on the Crowsnest are above or below a  
14 certain threshold, as you indicated.

15 So what this would entail is, essentially, I  
16 think, offering staff to conduct winter streamflow  
17 measurements on the Crowsnest at this station. That  
18 basically gives us streamflow measurements that are  
19 then used to calibrate continuous estimates of  
20 streamflow which you get from, like, the pressure  
21 transducers.

22 You do need these streamflow measurements because  
23 they're -- they're a complicated -- the reason why you  
24 cannot use stage discharge curves in winter is because  
25 ice is a source of backwater, which basically means  
26 that you have -- you have more water depth than you

1           should for a given discharge because everything is  
2           backed up. So those stage discharge curves that Water  
3           Survey develop and refine over time, they are not  
4           applicable in winter. That's where the streamflow  
5           measurements come in to help calibrate those continuous  
6           winter estimates.

7           So just talking with Mr. Houston, I think we're --  
8           we can commit to essentially conducting those  
9           streamflow measurements on the Crowsnest in the winter  
10          to kind of calibrate those -- those winter estimates,  
11          subject to, of course, risks associated with winter  
12          sampling on the river, ice safety, all that kind of  
13          stuff; right?

14        Q    Sure. Okay. Thanks, Mr. Bewley. I have one follow-up  
15          on this. So that's -- that's your proposal.

16          Let me throw an alternative sort of assumption at  
17          you. Let's say, for whatever reason, you have  
18          challenges in identifying the real-time flows to know  
19          if, on a particular day during the winter, when this is  
20          mostly an issue, the Crowsnest has fallen below the  
21          rate at which you need to assure you are putting at  
22          least 500 cubic metres a day into the system. Would  
23          you be willing to commit that when you don't have the  
24          data, you would commit to maintaining throughout that  
25          entire period, presumably during the winter, when you  
26          don't have data, that you would return the 500 cubic

1 metres per day to the Crowsnest, obviously via Blair  
2 [sic] or Gold, to make sure that you were satisfying  
3 this objective?

4 A MR. HOUSTON: Yes, that -- that's a fairly  
5 small number compared to what we're -- we're planning  
6 to put back in the system on a daily basis, so we -- we  
7 could commit to that.

8 Q Okay. Thank you, Mr. Houston. Let's move on. And  
9 thank you, Mr. Bewley.

10 Good. Good. Good. Good. Another question  
11 related -- two more questions related to monitoring of  
12 flows. Okay. This -- my initial preamble we've  
13 already covered a number of times. So we've talked  
14 about you've agreed to return water -- "return" during  
15 operations when flows are below the critical  
16 thresholds. You've proposed a monitoring plan.

17 MR. O'GORMAN: If we could haul up CIAR, Zoom  
18 Host, please, Number 44. Excuse me. And look at -- in  
19 CIAR 44, PDF 77.

20 Q MR. O'GORMAN: Right. So I won't ask you to  
21 go through this, but you may remember this document --  
22 it came from your materials some time ago -- which had  
23 a monitoring plan for how you would be monitoring  
24 for -- for -- for these flows. I just wanted to  
25 illustrate that we had seen it.

26 Separately from this -- that's it --

1 MR. O'GORMAN: You can take it down, Zoom  
2 Host.

3 Q MR. O'GORMAN: Separately you've also  
4 provided us with critical thresholds for Blairmore  
5 Creek in Addendum 12. We don't need to haul those up.  
6 Those are the numbers we've been discussing. And you  
7 are going to produce, as a result of the undertaking,  
8 the threshold -- the thresholds we need to see for Gold  
9 Creek.

10 So if we can -- do I actually need to haul up this  
11 document? Hmm. Yes. So let's go -- open up again  
12 Addendum 12, CIAR 360, and go to PDF 27.

13 MR. O'GORMAN: 27. Good. Let's scan down to  
14 the bottom of that page, please. Okay. Good.  
15 Actually scan down a little bit more, just to the very  
16 bottom of the page.

17 Q MR. O'GORMAN: I'm wondering if we show --  
18 oh, looks like we define those terms at the top of the  
19 next page, the 'Q's and the 'A's that you see on this  
20 page.

21 Okay. So in this document what we did was we  
22 presented you with a set of equations as a method to  
23 compute what the minimum operational release rates to  
24 Blairmore and Gold Creeks would be when flows are below  
25 the critical thresholds. We've focused a lot so far on  
26 the critical thresholds, but it's a separate question

1 as to how much water you would need to release if the  
2 flows fall below there.

3 And I -- to be -- so I guess what we want to know  
4 is whether you'll be able to follow this method to  
5 compute the minimum operational release rates. And I  
6 should be a little more clear with that. We want to  
7 know operationally how you're going to be able to tell  
8 every day, while you're at work mining for coal,  
9 whether or not you need to release extra water into  
10 Blairmore and Gold Creek; and if so, how much?

11 A DR. BEWLEY: Sorry. Just one moment,  
12 Mr. O'Gorman. Thank you.

13 Q Yeah.

14 A Thanks for waiting, Mr. O'Gorman.

15 So we do have some experience with this  
16 essentially with projects that need to, you know,  
17 maintain certain flows or water levels under certain  
18 permit conditions.

19 So what I think we can offer here is, as -- as we  
20 have discussed this last week, we do have hydrometric  
21 stations in Gold and Blairmore Creek as we stand.

22 The one thing that I think is important here is, I  
23 think we're -- the need in this particular question is  
24 for real time or near real-time data in terms of water  
25 levels, water temperatures, and essentially estimated  
26 flows in a real-time basis. That we can do if we set

1 up our hydrometric stations with the ability to have  
2 telemetry on those sensors in the hardware, and  
3 basically what that means is through the telemetry, the  
4 data calls into a server or a database however --  
5 how -- how regularly we want it. So often we -- we  
6 collect near real-time data from the last day based on,  
7 you know, the data in the last day, and that goes  
8 through the telemetry systems.

9 So what I think we're offering here is the -- the  
10 ability to add that telemetry option to our hydrometric  
11 gauges to call in with the latest data and essentially  
12 characterize the flows on a near real-time basis, and  
13 that then gets fed into your calculations that I  
14 believe you're talking about.

15 Q Okay. And you would monitor on the mine site as well  
16 to estimate, you know, the mine flow?

17 A MR. HOUSTON: So, yes, Mr. O'Gorman, we --  
18 we could have that data available and use operating  
19 parameters to set alarms and -- and reaction points  
20 where we would -- we would take, you know, a -- action  
21 to correct a -- a low-flow situation.

22 Q Okay. Okay. Follow-ups. So what we're describing  
23 and, Mr. Bewley, what you just sort of talked out is  
24 the sort of "return strategy" and the monitoring to  
25 support a return strategy that our hydrologists have  
26 been seeking. So is your plan that you would prepare a

1 detailed plan that describes a return strategy and  
2 submit it at some point? If it'll be part of the plan,  
3 you know, what -- when would we see that or some future  
4 regulator see that? What else would that plan include?

5 A So, Mr. O'Gorman -- yeah. I'm not on mute.

6 Mr. O'Gorman, we -- we have submitted a draft  
7 aquatics monitoring plan, and I believe these would be  
8 details that we could add to that aquatics monitoring  
9 plan to be more specific about the timing of data  
10 retrieval and -- and operating characteristics. So  
11 our -- our -- our understanding has always been that we  
12 will finalize that aquatics monitoring plan with the --  
13 with the regulator post this -- this process.

14 Q Okay. Final question on this theme.

15 Sorry. I have construction taking place outside.  
16 I don't know if people can hear that.

17 Just can you elaborate a little bit more about  
18 whether you have a plan about where you would install  
19 the type of equipment that Mr. Bewley was just talking  
20 about?

21 A It -- it would be associated with the existing  
22 hydrometric stations that we have on -- on the creeks,  
23 Mr. O'Gorman.

24 Q Okay.

25 A And -- and I should add, and -- and potentially at any  
26 outfall location that we -- we choose, you know, that

1 we create.

2 Q Okay. So by -- Mr. Houston, by tying your response to  
3 the -- to the -- which plan did you just say?

4 A Aquatics monitoring or --

5 Q Aquatics monitoring plan?

6 A Aquatics monitoring plan, yeah.

7 Q So you're not saying you would prepare a separate piece  
8 which would be a water management plan?

9 A No. The -- the aquatics monitoring plan includes a  
10 broad range of monitoring programs, from quantity to  
11 quality to biological monitoring. So it's a fairly  
12 comprehensive plan, and we would try to keep it all in  
13 one document.

14 Q Okay. Thank you.

15 Let's move on. This last --

16 THE CHAIR: Mr. O'Gorman.

17 MR. O'GORMAN: Yeah.

18 THE CHAIR: Yeah. I'm just going to  
19 suggest, if you are about to change topic areas, we're  
20 going to be looking for a break soon, so you can either  
21 do it now or after your next set of questions.

22 MR. O'GORMAN: Actually, I'm not -- this is  
23 the final one that's sort of related to hydrology and  
24 monitoring, so let me do this question, and then I'll  
25 take a break, Mr. Chair.

26 THE CHAIR: Okay.



1 MR. O'GORMAN: And thank you for --

2 THE CHAIR: Sounds good.

3 MR. O'GORMAN: And this is, actually, I  
4 think, a fairly brief question.

5 Q MR. O'GORMAN: So, Mr. Houston, I don't need  
6 to haul the document up again. All of this is related  
7 to your response to IR 7.3. You did indicate in  
8 there -- if you need me to point you to it, I can --  
9 that you would augment the creek flows by pumping  
10 stored water from the selected sedimentation ponds.

11 During operations -- and, to some extent, we  
12 touched on this, but just to make sure we're clear --  
13 how will you monitor to ensure that the release of  
14 water from your site is the correct volume or flow rate  
15 needed to satisfy that water return?

16 A MR. HOUSTON: I don't think we've finalized  
17 how we're going to monitor the flow rates out of the  
18 various ponds. There are various methods -- you know,  
19 using shaped weirs, for example -- to -- to gauge  
20 the -- the flow rates, or we could just do a -- you  
21 know, a -- a level metring on the pond. So I -- I  
22 think it's going to depend a little bit on the -- on  
23 the final design of the ponds.

24 Q Okay.

25 A Yeah.

26 Q Do you have a sense of what kind of structure you're

1 going to need to ensure that you've got the return  
2 volume and rates?

3 A Yeah. Typically you would -- you would use a -- a  
4 shaped outlet from the pond that -- and that -- where  
5 you could measure the -- the height of water flowing  
6 through -- flowing over a weir, and use that as a -- a  
7 measure of the quantity of water that -- and -- and the  
8 rate of water that's flowing out of the pond. That --  
9 that would be my sense. It -- it's a little bit going  
10 to depend on the -- well, I -- I think that would be  
11 the primary method of managing water-flow quantities.

12 Q Okay. Mr. Houston, I'll accept that as an answer, and  
13 let's say that wraps up that set of questions. Thank  
14 you.

15 MR. O'GORMAN: Mr. Chair, I think this would  
16 be a good time for a break.

17 THE CHAIR: Okay. Thank you.

18 It's 10:30-ish, so we'll resume at 10:45. Thank  
19 you.

20 (ADJOURNMENT)

21 THE CHAIR: Okay, Mr. O'Gorman. Whenever  
22 you're ready to continue.

23 MR. O'GORMAN: Okay. Thank you, Mr. Chair.

24 Okay. Zoom Host, can we please call up CIAR 42,  
25 Section C, and we're going to go to PDF 117.

26 Okay. Yeah. The surge pond. That's good right

1           there.

2       Q   MR. O'GORMAN:                So, Mr. Houston, this document  
3       we're looking at does indicate the dam crest heights  
4       for the southeast surge pond as 1,509.2 metres above  
5       sea level, and the raw water pond as being 1,503 metres  
6       above sea level. Do you agree with that?

7       A   Yes.

8       Q   Okay. Great.

9       MR. O'GORMAN:                So, Zoom Host, in this  
10      document can we scan down, please, to PDF 193? And  
11      scan down on that page a bit, please. And zoom in at  
12      the -- sort of the bottom half of the page. Scan down.  
13      Just -- no. The bottom half of the page. Okay. And  
14      can we -- a little bit lower now. And can we zoom in  
15      one more time maybe? And maybe one more zoom. One  
16      more magnification, Zoom Host, please. Okay. That  
17      should work.

18     Q   MR. O'GORMAN:                Mr. Houston, here we see the  
19      location --

20     MR. O'GORMAN:                Oh, that's good. Thank you  
21      Zoom Host.

22     Q   MR. O'GORMAN:                We see the location of the  
23      southeast surge pond and the raw water pond.

24     MR. O'GORMAN:                Oh, no, we've lost it, Zoom  
25      Host. I need both of those ponds to be showing,  
26      please. Can you roll back down on the page? Just

1 scroll down the page a little bit so we can see both of  
2 the ponds, Zoom Host. Good. Thank you.

3 Q MR. O'GORMAN: Okay. So here we see the  
4 southeast surge pond and the raw water pond is.  
5 There's an interconnecting water pipeline in pink, and  
6 we also see the surface contours on the map for the  
7 area between those two ponds.

8 Now, it looks like we have the height of the land  
9 between the two peaking at about an elevation of  
10 1,570 metres above sea level, which would be more than  
11 50 metres higher than the southeast surge pond. Does  
12 that look right to you, Mr. Houston?

13 A MR. HOUSTON: That -- that is what I'm  
14 reading off the map as well. Do you have a question  
15 you're going to follow on with?

16 Q Yeah.

17 A 'Cause I was going to ask Mr. Youl to --

18 Q Yeah.

19 A -- to weigh in on this.

20 Q It might be Mr. Youl. And we're going to actually call  
21 up later, just shortly, some conversation that Mr. Youl  
22 engaged in relating to this topic, but I was going to  
23 do that in a minute or two.

24 So leaving this picture up, I guess as our first  
25 question: Can you explain how under normal operations  
26 water is going to be moved from the southeast surge

1 pond -- surge pond to the raw water pond? And I can --  
2 you know, while you're thinking about that  
3 specifically, we're wondering about will this proposed  
4 pipeline be underground? What -- would it be a -- what  
5 would be its size? What would be the flow capacity of  
6 the pipeline? Is water going to flow by gravity or  
7 require pumping? So those kinds of questions.

8 A MR. YOUL: Want me to jump in?

9 A MR. HOUSTON: Yes, please.

10 A MR. YOUL: Okay. Yeah, Mr. O'Gorman,  
11 you're right. The peak of the natural ground surface  
12 between those two ponds is significantly higher in each  
13 pond, so the water will be pumped from the southeast  
14 surge pond to the raw water pond. So this is all  
15 contact water which eventually will require pumping  
16 into the saturated backfill zones.

17 The design of that pipeline, I -- I do recall we  
18 have stated that somewhere in the documents. I can't  
19 recall which page, but we talked to the diameter and  
20 the -- the flow rates, from memory. Whether that  
21 pipeline is on the surface or buried is still to be  
22 determined and whether it -- or be on the surface;  
23 it'll need to be heat traced. So that's still to be  
24 designed in the -- the actual material of the pipeline.  
25 But the -- the general theory is that that pipeline  
26 will move water back to the raw water pond for

1 processed water as well as going to the saturated  
2 backfill zone.

3 Q Okay. Thanks, Mr. Youl.

4 And, yeah, to clarify, by "underground", we  
5 weren't really asking whether it would be on top of the  
6 surface or a foot below surface. I guess we were  
7 wondering was there some plan to drill through that  
8 mountain to run your -- your pipeline?

9 A No. No. We'd smooth the surface to avoid any sort of  
10 undulations in the pipeline to give the water a clear  
11 path and minimize resistance to maximize the pumping  
12 efficiencies. But by and large, it will follow the --  
13 the natural ground surface.

14 Q Okay. Thank you.

15 And it will be pumped because --

16 A Yeah.

17 Q -- those ponds are both at essentially the same  
18 elevation; right?

19 A Correct.

20 Q Crests. Okay.

21 Okay. We're going to look at a couple of  
22 transcripts, please.

23 MR. O'GORMAN: Zoom Host, can you please call  
24 up the -- I think it's the November 6th transcript,  
25 which I think is CIAR 799.

26 And we're going to -- right. So page 2171. I

1 recognize that -- yeah, the page numbers in these  
2 transcripts, sometimes they're PDF numbers and  
3 sometimes they're page numbers. I can't keep them  
4 straight myself.

5 If we look at 2171 and we scan down -- actually,  
6 one full page to line -- starting at line 13,  
7 displaying down from there. So this was a converse --

8 MR. O'GORMAN: Okay. That's good. That'll  
9 be fine. Thank you, Zoom Host. That's good.

10 Q MR. O'GORMAN: So this was a conversation  
11 that I was engaged in with you, Mr. Houston, when I was  
12 asking about potential failures of that southeast surge  
13 pond which, as we've acknowledged, has contact water in  
14 it.

15 And I think, if we look at the response that we  
16 had from you, you indicated that one type of failure  
17 that the -- that pond or the dam -- we were talking  
18 about dams at the time -- might experience would be  
19 water coming in too fast to treat.

20 I assume you didn't really mean treat 'cause no  
21 treatment is taking place in that pond; right,  
22 Mr. Houston?

23 A MR. HOUSTON: That's correct. Although, if  
24 it's -- if there is an emergency situation and -- and  
25 were not able to accommodate in the raw water pond and  
26 the saturated backfill zone, then there -- you know,

1 with a high quantity of water to deal with, we could  
2 run into a situation where -- through the whole system  
3 that there's an inability to treat at that -- at that  
4 quantity. Like, we -- we're not treating in this -- in  
5 the -- in the surge pond, yes.

6 Q Right. That's all I was asking. Sorry. I mean,  
7 that's fine.

8 A Yeah.

9 Q That was a simple misstatement using the word "treat"?

10 A Yeah.

11 Q But more so the issue is how I seem to be interpreting  
12 your answer is water is coming in too fast to the  
13 southeast surge pond, and in that case, the discharge  
14 would be through the raw water pond, and then would  
15 flow out towards Blairmore Creek. Is that -- that's  
16 what you said there; right?

17 A Yeah. And to be clear, that -- that would be through  
18 that pipeline that we were just talking about.

19 Q Okay. And that's -- okay. Fair enough.

20 MR. O'GORMAN: Can we please call up, Zoom  
21 Host, CIAR 42, Section C -- actually, while you're --  
22 while you're hauling that up ...

23 Q MR. O'GORMAN: I just want to be clear,  
24 Mr. Houston. So I just want to make sure I understand  
25 how if the -- if the southeast surge pond has water  
26 coming into it too fast, you get it over the top of



1           that 15-plus-metre crest to get discharged over to the  
2           raw water pond, like, your pumping capacity will be  
3           able to handle that and that pipeline?

4    A   MR. HOUSTON:                    So maybe I should ask Mr. Youl  
5           to -- to provide additional details.

6    A   MR. YOUL:                        Yeah. The -- the pumping  
7           capacity that southeast surge pond is designed to --  
8           it's a matter of days to empty that pond. I can't  
9           recall the exact number. And I wasn't involved in --  
10          in this work, so I'm just trying to recall that from  
11          memory.

12                 But in theory, we're looking to keep that  
13                 southeast surge pond at a lower level. The raw water  
14                 pond will be the main pond where we maintain  
15                 operational water levels, and the intention is with  
16                 that pipeline and pumping system, we'd continue to top  
17                 up the raw water pond from the southeast surge pond and  
18                 keep that southeast surge pond at a -- at a typically  
19                 lower level. It's a buffer pond, if you like. So  
20                 we're not intending to store contact water there for  
21                 long periods of time.

22                 But the raw water pond will be the main pond,  
23                 which will have its operational limits designed into  
24                 it. There will be a lower limit. There's a buffer  
25                 capacity for maintaining some supply at the processing  
26                 plant, particularly during the -- the low runoff

1 season, and then an upper limit, and then above the  
2 upper limit there's the flood mitigation limit, and  
3 then you have your freeboard, and then you top through  
4 the spillway.

5 Q Okay. Thank you, Mr. Youl.

6 MR. O'GORMAN: Zoom Host, can we look at --  
7 back to CIAR 42, Section C, and look at PDF 116,  
8 please. Yeah. That's -- that's what we want.

9 Q MR. O'GORMAN: So is it -- it is on that  
10 table. The inflow design flood is there. Yeah.

11 So this -- this table above does include the  
12 inflow design flood for the surge ponds and for the --  
13 actually, maybe it is --

14 MR. O'GORMAN: If you scan down a bit. I'm  
15 looking for the southeast surge pond. Table 556.  
16 Yeah, it's the one on the bottom of that page. Sorry.  
17 So if we just blow up the bottom of that page, please,  
18 Zoom Host, and scan down. Right. Good. Good. Thank  
19 you.

20 Q MR. O'GORMAN: So we see down here we've got  
21 the preliminary dam specification and inflow design  
22 floods for the different surge ponds.

23 The southeast surge pond is shown as being, for  
24 the inflow design flood, two-thirds between a  
25 thousand -- a thousand-year and the probable maximum  
26 flood; is that right?

1 A MR. HOUSTON: That's correct. Yes.

2 Q Okay. Thanks.

3 MR. O'GORMAN: And if we scroll down to the  
4 next page, please, Zoom Host, PDF 117, but it's just  
5 the next page. We're looking at Table 5-8 -- 5.5-8  
6 now. So scan down a bit.

7 Q MR. O'GORMAN: Again, southeast surge pond at  
8 the bottom is the one that we're interested in. But  
9 this table shows us details on the surge pond emergency  
10 overflow spillways. For the "SESP", let's call it, it  
11 does indicate an inflow design flood of 21 cubic metres  
12 per second; correct?

13 A MR. HOUSTON: Yes.

14 Q It's in the first column of numbers. And a 140-metre  
15 discharge channel; is that right?

16 A Yes.

17 Q Okay. So in the circumstance for the emergency  
18 overflow spillway, can you just clarify where that  
19 discharge channel will be directed?

20 A I -- I believe that would lead over to Gold Creek.

21 Q Right. Okay.

22 A Mr. O'Gorman, I think it's important to understand the  
23 purpose of the surge pond. We're -- we're -- we're  
24 using this as a place to put the contact water, and the  
25 contact water would come from the ex-pit dumps,  
26 percolate through and be picked up in -- in toe drains.

1           Any -- the catchment basin, if you will -- if  
2           you're thinking about a rainfall event, the -- the  
3           surge pond in -- in fact, we're -- we're going to  
4           arrange surface flow so that it doesn't go into the  
5           surge pond, again, with the idea of keeping clean water  
6           clean. And -- and so I -- I just wanted to make sure  
7           we're all thinking about this the same way, that  
8           this -- this is not a pond that's catching rainwater  
9           and -- and dealing -- dealing with a high-precipitation  
10          event. In fact, we would design this pond to not have  
11          that surface flow -- the clean water arrive in the  
12          pond.

13        Q    Okay. Thank you, Mr. Houston.

14        MR. O'GORMAN:                    We're going to call up a  
15          different document, please, Zoom Host. I,  
16          unfortunately, don't have the CIAR number, but it was a  
17          transcript. The transcript from November 18th, two  
18          days ago. I did indicate to you folks -- you kind,  
19          Zoom Master folks, that I'd be asking for it, but I  
20          don't think I have the CIAR number. And -- great.  
21          Thank you. We're going to scan down, please, to page  
22          3673. And going to go down to the bottom of that page.  
23          Starting at line 24. So let's show the bottom of the  
24          page, please. Great. Thank you.

25        Q    MR. O'GORMAN:                    So this, Mr. Youl, you'll  
26          remember -- it was only two days ago -- you were

1 speaking with Mr. Rennie this week. There was -- if  
2 we -- if we look at -- there's -- we -- you were  
3 discussing spillways applying to engineered channels  
4 that would flow to -- in particular, we were interested  
5 in a gully that existed between Grassy Mountain and  
6 Bluff Mountain.

7 If we take a look at -- starting at line 24 here,  
8 and then we'll scroll through the next page, I -- I  
9 think you said -- actually, why don't I ask you if you  
10 wanted to repeat, starting at line 24, and we'll go to  
11 the next page.

12 Could you read that for me, please, Mr. Youl?

13 A MR. YOUL: Yes. (as read)

14 The surge pond that will feed any emergency  
15 overflow water will flow over a spillway.

16 [And this is the raw water pond, not the  
17 southeast surge pond, just to be clear.] It  
18 will be an engineered designed spillway based  
19 on the Canadian Dam Association guidelines;  
20 and that will flow down the spillway, over  
21 the dam wall, and down into an engineered  
22 channel that will, by gravity, discharge  
23 eventually into Blairmore Creek.

24 Q Okay. So you were talking here about the raw water  
25 pond, not the southeast surge pond?

26 A That's correct.

1 Q Okay. So there's no gully that exists, that you know  
2 of, between the southeast surge pond and the raw water  
3 pond; right? We didn't miss this in your diagrams?

4 A No. No. The gully -- there may be a better  
5 description for it, but it's a topographic low, an  
6 actual low that sits between Bluff Mountain and Grassy  
7 Mountain. And that ridge we talked about before on  
8 that plan which was -- I don't know -- 1,570,  
9 thereabouts, that's the high point; and then from there  
10 to the west towards the raw water pond, the elevation  
11 decreases all the way down to -- to Blairmore Creek.

12 Q Okay. Okay. That's -- that's good, Mr. Youl. Thank  
13 you.

14 A MR. HOUSTON: Mr. O'Gorman?

15 Q Yes.

16 A I've been discussing with my colleague Mr. Jensen on  
17 the answer I gave just a few minutes ago about the  
18 purpose of the surge pond, and he would like to clarify  
19 the -- the different kinds of events that -- that we  
20 could see at that surge pond. So if you don't mind,  
21 just to make sure that the record is -- is perfectly  
22 clear.

23 Q Yeah. Please proceed. That's fine with me.

24 A MR. JENSEN: Thank you, Mr. O'Gorman.

25 When we look at -- at different types of events  
26 for -- I should preface this by saying I'm not a -- I'm

1 speaking as a -- as a water management professional and  
2 not as a geotechnical engineer. But generally we're  
3 dealing with two distinct type of -- types of events.  
4 One is the EDF, which is the environmental design  
5 flood; and the other one is the IDF, which is the -- is  
6 the inflow design flood.

7 The EDF is the -- is the event that you expected  
8 to contain so -- so that there is no -- no uncontrolled  
9 release into an environment. And, you know, the --  
10 we -- it's project dependent and situation dependent  
11 what you define the EDF as. I don't know if it's been  
12 finally established what the -- what the EDF would be  
13 for this. I know for some of the channels we're  
14 talking about a 1-in-200-year event is -- is not  
15 untypical for EDFs; whereas for IDFs, you know, the  
16 guidance listed in the -- in the CDA guidelines, the  
17 Canadian Dam Association guidelines, apply.

18 So what -- what we've been talking about here is  
19 the IDF. And the IDF -- the intent of the IDF is to  
20 protect structures. So you want to make sure that you  
21 can either contain or you have a spill where they can  
22 convey that maximum event you designed for. And -- and  
23 it's great. So that maximum design event would  
24 indeed -- you know, if we were in a PMF-type situation  
25 or two-thirds between of a 1-in- -- in-1,000 and a PDF,  
26 that would indeed be -- likely be released into a --

1 into Gold Creek.

2 What -- what would be contained and would be  
3 managed is anything up to the EDF. So the EDF we  
4 haven't -- I don't know if -- if it's been defined yet  
5 on the record. It's typically a detailed design  
6 consideration. I know we looked at -- at different --  
7 at the hydrotechnical considerations around routing.  
8 But -- but the clarification I wanted to make is that  
9 EDF is the event that would be contained, just -- just  
10 so it's clear.

11 Q Okay. Thank you, Mr. Jensen. Jensen; right?

12 A Yes.

13 Q Yeah. Thank you.

14 Okay. We'll -- that -- that clarified some things  
15 for us.

16 MR. O'GORMAN: Zoom Host, could you take this  
17 down, please. Actually, no -- yeah. Take down the  
18 transcript. And we're going back to Registry Doc 42,  
19 Section C, and this time, we're going to look at  
20 PDF 113. Okay. PDF 113. At the bottom, Table 5.5-2.  
21 Okay. Thank you.

22 Q MR. O'GORMAN: We saw this a moment ago,  
23 Mr. Houston, or whoever wants to answer it. But you  
24 did provide preliminary dam classification with inflow  
25 design floods for the sediment ponds and the surge  
26 ponds. And this table actually had the sediment ponds.



1           And if we jump forward -- I don't think we even  
2 really need to. I -- I think we -- 'cause we saw it a  
3 minute ago, Table 5.5-6 showed the same. Actually,  
4 let's go ahead and show it.

5 MR. O'GORMAN:                   Jump forward to PDF 116,  
6 please, Zoom Host, a few pages down.

7 Q MR. O'GORMAN:                   And on that page at the bottom  
8 we'll see you provided preliminary dam classifications  
9 and IDFs for the surge ponds and the raw water pond,  
10 which also contains selenium. Sorry.

11           So I want to just confirm if it's correct, and I'm  
12 not going to show them, but I -- I think you'll be able  
13 to confirm without me showing as an exhibit that the  
14 categories listed under the classification based on  
15 incremental losses was based on the Canadian Dam  
16 Association consequence classification rating systems  
17 for dams?

18 A MR. HOUSTON:                   I -- I believe at the time  
19 this was written out, that was the document we used.

20 Q Okay. And no one else would disagree with that?

21 A Mr. O'Gorman, we -- we talk about preliminary ratings  
22 of dams. Obviously there's a lot of work to -- to be  
23 done. We would follow the Alberta Dam Safety  
24 Guidelines in -- in terms of final designs for these  
25 dams, and that would include things like inundation  
26 studies during the -- during the detailed design phase

1           that would, you know, solidify these classifications of  
2           the various water storage structures.

3    Q    Okay.  Okay.  Thank you, Mr. Houston.

4           So -- right.  I just want to clarify it's correct  
5           to assume that, looking at some of these categories  
6           that you've assigned here, the ratings -- the  
7           consequence ratings in the middle column of  
8           environmental and cultural, those are primarily driven  
9           by environmental considerations for these dams in --  
10          the surge pond dams in particular; is that right?

11   A    That -- that's correct.

12   Q    Okay.  So I wonder if you could just, for the record,  
13          tell us, you know, briefly why the ponds that we see on  
14          the Gold Creek side, so the east -- northeast sediment  
15          ponds and the southeast surge pond, were rated as -- so  
16          we see the southeast surge pond on this -- the table.  
17          We can go back and look at the other table, if you need  
18          to.

19                 But I wonder if you can just quickly tell us why  
20          those ponds and their -- their dams on the east side of  
21          the project all were rated as "very high" under the  
22          "Environmental Consequence" category?

23   A    It -- at this stage of the design, Mr. O'Gorman, the  
24          ratings are based on an appreciation for the size of  
25          the structure, the -- the -- the type of consequence  
26          that -- that could be expected.  And -- and, again,

1 we're -- we're talking about worst-case consequences,  
2 so what could be expected, and -- and then using  
3 professional judgment, deciding whether that's high,  
4 low, or very high.

5 That needs to be confirmed through -- through the  
6 inundation studies that I was talking about and some  
7 discussion with the -- the regulator, in this case,  
8 AER, to -- to assign a final rating.

9 Q Okay. Thank you, Mr. Houston.

10 So your -- an element, I think I heard you say, in  
11 your response of that rating is related to, would you  
12 agree, the sensitivity of the potential receptors in  
13 the case of something bad happening?

14 A That -- that's -- that's correct. And that combined  
15 with the potential volume of water and -- and, you  
16 know, some professional judgment to assess what the --  
17 what the consequences of that could be.

18 Q Okay. So I actually want to ask you about the ponds  
19 and their dams on the -- on the west side of the  
20 project where the environmental and cultural ratings  
21 were much lower. Your southwest surge pond you rated  
22 as being -- classified as being of "low consequence".  
23 And if we go back a few pages, we would also see  
24 smaller ratings. Smaller, you know, not -- not very  
25 high ratings for the other dams and ponds on the -- on  
26 the west side of the project that would -- let's call

1           it the "Blairmore Creek side of the project".

2                   I wonder if you could just explain your basis  
3           for -- for those ratings?

4    A    And it -- it's the same process, Mr. O'Gorman,  
5           assessing the receiving environment, looking at the  
6           quantity of water in -- in the ponds -- specific ponds,  
7           and using professional judgment to assess what the  
8           impacts would be.  Again, all that needs to be verified  
9           through a -- an inundation study.

10                   The -- the point of -- of this level of assessment  
11           is really to take a first crack at what the structure  
12           itself might look like, what -- what footprint it might  
13           need to take up on the -- on the -- on the plan.  
14           And -- and so that -- that's the basis for assigning  
15           these classifications at -- at this stage and -- and --  
16           and, you know, go -- going to this depth, is -- is more  
17           or less to have a preliminary assessment of how big  
18           these ponds need to be, how high, and what size that  
19           would look like on the footprint.

20    Q    Okay.  I'm trying to think about what I heard you say.

21                   So was the potential sensitivity of the receptors  
22           in Blairmore Creek, in the event of, as I call it,  
23           something bad happening, was that a factor in these  
24           rankings?

25    A    Yes, and that will continue to be a factor as we go  
26           through the more -- more detailed studies.  Yes.

1 Q Okay. But I would point out that there are still  
2 near-pure westslope cutthroat trout in Blairmore Creek.  
3 You would agree with that; correct?

4 A Up -- upstream of a point on the creek, yes, I would  
5 agree with that.

6 Q Okay. Okay. And one last question on this topic,  
7 although I might need to go back and clarify one thing.

8 MR. O'GORMAN: I will ask -- I submitted an  
9 aid to questioning, and I don't have the CIAR number,  
10 but I did tell you kind Zoom host folks that it was  
11 coming. It was the AEP Dam Consequence Classification  
12 System.

13 MS. ARRUDA: Mr. O'Gorman, it's AQ  
14 Number 1.

15 MR. O'GORMAN: Right, AQ Number 1. And I  
16 think, Ms. Arruda, you told me that the page number was  
17 48 in that document, if I remember correctly?

18 MS. ARRUDA: I believe so.

19 Q MR. O'GORMAN: Okay. And it spans over the  
20 next couple of pages.

21 And I just want -- Mr. Houston, you -- you may  
22 have even sort of answered this, so just to -- for  
23 completeness, these are the Alberta Environment and  
24 Parks dam consequence classification system, and we  
25 wanted to confirm that you would expect to update or  
26 revisit your classification for your different dams

1 according to this document?

2 A MR. HOUSTON: Absolutely. And based on --  
3 based on the further engineering work that -- and  
4 investigation that we're going to do. Yes.

5 Q Okay. Thank you.

6 Before we leave this topic, I do want to come back  
7 to you, Mr. Youl. I have -- we remembered your  
8 conversation with Mr. Rennie, I think, potentially  
9 differently than you indicated a minute ago. I don't  
10 know if we need to go back through the transcript, but  
11 we did -- we can haul it up, if you'd like.

12 We certainly had the impression that when you made  
13 those comments -- or maybe Mr. Rennie or you, at least  
14 one of you was talking about the southeast surge pond.  
15 So I wonder if you wanted to clarify if what you said  
16 this morning was a correction, or if you genuinely --  
17 we can -- I'll let you look at the transcript, and then  
18 maybe you can tell me whether you were correcting  
19 something that was said or if you stand by that,  
20 please.

21 A MR. YOUL: Okay. Just while you're  
22 bringing it up, I -- I definitely recall referring to  
23 discharge to Blairmore Creek, not Gold Creek.

24 Q M-hm. Right. No. We agree with that.

25 A Yeah. Was there any other clarification you were  
26 seeking?

1 Q Okay. I don't think it's that important to pursue.

2 A Okay.

3 Q So let's -- let's move on from there, 'cause I think we  
4 understand what you're saying this morning, so -- and  
5 we -- we heard some useful information there. So thank  
6 you both very much. That's it for that question.

7 And for the topic of hydrology until -- one future  
8 hydrology question to come.

9 Okay. 11:21. We're going to change gears and  
10 talk about geology and geochemistry, gentlemen and  
11 ladies. So I'm going to ask -- I think that I --  
12 probably all a little bit surprised that a week into a  
13 discussion about water for, I think, a mine -- a  
14 proposed mining project, I'm not sure there's been any  
15 reference to acid rock drainage yet, so we might  
16 actually touch upon that a little bit in these  
17 questions to come.

18 MR. O'GORMAN: I'm going to ask, Zoom Host,  
19 please, that we call up CIAR 42, Appendix 10, and  
20 PDF 134. And we're in the geochemistry reports here in  
21 Appendix 10. PDF 134. Right. Okay.

22 Q MR. O'GORMAN: So, gentlemen, metal aging  
23 potential was evaluated by SRK, by conducting humidity  
24 cell tests and comparing shale samples to the average  
25 crustal abundance for shale, graph of humidity cell --  
26 I don't think this is -- I don't think I have asked you

1 for the right page 'cause I thought I was going to be  
2 looking at -- yeah. That's the wrong reference maybe.

3 MR. O'GORMAN: Are you showing me Appendix 10  
4 from CIAR 42? Yeah. It looks like it. I expected to  
5 see a different figure. A little help here. Just one  
6 second, folks. Geochemistry reports. Let's go down to  
7 PDF 134. Yeah, this is the one. Okay.

8 Q MR. O'GORMAN: So I'm not sure what the first  
9 problem was. But there it is.

10 So we're looking at arsenic here and some tests  
11 that you folks did -- that SRK did. So if we look at  
12 this, the graph of humidity cell data does indicate  
13 that over .2 milligrams per litre of arsenic would be  
14 released from the Adanac and the Cadomin found --  
15 formations or members, combined that is, within a week,  
16 you know, with the majority of that from the Cadomin  
17 but also a contribution from the Adanac. See the  
18 Cadomin numbers in green at the top and Adanac starts a  
19 little bit lower.

20 We do see that after, you know, 20 weeks or so,  
21 you get up to -- this is a logarithmic scale on our  
22 left-hand side, so we get back to that .2 milligrams  
23 per litre of arsenic release indicated in this test.

24 You agree with that? I'm not sure which of your  
25 experts will speak to this. It might be Mr. -- well,  
26 I'll let you tell me, Mr. Houston.



1 A MR. HOUSTON: Yeah. Mr. Day, are you able  
2 to answer?

3 A MR. DAY: Yes. For sure, yeah.  
4 Yeah. You're correct, Mr. O'Gorman, yeah.

5 Q Okay. Thank you. Okay. So that's one.

6 MR. O'GORMAN: Can we next haul up on the  
7 same document at 'P' -- Zoom Host, most of -- we're  
8 going to use this document for most of this round of  
9 questioning. Let's go to PDF page 68, please.

10 Q MR. O'GORMAN: Here's a -- we wanted you to  
11 know we -- and by "we", I mean our geochemistry  
12 experts -- did look at the X-ray diffraction results  
13 you submitted, and I wonder if you could say whether  
14 this figure does confirm the presence of sulphides in  
15 the Adanac and the Cadomin?

16 A MR. DAY: Yeah. Mr. O'Gorman, I -- I  
17 don't know which rock types these refer to in  
18 particular, but there are definitely sulphides in  
19 those -- those units. I can confirm that, yeah.

20 Q Yeah, we can sort of see them if we dig through.

21 A Yeah. The blue -- the blue, pyrites.  
22 (INDISCERNIBLE - OVERLAPPING SPEAKERS)

23 Q MR. O'GORMAN: Exactly. Yeah.

24 A MR. DAY: Yeah. Yeah.

25 Q The pyrites --

26 THE COURT REPORTER: Excuse me, gentlemen.

1 A MR. DAY: Yeah. For sure.

2 THE COURT REPORTER: Excuse me. I can't understand  
3 you both at the same time. The last thing I heard  
4 was -- clearly was something about "the blue".

5 MR. O'GORMAN: That's my fault. That's my  
6 fault, Zoom Host [sic]. I -- I shouldn't have spoke  
7 over you.

8 Q MR. O'GORMAN: I apologize, sir.

9 Okay. I appreciate that. So dum de dum de dum.

10 A MR. DAY: Recorder [sic], do you need to  
11 clarify that point, or are you -- are you okay with it?

12 THE COURT REPORTER: That's up to the questioner.

13 Q MR. O'GORMAN: Yeah. Why don't you -- why  
14 don't we try that again.

15 Can you confirm that this suggests the presence of  
16 sulphides?

17 A Yes, I confirm. The -- the label -- the legend there  
18 shows pyrites.

19 Q Right.

20 A And that is the most common sulphide in these -- in  
21 these rocks.

22 Q Okay. Thank you.

23 MR. O'GORMAN: Okay. So we're going to haul  
24 up another reference now, please, Zoom Host. We're  
25 going to go to -- this time it will be a different  
26 document, so I lied a couple of minutes ago. We're

1 looking at Addendum 10, so Registry 251, Package 5, and  
2 we're going to, within there once it -- once you get it  
3 open, jump to PDF 32 and scan down, please. A bit  
4 lower. Right. To the bottom. All the way to the  
5 bottom of that page, Zoom Host, please. Okay. That's  
6 good.

7 Q MR. O'GORMAN: So here was an information  
8 response request. You indicated that in an effort to  
9 evaluate long-term treatment of selenium and nitrates,  
10 the column testing is ongoing to simulate in the lab  
11 the mobility of selenium for mine waters. And the  
12 column tests involve, if you'll agree with me, the  
13 measurement of selenium and nitrate under various  
14 conditions; correct?

15 A MR. HOUSTON: That -- that's correct,  
16 Mr. O'Gorman.

17 Q Okay. It's unclear whether or not other analytes like  
18 arsenic, which we looked at a second ago, are also  
19 being measured in your column tests. Can you clarify  
20 that?

21 A No. No, they are not, Mr. O'Gorman. This was  
22 specifically focusing on nitrates and -- and selenium.

23 Q Okay, Mr. Houston or whoever. Actually, this question  
24 is not for you, Mr. Houston.

25 A I'm afraid that these column tests were not conducted  
26 by SRK, and so I'm worried about asking Mr. Day to --

1 to comment on them. That's all.

2 Q Okay. Well, okay. No. I'm not going to get into  
3 exploring the column tests too much, actually. They  
4 might be slightly more general questions.

5 So if you remember the first figure that I showed,  
6 Mr. Day, we showed leach rates for arsenic of up to .2  
7 milligrams per litre. I wonder if, in your  
8 professional opinion, that would be considered high?

9 A MR. DAY: I'm talking to myself here.  
10 Apologies.

11 Yes, definitely that would be considered high. I  
12 agree. Yeah.

13 Q Okay. And can you confirm for me where -- which  
14 mineral phases you understand to house the arsenic?

15 A Most likely it's in the pyrite.

16 Q In the pyrite, so sulphides?

17 A Yes. Correct, yeah.

18 Q Correct. Okay. Thank you.

19 A I -- I -- do you mind if I -- I -- I mean, I think  
20 to -- you've asked about whether those are high, but I  
21 think it should be clarified the situation in those  
22 tests under which those arsenic concentrations came  
23 out. Do you mind if I do that?

24 Q I do not mind, sir.

25 A Okay. Could the -- Zoom Host, could you go back to  
26 that? I can't -- I can't recall what the page number

1 was for the arsenic.

2 Q I can tell you.

3 A Yeah. That would be good. Thank you.

4 Q The very first figure we looked at was, in the  
5 geochemistry reports, PDF 134.

6 A Do you -- could you bring that up, please?

7 Q Yeah.

8 MR. O'GORMAN: Zoom Host, sorry. Right.

9 A MR. DAY: Okay. So I would like you to  
10 go up to PDF page 118 in the same document.

11 And what I want to point out here is those high  
12 arsenic concentrations are associated with low pHs. So  
13 you can see those -- see those symbols there at the  
14 bottom there, the brown -- the brown squares and the  
15 green circles? So those high arsenic concentrations  
16 are associated with very low pHs.

17 And maybe you're going to ask more questions about  
18 that, but I wanted to -- to be clear on that because  
19 you asked me about whether they were high arsenic  
20 concentrations, and that is due to the low pHs.

21 Q MR. O'GORMAN: Okay. Sure. Thank you,  
22 Mr. Day.

23 So just to clarify, we talked about sulphides and  
24 the pyrite. Are there mineral phases other than  
25 sulphides that you might expect to house arsenic?

26 A In the -- yes. In the weathered materials you can

1 expect that the weathering of pyrites will convert to  
2 iron oxides, and it's very likely that the arsenic  
3 would be sequestered with the iron oxides.

4 Q Okay. We're wondering how the potential release of  
5 arsenic from these phases might be -- is going to be  
6 tested, or will you?

7 A What additional testing are you thinking of? Or you've  
8 done the -- the desalt testing. Are you thinking of --  
9 okay. I'll let you answer that question.

10 Q Sorry. I'm curious whether you have any plan to  
11 testing, like column tests, for example, which is the  
12 reason why I took you to the column tests as a part of  
13 the preamble.

14 A MR. JENSEN: Steve, perhaps I can --

15 A MR. DAY: Sure. Go ahead, Soren.

16 A MR. JENSEN: -- jump in here?

17 A MR. DAY: Yeah.

18 A MR. JENSEN: Yes. Mr. O'Gorman, so -- yes.  
19 So one of the primary purposes of the -- scale of tests  
20 we have proposed for -- specifically for the saturated  
21 backfills and -- well, in general for the -- you know,  
22 along the similar lines of what the intended purposes  
23 of the column tests were is to precisely look at -- and  
24 I believe I testified to this previously a couple of  
25 days ago -- is the one thing we are, let's say, unsure  
26 about and we want to test through on-site testing is

1           this potential for -- you know, we do see reductive  
2           dissolution of not just arsenic but manganese and iron.  
3           Those are typically the ones we're worried about. So  
4           one thing we specifically want to look at through that  
5           ongoing test work is to what extent we might see  
6           manganese, iron, arsenic, and -- and potentially other  
7           constituents be released as part of that process.

8           So it's one reason we did propose -- I did advise  
9           Benga to plan for -- for post treatment of SRF effluent  
10          is precisely for that reason, because we can't  
11          categorically say that this won't be an issue, and so  
12          we wanted to have mitigation in place to accommodate  
13          that.

14          But until we do actual on -- on-site tests with  
15          the material that we -- that will be exposed to these  
16          reducing conditions, we can't say for sure, but the  
17          mitigation is there to -- to address it.

18        Q     That mitigation being?

19        A     That -- that mitigation being -- being lime treatment.

20        Q     Right.

21        A     And -- and -- and -- and specifically to address  
22          arsenic, it is possible to remove arsenic in that same  
23          process but it may require the addition of -- of a  
24          ferric coagulant.

25        Q     Okay. Thank you, Mr. Jensen.

26                  And you anticipated, I think, my next question to

1       some extent. I'll ask it anyway. But considering that  
2       we saw what might be considered high levels of leaching  
3       of arsenic in the humidity cell tests, and also, I  
4       think, people won't disagree with me that arsenic can  
5       have high mobility under anoxic or suboxic conditions,  
6       we are curious about your views on the potential for  
7       arsenic to be mobilized from the mine waste; and if  
8       that happens, how it would be attenuated which ...

9     A    Yes. That's right. And -- and, you know, we  
10       absolutely share that -- that concern. It's something  
11       that absolutely needs to be addressed. It's a lot  
12       of -- for lack of a better way of thinking about it,  
13       it's the obvious concern that would be associated with  
14       something like this. So it's very much at the  
15       forefront of our thinking, and -- and, like I said, I  
16       mean -- you know, we suggested to Benga that this  
17       mitigation needs to be anticipated.

18    Q    Only lime treatment? Are there other mitigation  
19       measures you might consider?

20    A    Yeah. I mean, you can consider if arsenic turns out to  
21       be -- to be, like, the issue that will be concerned  
22       with, it may be necessary to implement a different --  
23       you know, use ferric -- ferric co-precipitation is  
24       typically the -- the approach that you take to -- for  
25       removing arsenic. But it is -- like I said, other  
26       (INDISCERNIBLE), molybdenum, or antimony are -- you



1 know, they -- they require lower pHs for effective  
2 removal. Arsenic you can remove at higher pH as part  
3 of a lime treatment system, but like I said, it does  
4 require the addition of a ferric coagulant unless, of  
5 course, we also see -- you know, we see parallel  
6 mobilization of iron at the same time, then the  
7 effluent may just come with iron we need to remove  
8 arsenic. But either way it's -- we need that  
9 co-precipitation step. That's what would be required.

10 Q Okay. Thanks.

11 What about the weathering of the pit walls, might  
12 that be a source for arsenic?

13 A MR. DAY: Can I can I speak to that?

14 Q Yes, by all means.

15 A Okay. Sure. Yes, you're correct, Mr. O'Gorman.  
16 The -- there are sections of the pit walls which  
17 could -- and under those circumstances it would be acid  
18 generation which would mobilize arsenic, as shown in  
19 the humidity cell tests. There is a plan to -- to  
20 mitigate that through -- through covering the pit walls  
21 with -- with the non-acid-generating materials to -- to  
22 try and mitigate that.

23 Q Okay. Thank you, Mr. Day.

24 Can you confirm the measures you will put in place  
25 to monitor for arsenic levels -- arsenic levels, sorry,  
26 and the runoff and/or the oxygenation of the blended

1 mine waste, especially considering arsenic can be  
2 highly mobile?

3 A You're referring to the -- the -- the -- waste rock  
4 dumps?

5 Q I'm sorry. Out of the -- yes.

6 A Yeah. I mean, that'll be --

7 Q I'm sorry. The waste rock dumps and/or the SBZs?

8 A Yeah. So that would be a normal part of water -- water  
9 monitoring. You'd normally monitor for -- for both  
10 parameters that are of interest to help you understand  
11 that parameter -- like arsenic itself, but also the pH,  
12 the ORP, the other parameters that would be involved,  
13 like iron.

14 Q Okay. Great.

15 Can you tell me whether or not your water column  
16 studies have revealed sulphide oxidation via nitrate in  
17 the absence of oxygen?

18 A MR. HOUSTON: So, again, SRK wasn't involved  
19 in those column studies, and -- and I'd -- just not  
20 being an expert in that field, I would have to say  
21 that's not something we were specifically designing  
22 those column studies for, Mr. O'Gorman.

23 Q Okay.

24 A Steve -- Mr. Day, can you add to that or ...

25 A MR. DAY: Yeah. Mr. O'Gorman, it's a  
26 very good question. It's something that -- you know,

1           that we do think about. So it's just to clarify  
2           your -- your questions around -- normally pyrite is  
3           oxidized by oxygen, but you're asking whether nitrate  
4           can actually function as an oxidant of -- of pyrite.  
5           That's really what you're asking there, isn't it?

6   Q       Yeah, it is.

7   A       Yeah. I --

8   Q       And so -- yes, I was asking whether you had seen it.  
9           Recognizing or acknowledging you didn't do this test,  
10          at least weigh in on the potential that that might  
11          happen, and whether that's something to be concerned  
12          about?

13   A       Yeah. I -- I can -- I -- I haven't looked at those --  
14          that column data. And as has been mentioned, we  
15          weren't involved in the test work. I mean, I can -- I  
16          can help with the question in generalities. It's  
17          something that I've -- I've actually taken a hard look  
18          at for some other coal projects. So I'm -- I have  
19          had -- had to think about it quite a bit.

20                 And I think, you know, in general, you know, what  
21          you're talking about here is that you're --  
22          denitrifying nitrates to -- in order to -- to -- for it  
23          to function as an oxidant in those conditions. And --  
24          and it -- and it -- definitely in theory can be an  
25          oxidant for iron -- for iron sulphide. There's no  
26          question about that. But it's -- the circumstances

1 under which that must occur are low oxygen by  
2 definition, and so its potential to do that chemically  
3 exists, but it's -- whether it's a significant process  
4 is another matter. And the conclusion is really that  
5 it -- that it wouldn't -- that it isn't significant  
6 compared to oxygen as an oxidant. That's about as far  
7 as I can take you, though.

8 Q Okay. That's fine.

9 So in the presence of nitrate in the saturated  
10 backfill zones, is that something that causes you --  
11 gives you pause on the arsenic front?

12 A On the arsenic front, you're -- you're thinking of  
13 whether it would release more arsenic from the -- from  
14 the pyrite; is that the --

15 Q M-hm. Yes.

16 A I -- I -- professionally I -- I don't think that's a  
17 significant issue. I just don't -- I just don't think  
18 it's -- it would be a source of arsenic, no, I don't,  
19 but we don't have the data but -- specifically for this  
20 project to say that, and I think that's something that  
21 would be looked at logically through those -- through  
22 the current testing that -- that Mr. Jensen was talking  
23 about.

24 Q Okay. So last -- I think my last arsenic question.

25 And, Mr. Jensen, you did sort of get at it a  
26 little bit. I guess to bring this to a close, this --

1           this thread, I think I heard you say, Mr. Jensen, that  
2           you would start monitoring for this once you have a  
3           real waste rock to monitor and test. You are not  
4           planning testing in advance of actual construction with  
5           the rock from the -- from the mine area to -- to know  
6           whether or not you expect arsenic to be a big problem;  
7           is that right? You'll monitor once you get going with  
8           the mine, or am I getting that wrong?

9    A   MR. HOUSTON:                    So, Mr. O'Gorman, if -- if I  
10           can step in here. The pilot testing that we're talking  
11           about would be started at the same time as  
12           construction, and so there would be a -- a pilot-scale  
13           test of the saturated backfill zone process using  
14           on-site materials that would commence with the start of  
15           construction. So we're hoping that that would give us  
16           some data that would help guide our next steps, and --  
17           and then certainly through the operation we will be  
18           monitoring and, you know, looking -- looking for trends  
19           from -- from the -- in -- in terms of arsenic. I'd --  
20           I'd --

21   Q   Okay. So you --

22   A   Yeah. Just speaking --

23   Q   You are committing to that plan? Okay.

24   A   Yeah. Yes, we have committed to it. We are committing  
25           to it, yes.

26   Q   Okay. And I guess you -- can you tell me at this point

1           what results from monitoring triggered Benga to decide,  
2           We are going to build a metals treatment plant, a lime  
3           treatment, a -- something to -- to mitigate the release  
4           of arsenic?

5       A     Just give me a moment, Mr. O'Gorman.

6           So, Mr. O'Gorman, I don't have a specific answer  
7           to what would trigger a specific number. Again, we --  
8           we think that a pilot-scale test on-site at a -- at a  
9           scale that is significant is necessary to, you know,  
10          have a better handle on -- on this. We -- we would  
11          monitor. We would expect that any indications of  
12          arsenic or -- or other metals of concern that would  
13          need treatment would develop gradually. Basically  
14          these -- these issues arise from the gradual deposit of  
15          waste rock external to the pit and subsequently to  
16          water percolating through those waste rock dumps.

17          So that volume of water and, more importantly, the  
18          amount of elements or chemicals that would leach out of  
19          the rock is going to develop gradually with the  
20          project. So our expectation is that monitoring the  
21          trends would provide a significant -- sufficient  
22          advanced warning of the need to implement a metals  
23          treatment plant. But I -- it's difficult to provide an  
24          exact number as a -- as a trigger point.

25       Q     Okay. Thank you.

26           All right. Let's haul up a different document,

1 please. Actually, not a different document. We're all  
2 in the geochemistry document here. Let's look at  
3 PDF 163, please. Great.

4 Now we're looking at uranium. I think you'd  
5 agree, Mr. Day, or Jensen, perhaps, that if we look at  
6 this, we do see data that indicates uranium leach rates  
7 of up to .1 milligrams per litre in the Cadomin in that  
8 first week?

9 A MR. DAY: Yeah, that's correct. Again,  
10 I'd just like to point out that these are the acidic --  
11 those tests that were highly acidic, so they're not  
12 representative of -- in general of these materials.

13 Q Okay. Fair enough.

14 MR. O'GORMAN: Zoom Host, we're going to haul  
15 up something different to show, please. It's Registry  
16 Document 555. And PDF 233. This was the submission by  
17 CPAWS. 233, please. Good. Yeah. If we scan down a  
18 little bit and -- no. Zoom in. I did want to be able  
19 to see it.

20 Q MR. O'GORMAN: So we see a couple of the  
21 lower -- little pink blobs, refer to the microbial  
22 "Shewanellaceae" -- maybe is how that's pronounced. We  
23 actually see high proportions of Pseudomonas as well.  
24 The Pseudomonas is over 20 percent, and also there's --  
25 yes, the Shewanellaceae is a smaller amount. You see  
26 that and agree with that, Mr. Day?

1 A I certainly see it, but this is not my -- my area, so I  
2 think you're going to have --

3 Q Oh.

4 A -- to be talking to other people about this one.

5 Q Okay. I'm not sure who to speak to.

6 Is there -- who -- who -- who would be able to  
7 comment? Here's my question. About the fact that you  
8 do have not insignificant potential for leaching of  
9 uranium based on the test that we looked at a minute  
10 ago, and whether the fact that you have these bacterial  
11 communities -- not bacterial. Yeah, microbial  
12 communities in your -- in your rock, whether that might  
13 cause a concern that -- the interaction with uranium  
14 and why or why not?

15 A MR. HOUSTON: I don't believe we have  
16 anybody on the panel who can address this specific  
17 question, Mr. O'Gorman. We -- we'd probably have to go  
18 back to the author of this report to -- to get a  
19 specific answer to a specific question.

20 Q Okay. If you can't answer, that's fine. I mean --  
21 okay. I was going to ask you some questions. I mean,  
22 CPAWS brought this up in their written submission that  
23 these sometimes can be of concern, but we'll -- we'll  
24 leave that thread of questions, and I'll jump forward.

25 MR. O'GORMAN: Okay. We can take that down,  
26 please, Zoom Host, and let's go back to the



1 geochemistry reports, Document 42, Appendix 10, and  
2 look at PDF 42.

3 Okay. And we are on 42. Could you zoom out to  
4 see the full page, please, Zoom Host.

5 Q MR. O'GORMAN: Okay. We're talking about  
6 acid rock drainage, or let's call it "ARD". So in this  
7 document, we see primary mitigation. This is just an  
8 example, I think, of this one page, but I think you  
9 will know that you have proposed your primary  
10 mitigation measures for ARD to be blending and  
11 subaqueous disposal by backfilling, which obviously is  
12 also a selenium mitigation measure for your project.

13 You've indicated that in situ performance  
14 monitoring with groundwater wells and -- will be  
15 conducted as part of the project. However, you've not  
16 provided us with action levels for -- in an aquatics --  
17 aquatic effects response plan to give us the triggers  
18 at which you would take some actions to -- if acid rock  
19 drainage was detected and what those actions would be.  
20 It's also unclear how long-term monitoring would be  
21 conducted and for how long.

22 So having put those statements to you, here's my  
23 question: So with regards to ARD and metal leaching,  
24 can you give us an overview, please, of your sampling  
25 schedule and your -- and locations, what analytes  
26 you'll be measuring and the thresholds for those

1 analytes which would trigger an investigation and an  
2 actionable response during operations?

3 A MR. HOUSTON: Could we just take a little  
4 moment to conference here, Mr. O'Gorman?

5 Q Certainly.

6 A I believe Mr. Day will -- will be able to speak to  
7 this, Mr. O'Gorman.

8 A MR. DAY: Mr. O'Gorman, I think -- and  
9 what you're -- what you're really -- you're asking is  
10 you -- you want to understand if ARD is detected, what  
11 would be the response? What I'd like to do is --

12 Q Well -- well, actually, no, Mr. Day.

13 A Okay.

14 Q We want to make sure -- first of all, to know how  
15 you're checking for detecting ARD, and then after that,  
16 what you would do about it if you detect it.

17 A Okay. Well, the normal detection for ARD would be to  
18 look for acid general -- acidity in your -- in your  
19 monitoring points, but is that -- is that helpful?

20 I mean, what I was -- what I was actually going to  
21 help you understand is I've been working on this -- on  
22 this similar approach with other mining companies for a  
23 number of years, and what I wanted to point out is that  
24 you do not -- you don't want to get yourself to the  
25 point where you are actually wanting to pick up whether  
26 ARD is being produced. You want to make sure that the

1 mitigation measure's working well first.

2 And in the case of blending, as you're -- as  
3 you're actually doing the blending, there should be a  
4 monitoring plan in place actually at the point of  
5 deposition to make sure that that's -- that's actually  
6 happening, and that's your -- that's the first thing  
7 you want to be doing, rather than monitoring the -- you  
8 know, your -- your kind of water points.

9 Q Okay. So you will develop a standard ARD monitoring  
10 plan, let's call it that, and implement it on-site?

11 A Yes. That should be done. Yes.

12 Q But at this point, you don't have an answer to what are  
13 the trigger levels -- if there is a problem, what you  
14 would do about it, or do you?

15 A Well, I would recommend that -- that -- that there  
16 be -- you know, would be -- there would be water  
17 monitoring. I think that would be your -- what you  
18 would do. But I think that should be developed as part  
19 of the overall ARD management approach.

20 I mean, there are -- there are things you can look  
21 for that -- I mean, obviously pH is one, but you're  
22 really looking for early -- early indications of --  
23 of -- of accelerated leaching as well, which comes  
24 before pH decreases. So there are -- there are  
25 parameters you can look for, but I think those details  
26 will need to be developed.

1 Q Okay. Okay. That's fair, Mr. Day. Thank you.

2 You have described to us what you -- how you plan  
3 to manage your -- your PAG rock, your potentially  
4 acid-generating rock, in terms of the -- the layering  
5 in the SBZs; right? That's the blending, sorry, that's  
6 described in your materials?

7 A Yes, that's right.

8 Q Yes. All right. Is there -- do you have any concerns  
9 into the long lifetime that those SBZs need to operate,  
10 that is said to be -- could start to be generated in  
11 there; and if so, how might that happen?

12 A As long as they are kept saturated, then they will -- I  
13 mean, this is a very standard measure for controlling  
14 acid rock drainage, which has been around for decades.  
15 As long as you have underwater conditions, then -- then  
16 that will be prevented. Acid generation will be  
17 prevented.

18 Q Would have to stay suboxic; right?

19 A Correct. That's right. Saturated, yeah.

20 Q Okay. How long do you expect you might need to monitor  
21 for ARD after closure, given that it can sometimes take  
22 many years to manifest?

23 A MR. HOUSTON: So, Mr. O'Gorman, I think we'd  
24 look for a -- in terms of long-term management and  
25 keeping the AR -- the -- the acid rock in -- in a  
26 submerged environment, we -- we would look for

1 self-sustaining water levels in the SBZs, and we would  
2 want to set up the entire water management system from  
3 the end-pit lake through the SBZs to the outfall in a  
4 state that would maintain a water level in the SBZ that  
5 would keep that acid-generating rock in a submerged  
6 situation. So that would be -- that, you know,  
7 engineering the outfall so that it maintained a minimum  
8 level of water in those structures.

9 Q Okay. Thank you, Mr. Houston.

10 I'm going to stay on this theme, but I'd like --  
11 MR. O'GORMAN: Zoom Host, could we look at --  
12 I've forgotten if we're on Appendix 10 of Document 42.  
13 If we are, that's what I want. And look at PDF 42. Is  
14 that 42? Okay. Similar on there -- if we maybe scan  
15 down, we'll see these ratios. I don't see them.  
16 Mixing ratios.

17 Q MR. O'GORMAN: Okay. We're not going to  
18 waste time finding them on the page. Hopefully you  
19 will remember that this is part of your materials.

20 So in addition to the subaqueous disposal in the  
21 SBZs, you're dealing with the PAG rock by blending.  
22 You're going to be mixing PAG rock with non-PAG rock,  
23 nonpotentially acid generating, to neutralize the  
24 acid-generating potential.

25 Similar in there -- unfortunately, it didn't seem  
26 to be on that page I showed us -- you suggested the

1 ratios -- mixing ratios that you would have necessary  
2 for the blending were 50-50 for the -- let's -- and the  
3 Moose Mountain members and 75 to 25, or 3 to 1 as some  
4 of us say, for the Cadomin formation and the Adanac  
5 numbers. Do those numbers sound right?

6 A MR. DAY: Mr. O'Gorman, I think you're  
7 looking for PDF 45. So we can go there if you're --  
8 oh, yes, there it is right there.

9 Q Okay.

10 A Yeah. Yeah, it's correct, yeah.

11 Yeah, these are -- these are some calculations  
12 to -- to just check what mixing ratios you might need.  
13 They're kind of considered, you know -- like, kind of  
14 low targets. Like, you'd want to be higher, but yeah.

15 Q Okay. And I guess, you know, those -- those blending  
16 ratios do -- you know, you're an expert, Mr. Day. Do  
17 you -- do they seem high to you?

18 A When -- when you say "high", what do you mean? That  
19 they're -- that they're -- it's a lot of PAG rock, or  
20 is that what you're --

21 Q Yes, exactly. The amount of non-PAG rock you need to  
22 blend with it to get it to be neutral?

23 A They're not -- I wouldn't say they're -- they're --  
24 yeah, I'm not really sure what you're -- what you're  
25 asking. I mean, they're -- like, I'm -- I've been  
26 working with, as I said, a number of -- a number of

1 mining companies with this over the years, and  
2 they're -- they're not -- they're not unusual. I mean,  
3 these are -- they -- they're pretty typical for these  
4 types of rocks.

5 Q Okay. All right. That's fine, then.

6 And we just want to clarify, do you plan to have  
7 any PAG rock not stored subaqueously?

8 A Well, some of it will be blended. I think that's ...

9 Q Blended in the pits, but will it also be blended, for  
10 example, in the rock dumps?

11 A External rock dumps. Maybe I should ask Mike -- Mike  
12 Youl to -- to respond on that.

13 A MR. YOUL: Look, in the early years  
14 before the end-pit dumping begins, yes, there'll be --  
15 all the waste will go to outer-pit dumps, so I guess,  
16 by extension, we will need to work on the blending and  
17 -- and containment of the PAG material within that  
18 waste dump.

19 Q Okay. Okay. Thank you, Mr. Youl.

20 MR. O'GORMAN: We touched on this a second  
21 ago. I will point out to my colleague, Mr. Chair, that  
22 I would like to finish the geochemistry questions  
23 before we break for lunch, and I can see that happening  
24 over the next, hopefully, 15 minutes or so, if that  
25 works for you, sir?

26 THE CHAIR: Yeah, that sounds fine.

1 Thanks.

2 Q MR. O'GORMAN: Okay. Yes. Mr. Day, we  
3 alluded a minute ago to, do you consider there to be  
4 the potential for oxygen infiltration into the pits;  
5 for example, snow melt, rainfall? And if so, how do  
6 you plan to manage or limit that?

7 A MR. DAY: Sorry. Is the question  
8 whether there will be oxygen transported with -- with  
9 water coming in; is that -- that --

10 Q Yes.

11 A And -- and -- and is the question related to  
12 functioning of the saturated backfill zone? Is that  
13 the ...

14 Q Yes. Both for selenium, but in this case, we're  
15 talking -- well, we might talk about that more in the  
16 selenium questions. I'm thinking of it now from an ARD  
17 perspective.

18 A The amount --

19 Q Maintaining the suboxic nature of the saturated  
20 backfill zone is what I'm asking.

21 A Yeah, I understand you're -- the question's around  
22 whether there's no oxygen coming in with the water to  
23 be -- to significantly -- to result in significant  
24 oxidation, really, that's the -- I think that's what  
25 you're asking?

26 Q That's what I'm asking.



1 A Yeah. I mean, there's been a lot of experience with  
2 this over the years that the water covers are very  
3 effective because the amount of oxygen that can  
4 dissolve in the water is -- is so low relative to the  
5 amount of oxygen that's in the -- that's in air. And  
6 so, I mean, yes, some -- certainly there's going to be  
7 oxygen that comes in in that form, but it'll be -- it  
8 gets used up very quickly and consumed, and it's -- I  
9 mean, that's the foundation for -- for some increased  
10 disposal being good, is that you -- you have such low  
11 oxygen coming by that route.

12 Q Okay. Did you say that there would be -- described the  
13 cover over the saturated backfill zone? Did you say  
14 there would be some sort of cover that prevents  
15 penetration of oxygen, for example, with snow melt?

16 A No. I -- I didn't say that, no. And I don't -- I  
17 wouldn't see the need for it.

18 Q Okay. All right.

19 A MR. HOUSTON: To be clear, though,  
20 Mr. O'Gorman, we will be -- or putting topsoil and  
21 revegetating the -- over the saturated backfill zones  
22 like the rest of the -- the project, so there will be  
23 that vegetative cover.

24 Q Okay. Thank you.

25 Can you confirm -- I think you said you will be  
26 monitoring to ensure that no acid is being generated

1 by -- in the SBZs?

2 A MR. DAY: That would be a normal part of  
3 the monitoring, yeah.

4 Q Okay. You're dumping the PAG and non-PAG rock down  
5 into the pit in layers. Would it be more effective for  
6 you to crush and mix those layers to create a  
7 homogenous blend at predisposal?

8 A Yeah, that -- sorry.

9 A MR. HOUSTON: Sorry. Go ahead, Steve.

10 A MR. DAY: I don't believe -- I don't  
11 think that's necessary. You know, the -- and crushing  
12 creates more surface area, which makes more reactivity,  
13 so I wouldn't -- I wouldn't recommend that.

14 The experience I've had with implementing a  
15 similar approach elsewhere -- not me personally, but  
16 working with companies that have done it -- we don't  
17 find that's necessary that the -- that -- that by  
18 end-dumping over high enough faces you get sufficient  
19 mixing on the face to -- to result in this kind of --  
20 this blending process. So I don't -- I don't -- I  
21 wouldn't recommend crushing. I don't -- I don't see it  
22 as necessary.

23 Q Okay. Last question in this group, and then I'll ask a  
24 couple of more.

25 MR. O'GORMAN: Just really quickly on  
26 page 47, Zoom Host, a couple of pages later, there's a

1 diagram.

2 Q MR. O'GORMAN: And we are wondering whether  
3 it would make more sense to dump a non-PAG layer at the  
4 base. Do you think that it matters?

5 A MR. DAY: It -- it doesn't matter. If  
6 you -- like, if -- if the concept of an un-PAG layer at  
7 the base is to -- is to neutralize acid produced above  
8 it, it wouldn't be effective. The key point about this  
9 diagram is not to illustrate an actual dumping sequence  
10 but to -- really to show that by having thin enough PAG  
11 layers that you effectively result in an  
12 un-PAG mixture -- functioning as just an un-PAG, and so  
13 what -- what's on the bottom really -- really doesn't  
14 make any difference. The intent is that the whole  
15 thing behaves as a nonacid-generating sequence.

16 Q There you go. Our confusion was thinking this  
17 presented your proposed --

18 A No. No. No. This is a demonstration of a theory.

19 Q Fair enough.

20 Okay. So the last group of questions in this  
21 theme. Can we please see, same document, let's just  
22 jump ahead a few pages to page 51, PDF 51, please.

23 So now we're talking about the derivation of the  
24 source terms. There's a line in here about how the  
25 results -- the input rates from the -- determined from  
26 the humidity cell -- I'm not going to find it on the

1 page. I'll ask you to believe that it's there. The  
2 input rates for the water quality model were determined  
3 from the humidity cell tests that were scaled to field  
4 commissions based on laboratory-to-field scaling  
5 factors determined for coal mine wastes in the Elk  
6 Valley.

7 We have here inputs that are given, and it's down  
8 on this page, but I'm pressed for time and I do want to  
9 move. We've got inputs that were given for elements  
10 that are controlled by pH and for selenium and  
11 sulphate.

12 We noted that the Fernie and Gladstone formations  
13 were not included in humidity cell testing or in the  
14 pit wall runoff calculations. Does that make -- does  
15 that make -- sound right to people, that you did not  
16 include the Fernie and Gladstone formations in --

17 A MR. DAY: Yeah. At the time of the  
18 testing we didn't have samples of Fernie to test, so  
19 that -- that does make sense. I'm not sure about  
20 Gladstone. I'd have to -- I'd have to check back on  
21 that.

22 Q Okay. Yeah, we did notice if we called up a different  
23 document -- so it's Registry 42, Section B this time.  
24 And we looked at PDF 96. If I wrote this down  
25 correctly. 96. That, yeah, on this graph -- graph.  
26 Sorry.

1           On this figure, the -- the Fernie is the big  
2 purple bit, and the pink line, I think, indicates the  
3 pit bottom; right? And there being -- if we see near  
4 the top of that central figure a fair chunk of the  
5 Fernie would be -- would be mined; does that make  
6 sense? Am I interpreting that figure correctly?

7 A I think it would help -- I think -- I think you're  
8 right, Mr. O'Gorman, but I probably should ask  
9 Mike Youl just to confirm that.

10 A MR. YOUL:                   Yeah, that's correct. The  
11 Fernie sits below the base of the lower seam, so in  
12 some areas we'll be excavating through that for foot  
13 wall stability and also for ramp access.

14 Q Okay. Great. I think we're on page 96, and if we  
15 scroll back to 94 in this document. It looks to me,  
16 and to us, like the Fernie formation would be exposed  
17 frequently along the pit boundary in some of these  
18 cross-sections. Do you agree with that?

19 A That's correct, yeah. In some of the final high walls  
20 it will be exposed and then backfilled.

21 Q Okay. Okay. Thank you for confirming that, Mr. Youl.

22           Okay. We'll go back to Appendix 10 again, and  
23 we'll go to Document 42, Appendix 10, the geochemistry  
24 reports, and we'll -- right. Go to page PDF 51. Oh,  
25 we're there. And this is the second paragraph from the  
26 bottom. If we'd scroll to the bottom of the page,

1 please.

2 It's a sentence that begins "the input rates" -- I  
3 found it earlier. Right, right there. Right there.

4 (as read)

5 The input rates were determined from humidity  
6 cell tests which were scaled to field  
7 conditions.

8 And I mentioned that earlier.

9 So can you briefly explain this -- the laboratory  
10 field-scaling factors that you're referring to to help  
11 our geochemists understand that translation you made?

12 A MR. DAY: Yeah. I'll explain that. So  
13 this is a standard thing that needs to be done to to  
14 use laboratory testing. The tests are performed under  
15 room temperature conditions, under finely crushed  
16 materials relative to -- to site scale and under fully  
17 oxygenated conditions. And it's necessary to -- to  
18 address all of those factors which tend to make  
19 weathering faster under laboratory conditions than they  
20 are at field scale. And we do this using scaling  
21 factors which translate the rates of -- for -- at least  
22 measured in the tests to -- to field scale.

23 Q Right. But what sort of -- are those scaling factors  
24 standard that one would look up in a textbook, or  
25 what -- like, what are the scaling factors?

26 A Well, yes, the scaling factors -- if you scroll down,

1 the actual scaling factors are shown in Figure 10,  
2 which I believe is on the next page of the document.  
3 There we go. Thank you.

4 I mean, these are -- they're not standardized  
5 because they're -- you need to consider site-specific  
6 conditions. But in order to develop these scaling  
7 factors for the Grassy Mountain Project, we referred to  
8 a paper that was referenced on a previous page which I  
9 was the co-author of, and a study that I designed, to  
10 look at scaling factors in the Elk Valley, and that was  
11 how we -- we used the same scaling factors because the  
12 rocks are very similar. The climatic conditions are  
13 similar enough for geochemical purposes to -- to come  
14 up with the scaling factors which are shown in that  
15 first row there in -- in Table 10.

16 There is a -- there's quite a bit of experience on  
17 this topic around the -- you know, in the --  
18 particularly in Western Canada, and these -- these are  
19 not unusual scaling factors. They're -- they're fairly  
20 typical. I mean, there's no -- there's no textbook you  
21 can go to look them up, but they're -- they're fairly  
22 typical.

23 Q Okay. That's fine. That's the methodology question I  
24 was really trying to get at, so thank you.

25 If we cut now in this document, please, to  
26 page 15. And we're going to have to find something --

1 right there. Right. Other formations will be mined.  
2 It's the final paragraph above where -- Section 2.4.

3 So I'll let you read that. We don't need to read  
4 it out. You can skim it.

5 We do want to know -- so you didn't have fresh  
6 samples of the Fernie formation when you did your  
7 testing. Is that what you said?

8 A Yeah. That's correct. Yeah.

9 Q Okay. I guess we did wonder, and I'm -- whether any of  
10 the drill holes that you drilled might have provided a  
11 sample from the Fernie that you could have tested?

12 A At the time there were not samples available for the  
13 Fernie formation. We did subsequently get samples from  
14 a part of the project area to look at Fernie, and I  
15 believed there are -- there have been samples that have  
16 come available subsequently, so there -- there are  
17 materials available that can be tested.

18 I would just like to say that -- I mean, from my  
19 experience working with these rocks throughout the  
20 region, the Fernie formation is not a -- is not a  
21 potentially acid-generating unit, so it's -- it's not a  
22 concern from that standpoint. And -- and generally the  
23 volume of rock is -- as Mr. Youl described, is  
24 relatively small, although most figures it looks like  
25 it's big. It's more of a -- it is a small part of it  
26 because they're -- they're really trying to avoid



1           having to mine much of it.  It's really just to access  
2           where the coal is and for stabilization reasons.

3    Q    Fernie has shales; right?

4    A    The Fernie is a -- it's a sandstone -- it -- it has  
5           sandstone units, it has siltstone -- siltstones and  
6           shales, yeah.

7    Q    Okay.  So those shales wouldn't be expected to contain  
8           pyrite?

9    A    Yeah, they do contain pyrite.  That's the regional  
10           finding on the Fernie.  They do contain pyrite, but  
11           they also contain -- tend to be quite calciurias,  
12           meaning a lot of carbonate, and so we -- we aren't  
13           concerned about acid generation from the Fernie in  
14           general.

15   Q    Okay.  Okay.  So nearly there.

16   MR. O'GORMAN:                    If we can haul up, please --  
17           this time we're going to a different document, Zoom  
18           Host.

19   Q    MR. O'GORMAN:                    And I'll ask for the document,  
20           and I'll throw one final question at you while -- while  
21           they're searching for it.

22                    Now we're looking at Registry Doc 42, Consultant  
23           Report 3, and while that's coming up, just to wrap up  
24           my last question.  So you aren't -- Mr. Day, you're not  
25           concerned about ARD from the Fernie.  What about metal  
26           leaching?

1 A MR. DAY: Yeah. The -- the geochemical  
2 characteristics of the Fernie are quite similar to the  
3 -- this mountain formation. It can have -- it can have  
4 higher sulphide content. But the element content of  
5 the Fernie tends to be similar.

6 So I'm not in general -- I'm not in general  
7 concerned about it, just because it's not -- it's  
8 not -- not a particularly unusual unit, and it does  
9 tend to be a relatively low proportion of the overall  
10 waste that's produced.

11 Q Okay. Okay. That's fine. Thank you.

12 So in this document --

13 MR. O'GORMAN: Zoom Host, PDF 85, please. So  
14 where is the figure that we want to see? Scan down a  
15 bit. What we're concerned about -- maybe you need to  
16 scan -- actually, you are going to need to scan it.  
17 And let's look at the legend.

18 Q MR. O'GORMAN: I think if we find -- when I  
19 looked at this earlier, if you blow up the -- zoom in  
20 on the legend a bit, you will see that the Fernie on  
21 here is indicated -- as I recall, they were in blues,  
22 but I'll admit I can't -- I'll admit I can't read it.  
23 But if we think about the overlay of your project  
24 design, we -- in looking at this figure, can you  
25 confirm that it seems the raw water pond is placed  
26 where the Fernie is at surface?

- 1 A MR. HOUSTON: It -- it appears to be,  
2 Mr. O'Gorman.
- 3 Q Okay. Now, Mr. Day, I acknowledge what you just said  
4 about your views on the Fernie formation. But the raw  
5 water pond, it will not be a suboxic environment;  
6 right?
- 7 A MR. DAY: I -- I can't speak to the  
8 design of the raw water pond. If somebody else could.  
9 I mean, I -- maybe Gary -- Mr. Houston.
- 10 A MR. HOUSTON: Yeah. No, it -- it -- it  
11 won't be suboxic. There'll be exchange of water  
12 through there, and -- and so it will be oxygenated.
- 13 Q Okay. So I guess we just were -- wanted to understand  
14 whether you would be checking for or monitoring whether  
15 you had concerns about the fact that the potential --  
16 that some of the sulphides in the Fernie formation  
17 might be exposed during the excavation of the raw water  
18 pond and be -- you know, release trace metals or cause  
19 ARD.
- 20 A MR. DAY: Yeah. My -- my advice to --  
21 whenever excavations are made at mine sites is that  
22 there is -- is at least a geologist checking to see  
23 what the rock looks like and, if necessary, geochemical  
24 testing done, but I think that would be normally part  
25 of a -- an MLA or ARD management plan that's developed.
- 26 Q Okay. Mr. Houston or Mr. Youl, can you remind us

1           whether you have planned to put a liner at the bottom  
2           of your raw water pond and particularly -- you'll  
3           understand, I think, where I'm going with this -- the  
4           potential for elements in the Fernie formation to be  
5           liberated into the raw water pond?

6    A   MR. HOUSTON:                    So I'll let Mr. Youl add to  
7           this, but we have not committed to lining the raw water  
8           pond. We will do additional investigation and -- for a  
9           number of issues, including the -- the quality of the  
10          rock, and we -- we could do something to line the raw  
11          water pond if those -- subsequent investigations at the  
12          time of construction indicated that there was reason  
13          for a -- a concern.

14                 Mr. Youl, do you -- do you want to add anything to  
15                 that?

16   A   MR. YOUL:                        Thanks, Mr. Houston.

17                 No. You've covered that pretty well. I don't  
18                 have much more to add, other than, you know, we are  
19                 considering liners; not yet committed. One of the  
20                 concerns with a liner is upward hydraulic pressure  
21                 pushing up the liner from underneath and -- and whether  
22                 by installing one we're creating other problems. So  
23                 we're still looking at all the potential solutions.

24   A   MR. HOUSTON:                    And just finally,  
25                 Mr. O'Gorman, I think we're talking about a fairly  
26                 small surface area compared to the rest of the -- the

1 project. So, you know, we -- we would anticipate that  
2 any -- any issues related to ARD are -- are relatively  
3 small in -- in the scheme of things from the raw water  
4 pond.

5 Q Would you plan to conduct humidity-style tests and  
6 maybe X-ray defraction on Fernie samples before putting  
7 in the raw water pond, or are you really just not  
8 concerned about it?

9 A One minute, please.

10 So, Mr. Day, can you -- can you speak to that?

11 A MR. DAY: Yeah, I'm happy to.

12 No. I would -- I would -- like, for something  
13 that's, you know, relatively small in the -- the, you  
14 know, context of the whole site, normally what I would  
15 recommend is that a geologist or somebody just take a  
16 look at the rock as part of the other investigations  
17 that are done to design the pond. I wouldn't see the  
18 need for a -- for -- for testing beyond that unless --  
19 unless that -- that geological look came up with  
20 something.

21 Q Okay. We're really close to the end. I was going to  
22 draw you to some things that you had said, but to -- to  
23 abbreviate it, cut to the -- cut to the chase, you  
24 haven't tested the Fernie formation, and we don't  
25 think -- we haven't discussed it, but we're not -- we  
26 don't think you've tested leaching potential from the

1 Gladstone formation either. Both of those might be in  
2 the rock that you dig up, and so we do wonder whether  
3 you think that estimated seepage from the waste rock  
4 for concentrations for dissolved metals, like cobalt  
5 and zinc, might be higher if you were to add a --  
6 potential leaching from the Fernie and the Gladstone  
7 formations. And to be fair, I haven't asked you about  
8 the Gladstone, so we can focus on the Fernie.

9 A I'll answer that, Mr. O'Gorman. I -- I really don't  
10 think that the -- the Fernie formation would have a  
11 significant influence on those -- those -- those  
12 predictions. I mean, they're -- we've based those  
13 source temp predictions on the bulk of the waste rock,  
14 and they also consider the influence of some of the  
15 units that are noted in the humidity cells that do  
16 react rapidly. So I'm -- I'm not concerned about the  
17 Fernie.

18 I -- I mean, I think it would be prudent to --  
19 to -- to be -- to be looking at the Fernie to -- as  
20 I've talked about, from the geological standpoint and  
21 confirming its geochemical characteristics, but I  
22 don't -- I don't think it really has an influence on  
23 the water chemistry predictions, not a -- not a  
24 significant influence anyway.

25 Q To clarify, there are no tests on the record to confirm  
26 that, though; correct?

1 A Definitely not for humidity cells. That's correct,  
2 yeah.

3 Q Okay. I think we're good. Thank you, gentlemen. That  
4 gets us through our section on geochemistry. Thank you  
5 for your -- for your responses.

6 And, Mr. Chair, I propose it's a good time for us  
7 to break for lunch.

8 THE CHAIR: Okay. Thank you,  
9 Mr. O'Gorman.

10 It's 12:30, so let's resume at 1:15, and  
11 Mr. O'Gorman will continue with his questions.

12 MR. SAWYER: Mr. Chairman --

13 THE CHAIR: Yeah.

14 MR. SAWYER: Mike Sawyer here.

15 THE CHAIR: Yeah.

16 MR. SAWYER: My apologies for interrupting,  
17 sir, but Timberwolf has reviewed Undertaking Number 19  
18 that was provided to us today, and I would like the  
19 opportunity to have a very brief redirect on the  
20 information that was provided in that undertaking, sir.

21 THE CHAIR: Okay. Okay. Mr. O'Gorman,  
22 would you mind if I provide that opportunity to  
23 Mr. Sawyer right after the lunch break before you  
24 resume?

25 MR. O'GORMAN: That's completely fine with  
26 me, sir.

1 THE CHAIR: Is that okay with you,  
2 Mr. Sawyer?

3 MR. SAWYER: Yes, sir. I think I'll be  
4 less than 15 minutes.

5 THE CHAIR: Okay. Thank you.

6 Okay. We'll see everyone at 1:15.

7 \_\_\_\_\_

8 PROCEEDINGS ADJOURNED UNTIL 1:15 PM

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1 Proceedings Taken via Remote Video

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3 November 20, 2020 Afternoon Session

4

5 A. Bolton The Chair

6 D. O'Gorman Hearing Commissioner

7 H. Matthews Hearing Commissioner

8

9 M. LaCasse AER Counsel

10 B. Kapel Holden AER Counsel

11

12 K. Lambrecht, QC Joint Review Panel Secretariat  
13 Counsel

14

15 T. Utting IAAC Staff

16 E. Arruda AER Staff

17 D. Campbell AER Staff

18 T. Turner AER Staff

19 T. Wheaton AER Staff

20 A. Shukalkina AER Staff

21

22 M. Ignasiak For Benga Mining Limited

23 C. Brinker

24

25 R. Warden For Ktunaxa Nation

26 T. Howard

1	K. Poitras	For Métis Nation of Alberta
2		Region 3
3		
4	Chief B. Cote	For Shuswap Indian Band
5		
6	B. Snow	For Stoney Nakoda Nations
7		
8	R. Drummond	For Government of Canada
9	S. McHugh	
10		
11	A. Gulamhusein	For Municipality of Crowsnest
12		Pass
13		
14	M. Niven, QC	For MD of Ranchland No. 66
15	R. Barata	
16	J. Nijjer	
17		
18	B. McGillivray	For Town of Pincher Creek
19		
20	D. Yewchuk	For Canadian Parks and
21		Wilderness Society, Southern
22		Alberta Chapter
23		
24	R. Secord	For Coalition of Alberta
25	I. Okoye	Wilderness Association, Grassy
26		Mountain Group, Berdina Farms

1		Ltd., Donkersgoed Feeder
2		Limited, Sun Cured Alfalfa
3		Cubes Inc., and Vern Emard
4		
5	R. Cooke	For Crowsnest Conservation
6		Society
7		
8	G. Fitch, QC	For Livingstone Landowners
9	C. Agudelo	Group
10		
11	M. Sawyer	For Timberwolf Wilderness
12		Society and Mike Judd
13		
14	(No Counsel)	For Barbara Janusz
15		
16	(No Counsel)	For Jim Rennie
17		
18	S. Elmeligi	For Alberta Chapter of the
19	A. Morehouse	Wildlife Society and the
20	S. Milligan	Canadian Section of the
21	M. Boyce	Wilderness Society
22		
23	J. Gourlay-Vallance	For Eco-Elders for Climate
24		Action
25		
26	L. Peterson	For Trout Unlimited Canada

1 R. Campbell For Coal Association of Canada  
2  
3 (No Counsel) For Alistair Des Moulins  
4  
5 (No Counsel) For David McIntyre  
6  
7 (No Counsel) For Fred Bradley  
8  
9 (No Counsel) For Gail Des Moulins  
10  
11 (No Counsel) For Ken Allred  
12 (Not Present)  
13  
14 (No Counsel) For Monica Field  
15  
16 S. Frank For Oldman Watershed Council  
17 A. Hurly  
18  
19 A. Porco, CSR(A) Official Court Reporter  
20

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21 (PROCEEDINGS COMMENCED AT 1:17 PM)

22 Discussion

23 THE CHAIR: Welcome back, everybody. Just  
24 before we let Mr. Sawyer do his follow-up cross, the  
25 Panel had a discussion at lunch, and I wanted to put  
26 this to the participants. We had planned to sit

1 tomorrow, and the reason for that, of course, was to  
2 try and contain the water section to one week, the six  
3 days, but it's clear, based on where we're at in the  
4 schedule, that even if we sit tomorrow, I don't think  
5 we'll -- well, we won't finish the water section  
6 tomorrow.

7 Looking at where we're at, my best guess is we  
8 probably have two full days after today, when I look at  
9 the participant time estimates for their direct and the  
10 cross. So even if we sit tomorrow, we're not going to  
11 finish.

12 So I'm also aware of the fact that we used our  
13 last two flex days, which were both Saturdays, and sat  
14 those days to try and kind of keep on schedule, and  
15 I've also noticed that we've gone late a few nights  
16 beyond kind of what we said we were going to sit.

17 So the Panel is of the view that it might be  
18 preferable to do what we can do today and then resume  
19 Monday and not sit tomorrow, and I know that's a  
20 departure from the schedule. So before we kind of make  
21 that decision, I wanted to kind of hear from any of the  
22 participants about whether that would create any kind  
23 of unmanageable scheduling issues in terms of, you  
24 know, expert witnesses or others.

25 MR. SECORD: It's Richard Secord here. I  
26 actually was wanting to just raise as a preliminary

1 matter exactly what you've raised. Looking at the  
2 schedule, I just wanted to get your confirmation that  
3 the four expert witnesses for the Coalition would not  
4 have to be on standby today and would come in tomorrow  
5 morning.

6 I -- my guess is that the four witnesses would  
7 probably not be adverse to coming on Monday, but I  
8 would need to check their availability. I know that  
9 they are available tomorrow morning, but subject to  
10 their availability on Monday, certainly I would have no  
11 objection.

12 THE CHAIR: Okay. Mr. Secord, thanks for  
13 that.

14 Any other participants have comments on that?

15 MR. DRUMMOND: It's Robert Drummond from  
16 Justice Canada. I will just have to confirm. As you  
17 know, there are a number of federal witnesses, and I  
18 want to make sure they're all available. If the  
19 hearing goes longer than the 30th, there might be a  
20 slight question of Canada asking to go at certain times  
21 because of one witness's availability, but I think we  
22 can leave that for now.

23 THE CHAIR: Okay. Thank you,  
24 Mr. Drummond.

25 MR. FITCH: Mr. Chair, it's Gavin Fitch.  
26 Yeah, I had been thinking up until, I guess, yesterday

1 that we would probably be putting up Dr. McKenna  
2 tomorrow, so we're not adverse in principle to not  
3 sitting tomorrow. Far from it. But like everyone  
4 else, I'll need to just check with Dr. McKenna to see  
5 if that creates any problems with his schedule next  
6 week.

7 THE CHAIR: Okay. Thank you.

8 MR. RENNIE: This is Jim Rennie speaking.

9 THE CHAIR: Yes, Mr. Rennie?

10 MR. RENNIE: I have an appointment on  
11 Monday from the middle of the day, from about 11:30  
12 till 12:30. Do you think that I would be giving  
13 evidence around that time or later in the afternoon?

14 THE CHAIR: It looks like you might be  
15 either late that day or Tuesday.

16 MR. RENNIE: Okay. Well, later on Monday  
17 will be all right. I just have that previous  
18 commitment in the middle of the day.

19 THE CHAIR: Okay. Thank you, Mr. Rennie.

20 MR. RENNIE: All right.

21 THE CHAIR: Mr. Ignasiak, any comments  
22 from Benga?

23 MR. IGNASIAK: Thank you, Mr. Chair. I don't  
24 think so. Not at this time. I haven't had a chance to  
25 talk to my client, so ...

26 THE CHAIR: Yeah. Understood.

1 MR. IGNASIAK: But, you know, we'll do  
2 whatever makes it easiest for the Panel to move this  
3 forward.

4 THE CHAIR: Okay.

5 MR. IGNASIAK: So we're in your hands.

6 THE CHAIR: Okay. Yeah. Again, sorry for  
7 the change in thought. But we're just looking at what  
8 we still have to get done this week, and it doesn't  
9 look like we'll get it done. And I think, you know,  
10 continuing to push as hard as we have been may not  
11 serve us well.

12 So I'll leave it for now, and maybe what I'll do  
13 is ask that if -- to the extent possible, those who  
14 have identified potential scheduling issues could try  
15 and, you know, just confirm with their clients -- or,  
16 sorry, their witnesses, depending on the case, whether  
17 moving to Monday, Tuesday to finish this session would  
18 create -- create an issue, and then maybe I'll poll  
19 people again just before the break to see if we can get  
20 some clarity.

21 In any event, given where we're at, the Government  
22 of Canada witness panel would not be up today, so it  
23 would be up tomorrow if we stuck to the original  
24 schedule. So I think they can certainly stand down for  
25 this afternoon. Looks like Mr. O'Gorman will probably  
26 take us to the end of the day.



1 MR. SECORD: And, sir, can we just send an  
2 email to Ms. Utting and Ms. Arruda to let them know  
3 that we're -- if all of my witnesses are okay for next  
4 week, would that be sufficient?

5 THE CHAIR: Yeah, I think that would be --  
6 that would be probably preferred, and then we can look  
7 at that at the break and -- and confirm our kind of  
8 course of action after the break.

9 MR. SECORD: Thank you very much.

10 THE CHAIR: Okay. Any other discussion on  
11 that topic?

12 MR. YEWCHUK: Just one point from  
13 Mr. Yewchuk at CPAWS. Is there any chance my witness  
14 will be up today, or should I release them?

15 THE CHAIR: No, I see no chance,  
16 Mr. Yewchuk, given where we're at, so thanks for  
17 asking.

18 MR. YEWCHUK: Thank you.

19 THE CHAIR: Mr. Sawyer?

20 MR. SAWYER: Thank you, Mr. Chair. Bear  
21 with my ignorance, but this IR Response 19, has it been  
22 entered into -- as an exhibit in this proceeding; and  
23 if not, can we?

24 THE CHAIR: I believe it already has, but  
25 maybe staff could confirm that.

26 MS. UTTING: It's entered this morning as

1 CIAR 877, I believe.

2 MR. SAWYER: Thank you for that.

3 Zoom Master, if I could ask you to bring up  
4 CIAR 877, please, and if you could turn to PDF page 4,  
5 please.

6 GARY HOUSTON, DANE MCCOY, MIKE YOUL, MIKE BARTLETT,  
7 CORY BETTLES, DAVID DEFOREST, SOREN JENSEN,  
8 MARTIN DAVIES, LEIF BURGE, DAN BEWLEY, Previously  
9 Affirmed

10 STEPHEN DAY, NANCY GRAINGER, Previously Sworn

11 Mr. Sawyer Cross-examines Benga Mining Limited

12 Q MR. SAWYER: Good afternoon, Benga panel.  
13 How are you all today?

14 A MR. HOUSTON: We're fine, Mr. Sawyer. Thank  
15 you for asking.

16 Q Okay. I have a few questions directly out of your  
17 response. And I just want to make sure I understand  
18 your numbers.

19 Now, did -- Mr. Bettles, are you there?

20 A MR. BETTLES: Good afternoon, Mr. Sawyer.  
21 How are you today?

22 Q I'm good. Thank you.

23 Did you prepare these numbers, or did one of your  
24 team members prepare them?

25 A I worked with a biostatistician that works with us at  
26 Hatfield.

1 Q Okay.

2 A Then the time to get the numbers turned around.

3 Q Okay. So I just want to make sure I understand these  
4 numbers.

5 A Sure.

6 Q And so I'm going to look at Table U19.1 on page 4. And  
7 under the Gold Creek values, I just want to focus on  
8 Reach 9, and Reach 9's not important in one or the  
9 other. I just want to make sure I understand how you  
10 did the numbers.

11 So as I look at Reach 9, I see that you -- during  
12 that survey, you caught a total of 203 fish; is that  
13 correct, sir?

14 A That's -- that's, I believe, the number that comes from  
15 the previous tables that -- in -- no. Actually, I  
16 believe that you're correct. That's right.

17 Q Okay. And then you indicate a number -- a survey  
18 length in metres, and in that case it was 368 metres;  
19 correct?

20 A That's correct.

21 Q And that would have been the length of the stream  
22 channel that you surveyed using electrofishing methods?

23 A Just one second, please.

24 The -- I was -- just to clarify, the total  
25 westslope that we caught, 203, we didn't catch those.  
26 That total westslope is as an estimate.

1 Q Okay. So, yeah, and I stand corrected. So that is  
2 your estimate when you applied the -- the statistical  
3 method from the number you caught?

4 A That's correct.

5 Q Okay. Thank you for correcting me on that.

6 So back to my question. In Reach 9, the stream  
7 length that you surveyed using those methods was 368  
8 metres; correct?

9 A That's correct.

10 Q And we look at your density number's 100 --  
11 per-100-metres square. Although you didn't use this  
12 later on, that's simply a number of dividing the -- the  
13 number of fish you estimate by the number of square  
14 metres of wetted channel in that 368-metre length;  
15 correct?

16 A It's length and width 'cause you need the square  
17 metre -- you need the area.

18 Q Okay. And for this calculation where did you get the  
19 width from?

20 A We had calculated the -- the width while we were out  
21 there doing stream channel measurements. So it's not  
22 reflected in the table, but we did take width  
23 measurements.

24 Q Okay. So that's based on the value it derived during  
25 the time you did the survey?

26 A That's correct.

1 Q And that would be a mean -- a mean value for the entire  
2 length that you surveyed?

3 A It's -- it's an -- it's -- it's an approximate number,  
4 a density number for that area that we surveyed based  
5 on the mark-recapture estimate, which is referred to as  
6 the total westslope number of fish.

7 Q Okay. And going along on that table, we --  
8 (UNREPORTABLE SOUND)

9 MR. SAWYER: My apologies, Mr. Chairman,  
10 for the ringing. I have no control over it, and it'll  
11 end shortly if it hasn't already. No.

12 Q MR. SAWYER: Continuing. So you surveyed  
13 368 metres of that reach; correct?

14 A That's the length that we surveyed, correct.

15 Q And -- and in that table you say the reach length was  
16 1,922 metres?

17 A Well, the -- where -- Reach 9 is comprised of 1,922  
18 metres itself, but we only sampled 368 metres of --  
19 survey length in there.

20 Q Okay. And then so if I'm correct, you -- if we look at  
21 those numbers, you would have created a ratio of how  
22 long you surveyed relative to the total reach length;  
23 correct?

24 A Sorry. I'm just double-checking here, looking at it.  
25 So, first of all, what we've -- what we've done is  
26 we've -- we've taken the density estimate and we've

1 applied a density scale factor to come up with a  
2 standard deviation of westslope cutthroat per 100 times  
3 square -- square metres.

4 Q I see that, sir, but that's -- that's not what I'm  
5 asking. If we look at, for example, in the -- in the  
6 right-hand block of the -- the Table 4, Reach 9, you've  
7 come up with an estimated number of westslope cutthroat  
8 trout of 1,060.2?

9 A It's not time -- it's not time-distanced. It's not  
10 time -- it's not time; it's distance. Sorry.

11 Q Okay. So just -- just let's back up here. You  
12 surveyed 368 metres of the reach; correct?

13 A It's a proportion of the full reach of Reach 9 that  
14 we've identified as 1,922 metres; correct.

15 Q Okay. And I would suggest to you if you do your  
16 arithmetic, you would see that that proportion was  
17 5.228. So you multiplied your total estimated fish of  
18 2,003 by 5.228 to get 1,060.2; is that not correct?

19 A Just one second. Bear with me. Sorry. I believe  
20 you're getting -- you're pretty much right there, I  
21 believe.

22 Q Mr. Bettles, I think I'm exactly right.

23 Okay. And you've used that same method for the  
24 calculations that you did on -- on Reach 7 angling,  
25 Reach 7 electrofishing, and Reach 8 electrofishing, as  
26 well as for all the data presented for Blairmore Creek;

1 correct?

2 A That's correct.

3 Q Okay. So let me ask you this question, sir: During  
4 the course of this study, have -- has the  
5 identification of the specific reaches changed during  
6 the course of the study?

7 A We -- we have been standardized -- we've standardized  
8 our reaches. We haven't changed them at this point.  
9 So the actual reach lengths that we've identified,  
10 we've maintained those reaches to date.

11 Q Okay. So what is the reach length of Reach 9, please?

12 A Well, in this -- based on the Table U19, we have 1,922  
13 metres.

14 MR. SAWYER: Okay. Zoom Master, I wonder  
15 if you could bring up CIAR 42, Addendum 1, Appendix A1,  
16 and if you could go to page 131, please. I must have  
17 the wrong document.

18 Where I'm looking is CIAR 42, which -- and then  
19 Addendum 1, Appendix A1. And I believe that --

20 MR. IGNASIAK: Mr. Chair, I think he means  
21 CIAR 44, if he's referring to Addendum 1.

22 MR. SAWYER: Mr. Ignasiak, I'll take that  
23 on advice. Let's just see where it shows up.

24 If we go to page 131, what do we see? Should be a  
25 Table A2.1. That is correct. My apologies,  
26 Mr. Chairman, and other participants. I didn't -- I

1 thought I had the right number.

2 So I wonder if -- Zoom Master, if you could zoom  
3 in on that so we can read the numbers, just in that top  
4 portion of the -- of the -- of the paper.

5 Q MR. SAWYER: Now, Mr. Bettles, you're  
6 familiar with this; correct?

7 A MR. BETTLES: Mr. Sawyer, yes, I am. I'll  
8 let you continue on here, and I will -- I have a  
9 response, I think, already prepared, so -- but  
10 continue, please.

11 MR. SAWYER: So, Zoom Master, if you could  
12 scroll over so we can see the values for Reach 9.

13 Q MR. SAWYER: Now, Mr. Bettles, would you  
14 confirm for me that your Reach 9 length, and I'm  
15 reading this directly out of the table, is 616 metres?

16 A MR. BETTLES: Well, that's the -- that is  
17 the number in that -- in that table you're showing  
18 there. Correct.

19 Q Okay. So you've told us that there -- that the reaches  
20 as they were defined early in the study have not  
21 changed; correct?

22 A I'd like to clarify that I think you're -- we've done  
23 further habitat work post 2015 and into 2016 where we  
24 actually have delineated the reaches through our  
25 habitat mapping. So this was used initially to inform  
26 further analysis that we did in 2016, so we have other



1 figures in our -- in our technical baseline report that  
2 were used to derive the actual reach lengths, more  
3 appropriately to cover off on a bunch of different  
4 aspects of our assessment.

5 So I would -- I would actually argue that we did  
6 not use the data in this -- in this table for our reach  
7 delineations in our mark-recapture estimates.

8 Q So, then, that means that your response to my earlier  
9 question is: Have the reach definitions changed over  
10 the time of your -- that was not a correct answer?

11 A Well, I guess you can -- I guess -- I guess it is  
12 inaccurate, but again, if -- if you look at our  
13 documentation in our -- in our actual baseline report,  
14 we refer to the work that was done in 2015, but we  
15 really focus on the 2016 habitat mapping that we --  
16 that we used.

17 So, I mean, yes, it's -- it's initially  
18 preliminary information we collected in 2015, but  
19 the -- the -- the scope of our assessment relied on the  
20 2016 habitat mapping that we conducted.

21 Q Okay. So you did not answer my question accurate.

22 So if we were to pull up that table -- or a table  
23 that shows you what the actual reaches that you used at  
24 some point in your -- would any of those tables jive  
25 with the numbers that you have presented in your  
26 response to the undertaking?

1           Specifically, do you have a table that shows the  
2           estimated reach length of Reach 9 as being 1,922  
3           metres?

4    A    It's -- that's the reach length that we -- that -- that  
5           we identified. I'd have to go back and look in the  
6           actual document to find those numbers, Mr. Sawyer.

7    Q    I'd like you to do that, sir.

8    A    Just bear with me for one second.

9           Yes, that would -- that would be Table 4.1 in the  
10          actual document, so yes. That's where we've -- we  
11          identified it, and I can let you -- sorry. And that's  
12          in the same document that we -- CIAR 44, Addendum 1.

13   Q    On what page, sir?

14   A    That would be on PDF 47.

15   Q    So you're saying this is in the same document as the  
16          one that I'm referring to, this table?

17   A    That -- that's correct.

18   Q    Okay. And when was this -- this document was published  
19          in 2016; correct?

20   A    That's correct.

21   MR. SAWYER:                    Okay. And so we can just go  
22          to that Table 4.1 on page 47, Zoom Master, please.

23   Q    MR. SAWYER:                    Okay. So Gold Creek -- I'm  
24          just checking some numbers here. Okay, sir. So we're  
25          going down a bit of a rabbit hole here, but I just want  
26          to check a couple things.

1           First of all, in your electrofishing survey, you  
2           used a reach length of 1,922 metres; correct?

3   A   MR. BETTLES:           That's what's in the table,  
4           yes.

5   Q   Well, I'm not asking whether it's in the table. I'm  
6           saying: Did -- is that the length of reach that you  
7           used for your calculations of population sizing  
8           confidence?

9   A   That is the number we -- that was incorporated in  
10          there, yes.

11   Q   And so now when I looked at the earlier number for  
12          Reach 9, it said in the same document we were referring  
13          to it was 616 metres long. Now, you've told me that's  
14          not correct, that you didn't use that number. And  
15          instead, you've told me you used this number, which is  
16          2,130, which is over a hundred metres longer than the  
17          number you used in your population estimate; correct?

18   A   That's -- that's correct.

19   Q   How do you explain that?

20   A   I believe that -- that's an error.

21   Q   Okay. Moving along. If we went down each of these  
22          reaches that -- Reach 7, 8, we would find the same  
23          error, wouldn't we, sir?

24   A   That -- that would be -- that would be accurate.

25   Q   Okay. Let's go back to your response to the IR, if I  
26          can, Zoom Master.

1           And here is -- here is what flagged this whole  
2           issue for me. The reaches as they're defined,  
3           notwithstanding our previous discussion here that you  
4           changed the reaches, the reach is the reach; correct?

5   A    It's what we have defined it as.

6   Q    Right. So if we look at Reach 7 under "Angling", and  
7           we go over to "Reach Length", you've defined the reach  
8           length for the purpose of that analysis as 400 metres?

9   A    That -- that's -- that's correct.

10   Q   And under "Electrofishing", you've defined the same  
11           reach as 2,474 metres, notwithstanding the -- the --  
12           the built-in errors around what the actual length is,  
13           how can you have the same reach, one -- one -- in one  
14           case measuring 400 metres and in the other case  
15           measuring 2,474 metres. It's the same reach. Explain  
16           that to me.

17   A    Sir, they get added up. Those numbers get added up.

18           So --

19   Q    Get added up from where?

20   A    Just one second, please.

21           So in this case, Mr. Sawyer, the -- the reach  
22           length is proportionate to the angling, so you would  
23           add up the two numbers for the reach, electrofishing  
24           and angling.

25   Q    So you're saying that the -- the reach length on 7  
26           should be presented as 2,874?

1 A Well, you -- you break it out based on the method of  
2 sampling that you did in the reach. So if you combine  
3 the two together because -- and that's what we've tried  
4 to do, is because of the type of sampling that was  
5 done, each reach length is proportionate to -- to the  
6 actual amount of effort that you put in based on the  
7 method that you used.

8 Q And what was the reach length of 7 that you presented  
9 in Table 4.1? What's --

10 A It was -- we documented it as 3,183.

11 Q So, again, you know, we're looking at a -- over a  
12 400-metre error in -- in what your -- the length of  
13 your reach is?

14 A I don't know if it's 400. I think it's less than that,  
15 Mr. Sawyer.

16 Q Approximately 400?

17 A Well, it's less than 400.

18 Q But it's more than 350?

19 A Well, it's -- it's in that range, then.

20 Q Okay. Would you agree, Mr. Bettles, given the errors  
21 that we've seen in your calculations here and in the  
22 errors we've seen -- or maybe more accurately, the  
23 changes that you've used in defining the length of your  
24 reach, if we embed all those errors in the  
25 calculations -- and remember, the lengths are --  
26 there's two variables here. One is the length that you

1 surveyed -- no, there's three variables: the length  
2 that you surveyed, how many fish you caught, and  
3 then -- and then based on that, how many did you  
4 estimate were in that reach you survey, and then you  
5 extrapolate to the entire reach.

6           Would you agree with me that the embedded errors  
7 in your calculations have resulted in you overstating  
8 the number of fish and, in this case, in -- in that  
9 survey you concluded there were 613 fish in Blairmore  
10 Creek, plus or minus, plus or minus 1,128, so that's a  
11 really wide range of error.

12           If you redid these calculations and eliminated the  
13 error in terms of reach length, would you agree with me  
14 that these numbers significantly overstate the number  
15 of fish that you would have estimated if you'd done it  
16 correctly?

17 A Mr. Sawyer, I -- I can't speak whether or not the  
18 number would be up or down at this point. What I can  
19 say is that each -- each -- each reach that we  
20 analyze -- or we -- we do a population estimate for  
21 each reach, and each reach is treated as its own  
22 independent experiment. And so based on that, we  
23 standardized to try and combine together.

24           So if you -- if you -- if you adjust the reach  
25 lengths, accordingly again, and given the number of  
26 high abundance of fish that are in the upper reaches of

1 the system, it might bring the numbers down, but I  
2 can't say right now at this point what that would do to  
3 the actual numbers.

4 Q Okay. So if we -- if we look at a Reach 7, for  
5 example, were there high abundance of fish in Reach 7?

6 A There's -- yeah. I mean, all -- the upper reaches have  
7 reasonable numbers of fish. That's why we included  
8 them.

9 Q Okay. And with respect to the Reach 9, sir, where did  
10 that -- bear with me one second. I'm going to actually  
11 do the exact calculation.

12 You said the reach -- your Reach 9 was 32 what?  
13 3,274?

14 A No, no. 31 -- Reach 7 was 3,183 based on Table 4.1.

15 Q Okay. And --

16 A Mr. Sawyer, if I can -- I can just clarify. If the  
17 reach numbers used are low, then the population  
18 estimate is an underestimate. So in -- in our opinion,  
19 at this point, just from a -- at a high level, we --  
20 we -- we believe that our actual numbers could be --  
21 could be an underestimate. We'd have to double-check  
22 the numbers, but just -- just doing some rough -- rough  
23 number crunching, it's an under -- it likely could be  
24 an underestimate.

25 Q Well, okay. So you're telling me that Reach 9 was --  
26 sorry. You said 31?

1 A No. Reach 9 was 21 -- 2,130 in Table 4.1.

2 Q 2,130. Okay. Bear with me one second, sir. 2,130.

3 Okay. So you've got an error reporting your  
4 reaches relative to what Table 4.1 had them listed, and  
5 your -- your -- your numbers -- or your estimated  
6 numbers on fish which on Reach 9 were -- you estimated  
7 there were 203 fish in 368 metres of stream that you  
8 tested; correct?

9 A Our -- our -- sorry. Repeat the question, please.  
10 Wait. We have -- what we've -- sorry. We've estimated  
11 based on the mark recapture 203 fish in Reach 9, based  
12 on a survey length of 368 fish. Or, sorry, 368 metres.  
13 Apologies.

14 Q Okay. And then once you had that estimate, all you did  
15 was multiply that number by the length of the reach,  
16 correct, to come up with your total estimate?

17 A Sorry. Just double -- I'm just doing the math here. I  
18 think that's -- I think that's reasonable.

19 Q Okay. And so if you multiplied by a reach length that  
20 was longer than what you purport to use in this  
21 calculation, you actually would end up making the  
22 number of fish you caught higher, wouldn't you? The  
23 estimate would be higher, not lower, but higher?

24 A Well, that's what I said. I think I just mentioned  
25 that previously, that our numbers would likely be  
26 underestimates, then, based on going with lower reach



1 lengths.

2 So what we did is we -- we converted the total  
3 number of fish to a density -- density estimate fish  
4 per 100 square metres, and that's the number that we  
5 applied.

6 But it's important to point out that I know the  
7 number -- even if there's an adjustment here, the  
8 number's -- if the number is underestimated or  
9 overestimated, it's going to fall within the same  
10 confidence intervals that we've identified here too. I  
11 mean, those confidence intervals may shift slightly if  
12 you were to update the reach lengths. But ultimately,  
13 I mean, the numbers still fall within that -- the range  
14 that we've identified.

15 Q Two things, and then I'm going to -- first of all, you  
16 did calculate the density of fish per 100 square  
17 metres, but you did not use that -- I'm going to  
18 correct you, sir. You did not use that number, which  
19 in this case was 13.13, in the calculation of your  
20 estimate of westslope trout in Reach 9 which -- which  
21 you've already told us was a multiplication of how many  
22 fish you found times -- divided by the length of the  
23 reach. How did you use the density calculation in  
24 coming up with that number?

25 A We converted the fish to 100 -- the number of fish per  
26 100 square metres and then scaled to the area of the

1 entire reach.

2 Q Well, no, no, you didn't, sir, because if we --

3 A That's --

4 Q If we --

5 A That's --

6 Q -- if we look at 1,060.2, if we -- if we divide that by  
7 the 3 -- well, if we divide the reach length by 368,  
8 which is 1,009.22 that you put in this table, it comes  
9 up with 5.22826, and then if we multiply the number of  
10 fish you found by that value, we get 1,068.2. So  
11 explain -- and that -- that calculation I just did did  
12 not include your density figure.

13 How does your density figure figure into that?

14 A Just one second, please.

15 Q It doesn't, does it?

16 A No, I asked just to give me a second, please. Thank  
17 you.

18 So, Mr. Sawyer, we converted fish to -- to density  
19 at 100 -- or per 100 square metres. We then scaled the  
20 area of -- of the entire reach, which is the same  
21 scaling factor of length to area. And both surveys add  
22 in total reach. If you see in the -- if you can see in  
23 the actual table, we've got a density scale factor and  
24 a reach scale factor that's been taken into account.

25 Q Okay. What width of wetted channel did you use in your  
26 calculation for density?

1 A The -- just one sec. Let me just double-check.

2 Mr. Sawyer, I believe we actually used the -- the  
3 widths from -- from the Table 4.1.

4 Q And bear with me, sir. What was the width you used for  
5 Reach 9?

6 A Yeah. We used the -- it's 4.2 metres av -- it's an  
7 average wetted width for the reach.

8 Q Okay. So -- and when you say "weighted", what do  
9 you --

10 A No, I said --

11 Q -- mean by --

12 A I said "average wetted width".

13 Q Oh, wetted. My apologies, sir.

14 So just one last question. If we look at the --  
15 at the numbers you presented in the undertaking  
16 response -- and, again, we're just talking about -- no,  
17 sorry. I apologize. I have two questions.

18 If we're just talking about Reach 9, your estimate  
19 of -- of trout was 1,060.2; correct?

20 A There's no .2 of -- no .2 of a fish, but that's just  
21 the calculation we wanted to take forward, so around --

22 Q And --

23 A -- 1,060 , yes.

24 Q And -- and when you did your confidence interval, it's  
25 plus or minus 1,084; correct?

26 A That's the confidence interval that's been -- been

1 given, yes.

2 Q Okay. And if we apply that confidence interval to  
3 the -- your estimate, in our worst case, you would have  
4 minus 23 fish; correct?

5 A Yes. Yes. And -- and in some cases that I've seen in  
6 literature and others, sometimes in some cases you can  
7 get negative. And it -- it -- it's a -- it's a  
8 calculation. It's -- it's -- it's -- sometimes it  
9 happens, and we recognize that that number -- the lower  
10 bounds, negative would equal zero.

11 Q Right. So is it not true that the purpose of doing the  
12 statistical test and to create a confidence interval is  
13 to allow people reviewing your data to understand how  
14 robust your analysis is and whether they can trust it?  
15 That's the purpose of a confidence interval; correct?

16 A I would agree, Mr. Sawyer, but what I'm -- I -- a  
17 couple points of clarification here. I mean,  
18 there's -- there's a lot of studies that have been done  
19 out there as -- as the COSEWIC 2016 report has -- has  
20 illustrated that -- that confidence limits have not  
21 been -- been provided or been calculated.

22 What we've done here is we've tried to calculate  
23 confidence limits across the reaches where we actually  
24 did our surveys where -- others that we've seen in this  
25 system that we know of that relied on one, maybe two  
26 sites very broad -- broader confidence limits that

1 we've provided. So this is an estimate. It's not --  
2 you know, we're not saying this is an absolute value or  
3 absolute figure that we -- we feel. That's why you  
4 put -- as you said, that's how you put the bounds  
5 around this, to -- to give the confidence about what  
6 we're seeing.

7 But, again, a lot of this is based on the  
8 recapture -- recaptures that you -- you -- you get from  
9 the mark-recapture study. And -- and that's one of  
10 the -- one of the challenges that you'd have with doing  
11 this sort of thing.

12 So I would argue, yeah, I mean, the number is  
13 what -- what the number is, and -- but that's  
14 inherently been captured, and we've tried to  
15 extrapolate and standardize the data across the system  
16 where the highest abundance of fish was seen to give us  
17 more confidence, which others have relied on much lower  
18 amounts of data.

19 Q Okay. Just one last question. I promise,  
20 Mr. Chairman, and -- and Benga.

21 If you turn back to Table 4.2, this is the --  
22 your -- your data for fish density determined through  
23 mark and recapture. On Reach 9, you initially capture  
24 23 fish; is that correct?

25 A I can't see the -- it's the wrong -- wrong document up  
26 at the moment.

- 1 Q This is your Undertaking 99?
- 2 A No, I know. I'm just -- it's -- I'm waiting for the --  
3 the Zoom host to pull up the -- the Table 4.2.
- 4 Or are you talking 4.2 in -- in the undertaking;  
5 correct?
- 6 Q I'm talking 4.9 in the undertaking. Oh, yes. The  
7 undertaking response, Table 4.9. There we go. So if  
8 we look at Reach 9 --
- 9 A M-hm.
- 10 Q -- you only did electrofishing, and on your first pass  
11 you captured 23 fish; correct?
- 12 MR. SAWYER: No, go -- go -- go down. Go  
13 down. Down. Right there. Stay right there, Zoom  
14 Host. Thank you.
- 15 Q MR. SAWYER: Correct?
- 16 A MR. BETTLES: Sorry. In your -- which --  
17 which column are you referring to again?
- 18 Q I'm talking about the row under Reach 9.
- 19 A Reach 9, correct. Yeah. So you're looking -- which  
20 number are you referring to now?
- 21 Q Well, 'M' -- 'M' would be the number of fish you  
22 caught --
- 23 A Yeah --
- 24 Q -- on --
- 25 A -- that's right.
- 26 Q And you marked those fish; right?

1 A That's correct.

2 Q And 'T' would be the number of fish you caught on your  
3 second pass?

4 A Total fish captured on the second pass; correct.

5 Q And 'R' would be how many of those fish on the second  
6 pass had been marked fish?

7 A And -- and that's one fish, and that goes to my point  
8 earlier that I had mentioned that it's -- a lot of this  
9 is driven by -- by the number of recaptures that you  
10 get and -- which is why we applied the -- the Chapman  
11 estimator, because of the low number of captures that  
12 we did encounter during the mark-recapture study.

13 Q Okay. I just want to point out, sir, that you didn't  
14 actually apply the Chapman estimator. We asked you to  
15 do it. Is that not correct? There's nothing in your  
16 document that showed what the confidence levels on your  
17 numbers were.

18 A You're talking about our technical data report?

19 Q I'm talking about any of your reports. Did you -- you  
20 never did present any confidence intervals. We had to  
21 ask for them. So I just -- I just say it's highly  
22 inappropriate for you to take credit for it now.

23 A I'm not taking credit for it now. We -- we -- we did  
24 what was asked, and we have -- we've provided that.  
25 And as I said earlier, Mr. Sawyer, there's a lot of  
26 studies that have been done out there don't apply

1 confidence intervals at all. So -- and that's been  
2 very -- made very clear in the COSEWIC 2016 report --

3 Q Sure.

4 A -- sharing that.

5 So I think, you know -- it's -- I think it's -- I  
6 think it's inappropriate -- and -- and -- to -- to --  
7 to -- to point out that, you know, we -- just because  
8 we didn't do it that -- that that's entirely  
9 inappropriate. I -- I agree that confidence intervals  
10 are -- are -- are -- are important information, and,  
11 yes, we did not include it in our report, but we've --  
12 we've -- we've provided it here. And what we're seeing  
13 with the estimates that we've come up with in our  
14 surveys actually somewhat align with some of the other  
15 numbers that are out there if you consider the  
16 confidence limits that have been provided.

17 Q So last question, sir. On the surveys you did on  
18 Reach 7 and Reach 8 and Reach 9 on Gold Creek, between  
19 your initial capture and your subsequent effort at  
20 recapturing, how much time passed?

21 A We -- we conducted the same -- same effort that we did  
22 through the original from the first pass -- from the  
23 first round of -- of -- of marking the fish.

24 Q Maybe you misunderstood my question, Mr. Bettles.

25 How many days, weeks, or months was there in  
26 between when the two --



1 A Oh --

2 Q -- surveys were done?

3 A Sorry.

4 MR. IGNASIAK: Mr. Chair, we are getting  
5 beyond the scope of this undertaking response here.

6 THE CHAIR: Yeah. We are, Mr. Sawyer. I  
7 think I've heard "last question" several times.

8 MR. SAWYER: Yeah. Mr. Chairman, I do  
9 apologize for that. I would say this is my last  
10 question, and I don't think it -- not -- with respect  
11 to Mr. Ignasiak's raising objection, the data that's  
12 presented here in terms of the 'M', 'T', and 'R'  
13 values -- this is the first time this data's been  
14 presented, and it's in their -- in their -- in their  
15 response -- well, regardless, it's in their response,  
16 and I promise you, Mr. Chairman, this will be my last  
17 question.

18 A MR. BETTLES: Can I -- can I finish  
19 answering the -- the last question? So just one point  
20 you make here, Mr. Sawyer, that that Table 4.9 that  
21 comes directly out of our -- our technical data  
22 report -- so there -- this has been presented  
23 originally. So that's -- that's the first point.

24 Second point is that the -- the recapture aspect  
25 of the mark recapture was done between three to four  
26 days post marking.

1 MR. SAWYER: Okay. Mr. Chairman, those are  
2 all my questions. Thank you.

3 THE CHAIR: Okay. Thank you, Mr. Sawyer.  
4 Okay. Mr. O'Gorman, we'll turn back to you.  
5 Alberta Energy Regulator Staff and Panel Questions  
6 Benga Mining Limited

7 MR. O'GORMAN: Thank you, Mr. Chair.

8 I'm going to start by asking, Ms. Porco, do you  
9 notice a difference in my volume now?

10 Yes? I did discover that I thought I had  
11 corrected -- maximized the input volume on my mic. I  
12 had done that, and my computer adjusted it on my behalf  
13 to make me quieter than I thought I was, so my  
14 apologies to people that had a challenge with hearing  
15 me earlier. Technology.

16 Okay. So thank you, Mr. Chair, for throwing it  
17 back to me. Let's move on to talking about selenium,  
18 which we've heard a little bit about this week.

19 So, Zoom Host, if we could please start by hauling  
20 up Document 42, Appendix 10, and going to PDF 233.

21 Great. Thank you. That's good. That's what I  
22 wanted to see. I think it's on this -- right.

23 Q MR. O'GORMAN: Okay. So I'm going to start  
24 this series of questions by first acknowledging,  
25 Mr. Houston, you -- you know, we've talked about this  
26 earlier, but recognizing you have a message for us to

1 think about the SB -- the saturated backfill zones as  
2 producing a final effluent of 15 micrograms per litre.  
3 We did -- I think you would agree most of the  
4 information that we have -- most, if not all, of the  
5 information about this issue on the record did approach  
6 it from a 99 percent treatment efficiency perspective.  
7 You agree with that?

8 A MR. HOUSTON: We -- we -- Mr. Jensen can  
9 speak to this more fully, but we -- we have two limits  
10 in the model. One is the 99 percent, and the other is  
11 the 15 micrograms per litre. One -- once the -- the --  
12 in -- input selenium concentration raises above a  
13 certain amount, the 15 micrograms per litre becomes the  
14 dominant limit in the model, but --

15 Q Okay.

16 A -- that -- I'll let you ask your further questions.

17 Q Sure. And, yeah, you don't need to elaborate on that,  
18 Mr. Jensen; it was really just a warm-up. I was mostly  
19 acknowledging -- we have two numbers to think about  
20 now, the 99 and the 15 milligrams [sic] per litre.

21 Okay. So on -- in this document, which was  
22 submitted back with your original EIS -- I think you'd  
23 agree that you did say that if the selenium  
24 concentration in the saturated backfill zone in your  
25 modelling that was done was higher than 1.5 milligrams  
26 per litre, prior to applying attenuation, the effluent

1 concentration was limited to a maximum concentration of  
2 .015 milligrams per litre?

3 A MR. JENSEN: Yeah, that's correct.

4 Q You agree that it says that?

5 And that -- so that was the modelling approach you  
6 took. To clarify, you had a water-balance model; some  
7 water flowed into the system to be treated, and if the  
8 model had a flux of water that actually exceeded  
9 1.5 milligrams per litre, you introduced a cap to say,  
10 We're going to -- we're going to treat it as the  
11 outflow as a maximum of 15 micrograms per litre; right?

12 A Yes, that's correct.

13 Q I'm actually going to introduce one other thing I meant  
14 to say up front. I'm worried about getting us all  
15 confused and the record confused if we keep switching  
16 back and forth between milligrams and micrograms, so  
17 for the sake of this conversation -- and I'm going to  
18 beg your indulgence -- and let's try and maybe all  
19 speak in micrograms per litre. I think it might be  
20 easier. There's less decimal points involved.

21 Is that okay, Mr. Houston?

22 A MR. JENSEN: Okay. Okay. Yes, sorry.

23 Q No, it 's good, Mr. Jensen. Thank you.

24 Okay. So you did introduce that cap.

25 MR. O'GORMAN: Now, I want to jump, please,  
26 Zoom Host, to page 252 of this document.

1 Q MR. O'GORMAN: So starting on this page, I'm  
2 not going to look at specific quotes on here, but I  
3 wanted to show you, we're talking about the source  
4 terms and leaching of selenium.

5 Starting in this section, Benga, you did describe  
6 how the leach rates and the loadings were developed for  
7 key parameters, including selenium. And I guess that  
8 we're wondering if you can give us an overview of how  
9 you obtained this source term of 1,500 micrograms per  
10 litre as the number you're going to assume as your --  
11 your influent -- sorry, your inflow concentration, and  
12 I'm looking for a high-level description here, please,  
13 but something that gives us a bit of clarity on where  
14 that number comes from?

15 A MR. JENSEN: Sorry. Mr. O'Gorman, I'm not  
16 sure I follow your logic in your question. I don't  
17 believe we stated that it will be 1,500 micrograms per  
18 litre specifically. I mean, that may be an outcome at  
19 times. But are you making the inference that the 15  
20 micrograms per litre is -- is important because it's  
21 1 percent of --

22 Q Okay. Yes, I'm working backwards from -- if you were  
23 introducing a modelling cap where the output is  
24 15 micrograms per litre and if you had -- so any  
25 inflows even higher --

26 A Yeah.

1 Q -- then, you know, you work your way backwards,  
2 obviously, and if -- essentially from a modelling  
3 perspective, equivalent to ignoring any input  
4 concentrations that exceeded 1,500 micrograms per  
5 litre, so --

6 A That's correct.

7 Q Right. So if you can give us some sense, and if -- if  
8 you don't want to focus even on specifically that 1,500  
9 number, but can you tell us fundamentally where that  
10 derivation comes from?

11 A Yes. Yeah. It's quite simple, really. It's -- so  
12 the -- you had directed our attention to Table 5-1. So  
13 the way -- and this is true both for sulphur and  
14 selenium, which is why they're listed together. We --  
15 when we think of geochemical source terms, we think of  
16 them either as a concentration-based or as a mass-based  
17 source. And when they're mass-based, Stephen and his  
18 team will estimate the release rates from a -- either a  
19 tonnage or a volume of waste rock on an annual basis.  
20 And so what we do is we estimate the volume of water  
21 that's -- that'll percolate through a given waste rock  
22 dump or waste rock storage area. We'll then take that  
23 dry load that you see listed in this table,  
24 milligrams-per-metres cubed per year, we'll divide that  
25 by the flow, so -- which is units of, say -- yeah, say  
26 it's metres cubed per year, and that will give us a

1 unit of milligrams-per-metre cubed or, you know, you  
2 can do the appropriate conversions.

3 But essentially what we do is we take that dry  
4 load and we apply it into the water that percolates  
5 or -- or that's intercepted by that footprint. I hope  
6 that made sense. It's a very simple calculation. It's  
7 very straightforward. The -- the total runoff --

8 Q Okay.

9 A -- or total volume of water receives that load, and  
10 it's a simple division.

11 Q So in doing that work, did you produce in, say,  
12 Tab Number 4, perhaps project it -- concentrations of  
13 selenium coming off the waste rock dumps that would be  
14 flowing into the saturated backfill zone?

15 A You know what? Honestly do not recall. I have to look  
16 in the appendix, then, for that information. I wonder  
17 if you'll give me a minute to look that up.

18 Q Sure.

19 A Okay. I apologize, Mr. O'Gorman. We're scrambling a  
20 little bit here.

21 So if you go to page 268 of -- of the same  
22 document, Zoom Host, if you please.

23 So this isn't exactly the answer. These are some  
24 of the sources. So you will see what the estimated  
25 concentrations are in the surge ponds that we are  
26 pumping up to the saturated zone. So I recognize it's

1 not exactly the answer you're looking for, 'cause  
2 there's additional sources --

3 Q No.

4 A -- being attributed from -- from in-pit dumps that we  
5 are not --

6 Q No, I hear you, Mr. Jensen. That's actually a very  
7 nice figure to illustrate some of this conversation.  
8 So why don't we leave that -- why don't we leave that  
9 up.

10 A Okay.

11 Q And to be clear, this figure, this were -- these would  
12 have been your average predicted selenium  
13 concentrations in the surge ponds; right?

14 A Yes, sir, that's correct.

15 Q Not any maximum or a higher level estimate? Higher end  
16 estimate?

17 A Yeah.

18 Q Okay.

19 A These are -- these are -- these are based on our best  
20 estimate geochemical source terms, that's correct.

21 Q Okay. I'll ask you if you can explain to me -- and I  
22 will start with you, Mr. Jensen. Can you tell us about  
23 what uncertainties exist in the source term derivations  
24 that still need to be resolved through monitoring of  
25 seepage water from the waste rock piles?

26 A I would pass that question off, if you don't mind,



1 to -- to Mr. Day, my colleague.

2 Q Sure. That'd be great.

3 A MR. DAY: Yeah. I'll -- I'll try and  
4 answer that. So it -- I mean, the underlying input  
5 into this for the selenium is the rate which were in  
6 those tables that you saw earlier. And so those are --  
7 those are scaled up from humidity cells using those  
8 scaling factors which we -- we talked about earlier.  
9 And I mean, that is -- that is the uncertainty.

10 I would say that the -- that that method -- the  
11 scale-up method is definitely -- definitely  
12 conservative, tending on the high side. So the  
13 monitoring will ultimately tell you what the rate is.  
14 I -- I would say that I'm pretty -- pretty confident  
15 the actual monitoring will show that the rates are  
16 lower than the -- than are used in the model, but  
17 that -- that will be the -- that will need to be  
18 determined in monitoring.

19 Q Okay. And what sort of tests might you need to do to  
20 resolve some of those uncertainties?

21 A Well, the very best way to do it is to make sure you --  
22 that we have good monitoring at the -- at the -- the  
23 points where water is coming into those ponds  
24 through -- through water chemistry monitoring and  
25 good -- good flow monitoring. That's -- that's what  
26 we've learned elsewhere, is just that the -- the best

1           indication is the -- is site, and to do that early, and  
2           make sure that monitoring is set up early on as the --  
3           the first rock is going out.

4    Q    Okay. That's good, Mr. Day. Thanks.

5           Okay. So this table -- figure is -- I will pull  
6           back for one second just to make sure that -- this  
7           might even be for you, Mr. Houston, and then I will  
8           come back to you, Mr. Jensen, and -- Mr. Jensen, at  
9           least.

10           I did want you to confirm that you understand the  
11           exercise that this Panel has been asked to undertake  
12           and necessitates that we do take a conservative --  
13           examine a conservative case; right? We -- when a  
14           proponent submits information in an EIS for this sort  
15           of review, we do want you not to give us your best  
16           guess but to err on the side of -- well, we do want  
17           your best guess, yes, but we want you to ensure you  
18           flesh out looking at the downsides and you give us the  
19           conservative estimate; right? On key -- on key issues  
20           of concern?

21   A    MR. HOUSTON:                    Yes, we understand that,  
22           Mr. O'Gorman.

23   Q    Okay. Thank you, Mr. Houston.

24           Now, recognizing, Mr. Jensen -- I'll go back to  
25           you -- you didn't -- you didn't, potentially at least,  
26           start in your modelling by thinking about the inflow.

1       You, instead, thought about the final result, the  
2       15 micrograms per litre and the 99 percent treatment  
3       efficiency to get you there. We see what some of your  
4       sample inflow -- inflow concentrations to the SBZs  
5       would be on this graph. These are averages, of course.

6               If the inflow concentration to one of the SBZs was  
7       greater than 1,500 micrograms per litre -- so the top  
8       of this scale is 1,200 -- how reasonable would it be to  
9       expect that even greater than 99 percent attenuation in  
10      the SBZ could be achieved to get down to the  
11      15-microgram-per-litre target?

12   A   MR. JENSEN:                I -- I think it would be quite  
13       reasonable. I mean, like I said, it -- the upper end  
14       of -- of the concentration range, when it comes to  
15       these types of removal mechanisms, it's -- it's much  
16       less relevant than the lower end. And the same goes  
17       for -- I believe I described this the other day. When  
18       it comes to things like precipitation mechanisms,  
19       it's -- let's take an example of , like, copper. If  
20       you start out with 200 micrograms of copper and -- and  
21       you -- you want to treat that, it doesn't really matter  
22       if it's 200 or 300 or 100, it -- you end up coming up  
23       against the same solubility limit.

24               So to be clear, this is -- these are distinctly  
25       different processes, but the analog is there to  
26       illustrate that, you know, the -- whether it's, say, a

1 thousand or 1,200 or 1,500, the influent concentration,  
2 it really is the same situation. You're in the same  
3 range. Where it gets interesting and where it gets  
4 tricky is when you get down to the ppb -- the low ppb  
5 level.

6 So I'm -- I wouldn't be terribly concerned about  
7 us being off, you know, some percentage in -- either up  
8 or down in the influent, but I would be concerned if --  
9 if suddenly we're in a situation where we have to --  
10 say I have to meet 5 ppb; then I would probably suggest  
11 that we put in -- you know, not to say that we can't,  
12 but to be sure we can, I probably would suggest maybe  
13 thinking about at least additional mitigation-type --  
14 you know -- or at least, you know, some backup options.  
15 15, I'm quite comfortable with.

16 Q And that --

17 A I hope I've answered your question.

18 Q It gets at answering my question.

19 I mean, your assertion that -- I don't want to --  
20 you know, so you're essentially saying if the inflow  
21 concentrations are high enough, that, you know, you're  
22 talking about an entirely different -- it doesn't even  
23 really matter. I suppose at some ridiculous level  
24 you're saying it mattered, but you're saying there's  
25 not a lot of difference, from your perspective, between  
26 an inflow concentration of 1,500 versus 2,000 or

1 something like that. Is that what you're saying?

2 A Yes, that is -- that is what I'm saying.

3 Q Okay. Do you have any -- I don't think I've seen  
4 anything on the record to suggest that or that explains  
5 that to us. Do you -- do you want to point me to that?  
6 Or ...

7 A Well, I mean, we have -- so there's a couple of  
8 examples, I guess, we have listed on the record that I  
9 can point to, Mr. O'Gorman. One is -- and, you know,  
10 we quickly will get into a discussion on the  
11 applicability. I -- I don't know if we need to pull  
12 them up or if I can -- if I can speak more generally to  
13 them.

14 Q Let's not.

15 A Okay.

16 Q Let's not.

17 A Thanks. I appreciate that.

18 One is we -- you know, through the course of our  
19 conversations here this week, we've looked at the  
20 presentation that was given by Teck this year, last  
21 year that -- that's on the record. I think they were  
22 in the 200 ppb range, just from memory. And they --

23 Q M-hm.

24 A -- they go down to about 10.

25 There's another example that we provided, which  
26 is -- it dates back quite some time to the 19 -- 1999,

1           actually. This is for a similar treatment that was  
2           applied to the Sweetwater pit in Wyoming. They sat at  
3           about 450 ppb in the pit, and, really, the  
4           interesting -- the primary purpose of that treatment  
5           process was to remove uranium and selenium both through  
6           this anaerobic attenuation, which, as a side note, some  
7           of the uranium questions that we -- that we discussed  
8           earlier and couldn't answer necessarily right then,  
9           it -- you know, these types of treatments are quite  
10          effective for removing uranium as well.

11                 But what they saw there is a relatively -- so they  
12          dozed, from memory, I think it's around 500 tonnes of  
13          carbon into that lake, and that's even without the  
14          benefit of having a backfill of media in there to help  
15          with absorption. Concentration went from 400 --  
16          450 ppb, roughly, down to 7. And I mean, I could -- I  
17          don't recall off the top of my head what other examples  
18          we have on the record, but those two I'm sure about.

19                 And I think that's just one illustration that this  
20          idea that there's a direct correlation between influent  
21          concentrations and effluent concentrations, it -- it's  
22          just not supported by the sort of basic thermodynamic  
23          premise of what we're looking at here. And in reality,  
24          that's precisely what we see. I mean, it's -- we're  
25          not -- so, you know, maybe I'll leave it at that.

26          Q       Sure. And, Mr. Jensen, just so you know, we're going

1 to come back and look at some of those examples just a  
2 little later this afternoon, including Sweetwater and  
3 others, so ...

4 A Okay.

5 Q So we'll have a chance to talk about them and their  
6 applicability.

7 A Perfect.

8 Q I want to look at this graph, though, because it,  
9 again, illustrates another point that I wanted to make.  
10 Your key result that you want to achieve is hitting  
11 15 micrograms per litre on the effluent from the SBZs.  
12 Here's -- this is an illustration of what some of the  
13 inflow concentrations to the SBZs might be. And  
14 recognize these are average cases, not sort of -- the  
15 sort of inflow we would want to see in a conservative  
16 assessment; right? We would want to see the -- the  
17 higher end of some upper percentile, I assume, for any  
18 given one of these model results. You agree with that  
19 for a conservative assessment?

20 A Well, I mean, I think it depends on -- on the degree of  
21 conservatism. I think --

22 Q Okay.

23 A I think that's a -- probably a longer discussion.

24 Q Okay. That's fine.

25 I'd like to work at it from the other direction,  
26 though, in terms of thinking about 99 percent.

1           So if we had -- I'm going to ask you to haul your  
2           calculator out, Mr. Jensen. I assume you have one on  
3           your phone.

4    A    Yes.

5    Q    We all do.

6           So if we had an inflow of 1,500 micrograms per  
7           litre, slightly higher than your highest case here for  
8           one of the ponds, the outcome after treatment was  
9           99 percent. That would -- that would be 1,500  
10          micrograms per litre; right?

11          I'm sorry. So 99 percent treatment on  
12          1,500 inflow would produce your desired outcome of 15;  
13          right?

14   A    That -- that's correct.

15   Q    Okay. What if your conservative upper case inflow was  
16          only 750 micrograms per litre? What would the final --  
17          what would the treatment percentage in the SBZ be in  
18          that case?

19   A    It would be 7.

20   Q    Now, if your -- if your input was 750 --

21   A    Oh, 750? It would be 7-and-a-half. Excuse me.

22   Q    If your -- if your input concentration was 750 and your  
23          final concentration was 15, what would be --

24   A    Oh.

25   Q    -- the percentage --

26   A    Oh, I see. I apologize.



1 Q -- by which 750 was reduced?

2 A That would be 98.

3 Q What if the conservative upper case inflow was 500?

4 What would the treatment percentage efficiency be?

5 A 97.

6 Q Two more to go.

7 A Okay.

8 Q If the -- if the inflow was, for the upper case  
9 conservative input, 375, what would the treatment  
10 percent efficiency need to be?

11 A 4.

12 Q 375 should take you to 96 percent, I think; right?

13 A Yeah. Yeah, that's -- oh, sorry.

14 Q Yeah, 4. I know what you mean.

15 A 4 -- yeah.

16 Q And the final numbers, if your conservative input case  
17 for inflow to the SBZs was 300 micrograms per litre,  
18 the SBZs' treatment efficiency would be?

19 A 95.

20 Q Right. Okay. Thank you, Mr. Jensen.

21 I'm going to move on from that, but I did think it  
22 was interesting when I thought about these numbers.

23 So I'll ask: Has Benga investigated or are you  
24 investigating the possibility of treating elevated  
25 levels of selenium in the contract -- in the contact  
26 water prior to injecting it into the saturated backfill

1 zones? Like, not completely removing it, but doing  
2 some sort of a treatment to decrease the concentrations  
3 so the saturated backfill zones might take it down even  
4 lower, for example?

5 A Well -- could I --

6 A MR. HOUSTON: Go ahead.

7 A MR. JENSEN: Okay. Your -- that's --  
8 that's an interesting question. Maybe before I answer  
9 that, I will mention that, as another level of  
10 conservatism, we treated the -- the whole backfill  
11 system as -- as a single entity, which in -- in some --  
12 in some respects is another level of conservatism  
13 because we had a different -- you know, at least at the  
14 end of the mine life we will have three distinct zones  
15 that are connected in series. So we didn't apply, say,  
16 99 in the first zone, then 99 percent in the second  
17 zone, and 99 percent in the third zone 'cause we -- we  
18 just had it all come through as one and then applied it  
19 at the end. So when we think about pretreatment, I  
20 mean, that would be -- that would be one consideration.

21 The -- the -- yeah. So, I mean, I -- I don't know  
22 to what extent it's appropriate to -- to discuss  
23 something that's not on the record. I'm a little bit  
24 hesitant to do that, but -- but I will say that it's --  
25 it's sort of a considerable interest of -- of mine  
26 personally to -- to look at what can be done at the

1 base of the -- of the waste rock dumps. 'Cause we  
2 know -- you know, we know from a lot of work that was  
3 done back in the '80s -- and I think I made reference  
4 to this before too that, you know, to the extent that  
5 you can produce reducing conditions at the base of a  
6 dump -- and I think that applies particularly to the --  
7 the south dump than central dump; there's more  
8 potential for it there -- to, effectively, make a -- a  
9 bit of a reactive barrier -- it doesn't have to be  
10 perfect, but it would have the effect of -- of reducing  
11 the load of selenium. But it -- it -- you know,  
12 it's -- you know, I -- I'm mentioning it here. It's  
13 not really part of the prior description as it stands  
14 on the record.

15 Q Okay. That's fine, Mr. Jensen. Thank you.

16 Okay. Sorry. Let's move to something slightly  
17 different.

18 Or, actually, I did want to clarify as well. It's  
19 sort of related. So you're not proposing a  
20 pretreatment of the water in these ponds before it goes  
21 into the SBZ; but at the end, when you take it out of  
22 the SBZ and it -- you -- you hope, is at 15 micrograms  
23 per litre or less, I just want to clarify, you're not  
24 doing anything else to the water at that point to take  
25 any more selenium out of it; correct?

26 A Yeah. I mean, as -- as it stands, that -- that --

1           that's correct. Well --

2    Q    Pending -- pending -- I recognize --

3    A    Yes.

4    Q    I'm sorry. I know you've --

5    A    You got it.

6    Q    -- talked about the potential -- right. So --

7    A    Right.

8    Q    But at this point there's no plans to do anything else  
9           to that effluent which would come out at 15 micrograms  
10          per litre in your -- in your assertions?

11   A    That's correct.

12   Q    Okay. Okay. This might have once been a longer  
13          question but is now a much shorter one because you sort  
14          of spoke to it yesterday, and I'm not even going to  
15          call it up. But you'll remember Dr. McKenna's  
16          presentation that he presented about a variety of ways  
17          to try and improve the selenium treatment --

18   A    M-hm. Yeah.

19   Q    -- in this operation.

20                I think it's fair to say, Mr. Houston, and  
21    Mr. Youl in particular, if I -- I'm working from  
22    memory; I didn't look this up in the transcript, but  
23    I -- I think you both alluded to those were some  
24    interesting ideas and you would think about them?

25   A    MR. HOUSTON:                    That's correct.

26   Q    Okay. I do want to point out something and hear your

1 response.

2 MR. O'GORMAN: So if we could haul up,  
3 please, Zoom Host, Registry Document 69, which is  
4 Addendum 5. This one was responses to IRs that came  
5 from staff before this Panel was appointed, as I  
6 recall. And we're going to look at PDF 94, please.  
7 Scan down.

8 So -- right.

9 Q MR. O'GORMAN: So this was an IR that was  
10 asked, IR93. It extends for the next couple of pages.  
11 I don't know if you remember it, but I'll summarize  
12 that it proposes to you the idea of extra source  
13 control measures to mitigate selenium leaching. You  
14 can probably skim what's on that page. We don't need  
15 to read it out loud.

16 MR. O'GORMAN: You can cut to the next page,  
17 please, Zoom Host. And -- good.

18 Q MR. O'GORMAN: So over a series of  
19 examples -- a series of subquestions, we -- staff did  
20 put to you, Here are some ideas -- or what have you  
21 thought about some ideas about potentially adding new  
22 source controls. I mean, is it -- if you can skim your  
23 responses there, do you think it's fair to characterize  
24 what you told us, is that you'd considered a lot of  
25 these, but they weren't really applicable to this site?  
26 And if you think that's unfair, I -- please, by all

1 means, correct my -- correct me.

2 A MR. JENSEN: I -- I -- I think what we  
3 specifically spoke to in this response is the -- the  
4 idea of constructing covers, low-permeability covers,  
5 over these waste areas. And we had done some -- you  
6 know, we had -- we had taken a close look at that, and,  
7 you know, the conclusions there.

8 Q Yeah.

9 A So I don't -- I don't think we really went any, like,  
10 much further, at least in -- in this response with  
11 respect to commenting on what else could be done.

12 Q Yeah. To be clear, I sort of went over the two pages  
13 of responses, not just what we're seeing on the screen.  
14 There are other bullets. You'll see the next one  
15 begins talking about potentially segregating waste  
16 rock.

17 A Yeah.

18 Q We asked in Part C any other source control measures  
19 that you might consider. And if you scan down into the  
20 next page, there was -- there you -- you see there was  
21 a mention of covers.

22 In a nutshell, I -- I guess I'm curious to know --  
23 a few years ago now when you responded to this -- you  
24 can -- sorry -- sort of give me a sense of were you  
25 more or less open to exploring some of the ideas for  
26 alternative selenium treatment?

1 A MR. HOUSTON: So if --

2 A MR. JENSEN: (INDISCERNIBLE - OVERLAPPING  
3 SPEAKERS) Mike Youl.

4 A MR. HOUSTON: Oh, yeah, no, I -- I -- I can  
5 talk to this a bit, and then I'd invite Mr. Jensen and  
6 Mr. Youl to -- to pop in.

7 Absolutely, we're -- we're looking at means to  
8 reduce the source of the selenium, the ex-pit dumps  
9 and -- and the water that percolates through them,  
10 et cetera. And a lot of the ideas that have been  
11 presented the other day, were -- are -- are things that  
12 we're either considering or will consider to -- to  
13 reduce the amount of contact water.

14 One of the biggest opportunities we see right  
15 now -- and Mr. Youl can talk to this -- is to reduce  
16 the amount of rock in the ex-pit dumps. And as  
17 Mr. Jensen mentioned, the amount of selenium that's  
18 generated is a direct consequence of the mass of rock  
19 in the ex-pit dump. So that's -- that's something  
20 we're looking at right now.

21 In terms of the pretreatment, that is something  
22 we've discussed. But, as Mr. Jensen mentioned, it's  
23 not part of our application because it's more of a  
24 notion right now , but we consider that there -- there  
25 are possibilities there that are -- are worth  
26 exploring. And we continue to look into gravel bed

1 reactors as, you know, potentially a pretreatment as  
2 well as a post-treatment, you know, depending on, you  
3 know, what is most efficient from a water management  
4 point of view.

5 So, Mr. Youl, I wonder if you can just talk a  
6 little bit about the capacity to manage the ex-pit dump  
7 storage.

8 A MR. YOUL: Sure. Happy to.

9 Just to elaborate, there are probably two main  
10 areas we focus on here. One is reducing the size of  
11 the outer pit dumps, so we're treating the problem at  
12 the source, and -- and through more sophisticated,  
13 judicious scheduling of -- of the mine and thinking  
14 about the faster we start up and ramp up to full  
15 production, the more quickly our initial pits advance.  
16 The quicker we can do that, the quicker we can start  
17 in-pit dumping.

18 So our -- my planning team is looking at all of  
19 that as we speak to accelerate that. It's a scheduling  
20 condition or issue. And making sure the trucks don't  
21 all get compressed into too small a space. But the  
22 intention is to create that in-pit dumping space  
23 earlier in the mine schedule and minimize the amount of  
24 outer pit dumps, particularly the -- the south dump,  
25 which -- which happens from Year 1.

26 The second aspect is our earlier conceptual



1 designs of those dumps essentially had a constant, on  
2 average 23-degree slope, and a flat top that nestled  
3 into the -- the north side of Bluff Mountain and  
4 constrained by ridges on -- on each side, which helped  
5 manage the drainage down towards the raw water pond.  
6 Our thinking has advanced beyond that now to look more  
7 closely at how we build a dump that sheds water much  
8 more quickly so we don't have spaces where water can  
9 pond or pool as the dump is being built.

10 So you can imagine, as we're raising this dump in  
11 layers, it's changing every day, and there will be  
12 areas where parts of the dump are hard in other parts  
13 of the dump, and there will be haulers, and any  
14 precipitation that falls could conceivably be caught in  
15 those hollows and start percolating down.

16 So it's much more attention to, as we build the  
17 dump, we're creating an active drainage network that  
18 sheds that water down the outside of the dump and into  
19 the toe drain.

20 And as part of all of that, our thinking is now  
21 progressing towards building a dump in much smaller  
22 lifts, as Dr. McKenna illustrated on his artistic sort  
23 of conceptual drawing, which was very good, very  
24 interesting. But as we reduce the size of the lift,  
25 we're getting much better compaction, which is limiting  
26 the infiltration of surface water in through the dump.

1 And so the intention is to shed it off the top, down  
2 the sides, into the toe drains as quickly as possible.

3 Q Okay. Thanks, Mr. Youl.

4 And, in fact, that sort of takes me -- well, I'll  
5 ask you to respond to something Dr. McKenna put into  
6 his submission, where he suggested that prior to  
7 construction, you should undertake a formal options  
8 analysis. I wonder if that particular suggestion of  
9 his is one that you agree with?

10 A I -- I do, and, in fact, with any engineering exercise.  
11 Now, whether it's building a structure or constructing  
12 a rock dump, you do a design-basis memorandum, so to  
13 speak. So you're laying out what you want to achieve  
14 at the completion of the structure and then the  
15 operational protocols of how you get there, managing  
16 risks, managing unforeseen events, and then -- so that  
17 will all become part of our operational sort of  
18 procedures in -- in how we build these through the  
19 course of the early years of the mine.

20 Q Okay. Thanks.

21 And some of what you've said actually leads me  
22 to -- I'm about at the end of this little set of  
23 questions. But, you know, we talked about the number  
24 of 99 percent capture. So let's talk a little bit  
25 about -- I'm sorry, 99 percent treatment. Let's talk a  
26 little bit about the number of 95 percent contact water

1 capture.

2 MR. O'GORMAN: So, Zoom Host, can you please  
3 haul up on Registry 42. Appendix 10, PDF 233. Right.  
4 And is -- so there's -- we had the number down a bit,  
5 down onto the bottom of the page. Okay. It's --  
6 right.

7 Q MR. O'GORMAN: So Mr. Fitch asked you about  
8 this, and I won't go into it in great depth, but I did  
9 want to, you know, reconfirm that the projected -- in  
10 all of the modelling for the results that have been  
11 presented to us, your base-case assumption was you were  
12 capturing for the south and north rock dump areas 95  
13 percent of the contact water, and at the second line  
14 from the bottom for the central rock disposal area, the  
15 one that has runoff reported into Gold Creek, you would  
16 be capturing 98 percent of the contact water. And I  
17 just want to confirm that that's -- that's what you  
18 told us?

19 A MR. JENSEN: Yeah. So, I mean, I wouldn't  
20 characterize it as much of an assumption as really an  
21 output of the model. So it's more of a -- I think of  
22 it more as a design basis or a design requirement.

23 Q Well, Mr. Jensen, I think it was an input to the model,  
24 right, as opposed to an output? I think you told the  
25 model, through iterative modelling, to achieve the end  
26 water quality. It might have -- I think it -- yes,

1           actually, it -- the sentence begins at the bottom of  
2           this page: (as read)

3           These capture efficiencies were selected  
4           through iterative ...

5           MR. O'GORMAN:                   Please scroll down, Zoom Host.  
6           Scroll down to the next page.

7   Q   MR. O'GORMAN:                   (as read)

8           ... iterative modelling efforts to meet ...  
9           Right, right. So -- right. You modelled back and  
10          forth, and you came up with -- those were the numbers  
11          you needed to -- to meet, so they were inputs; right?

12   A   MR. JENSEN:                    Yeah, well ...

13   Q   Depends on how you think of an input number?

14   A   It does. I mean, the exercise is correct, the way you  
15          characterized it.

16   Q   Okay. Thank you.

17          MR. O'GORMAN:                   So if we could look, please,  
18          at page PDF 274. That's it. So if we scroll down just  
19          a little. No, no, no, no, no. I want to see that  
20          figure. I just wanted to see the text at the bottom.  
21          Great.

22   Q   MR. O'GORMAN:                   So here were the results that  
23          you submitted showing some sensitivity runs in the  
24          final selenium -- well, in the output selenium  
25          concentration in Blairmore Creek for varying capture  
26          efficiencies of the ex-pit waste rock; right ?

1 A MR. JENSEN: That's correct.

2 Q Right. Where we see the green line at the bottom at a  
3 capture -- a scenario of capture efficiency  
4 100 percent?

5 A Yeah.

6 Q A hundred -- hundred -- okay. And then the red line in  
7 the middle, and the capture efficiency of 95 percent,  
8 and the blue line at the top, capture efficiency of  
9 80 percent; right?

10 A That's correct.

11 Q Okay. So would you agree that reducing your estimated  
12 capture efficiency in this scenario from 95 percent --  
13 I'm struggling -- oh, there -- the 95 percent to  
14 80 percent results in approximately doubling the  
15 predicted selenium concentration in Blairmore ground --

16 A Yes. Yes, that's what -- that's precisely what the  
17 graph's intended to show.

18 Q Okay. Good. Thank you for that.

19 MR. O'GORMAN: Let's jump ahead to PDF 424,  
20 please, Zoom Host. So on this page, if we -- okay. If  
21 we maybe scroll -- show the whole page, please, Zoom  
22 Host. You don't need to zoom in on this one, although  
23 that now becomes hard to read.

24 I mostly wanted to point this -- maybe you can  
25 zoom in a little bit, Zoom Host, while I read my  
26 question or point out that I wanted to show this to --

- 1 Q MR. O'GORMAN: In here you broadly describe  
2 capture methods to be implemented. It suggests that --
- 3 MR. O'GORMAN: No, go up to the top of the  
4 page, please, Zoom Host. Oh, maybe it is the bottom of  
5 the page.
- 6 Q MR. O'GORMAN: But in here, you talk about  
7 collection of seepage from the toe of the waste rock  
8 dump, use of collection ditches, and the use of seepage  
9 capture wells across deeper groundwater flow paths.  
10 Does that still sound like your -- your plan on how  
11 you're going to capture contact water?
- 12 MR. O'GORMAN: Yeah, I think we might be on  
13 the wrong page.
- 14 A MR. JENSEN: I think it's one up.
- 15 MR. O'GORMAN: That's 423. I asked for 424,  
16 please, Zoom Host.
- 17 A MR. JENSEN: Oh, one down. Sorry.
- 18 Q MR. O'GORMAN: Yeah. That one, exactly.
- 19 A MR. JENSEN: Yeah. Well, so --
- 20 Q Yeah.
- 21 A I mean, in some ways -- so -- so what we -- all we  
22 really attempted to say here is that we were -- we -- I  
23 think we'd always stated it probably here that it would  
24 be accomplished by doing these things. In fact, these  
25 are intended to serve as examples of -- of things  
26 that -- that can be done.

1           But really, this -- this document, we never really  
2           did intend to -- to address the specifics of exactly  
3           how. We did look at -- we had another -- one of our  
4           hydrogeologists at the time, we told him to take a look  
5           at -- you know, just calculate some rough well spacings  
6           that he might -- he thought might be appropriate, but  
7           we never really did look into any of the details. That  
8           was outside of the scope of this study. These are just  
9           general examples of -- of things that can be done.

10        Q    Okay. Let's jump, please, to a different document.  
11           Let's look at Registry 69, which is Addendum 5, and  
12           look at -- let's look at PDF 105, please.

13           So here we asked you a -- well, staff asked you --  
14           these are IR responses from a few years ago. You were  
15           asked about a similar question, capture efficiency,  
16           decrease from 95 to 80 percent, results in the twofold,  
17           increase in concentration.

18           You indicate in your response, and I think it's on  
19           this page, about another line of interception wells  
20           that could be installed downstream of the first set.  
21           Do we see that in there? It's right -- right -- yeah.  
22           Right where the -- the hand is pointing. If you could  
23           read that and verify if that's still your view?

24        A    Yeah. I mean -- so, again, I have to tread a little  
25           carefully here. I think this response was drafted in  
26           consultation with -- with the team, but I would say,

1 generally speaking, that's -- that would be true. As a  
2 nonhydrogeologist I would say that.

3 Q Okay. So I'm going to bring this to some questions. I  
4 just want to make sure you're not disagreeing, are you?  
5 You're agreeing that your modelling on the document we  
6 looked at a minute ago did use a 98 percent capture  
7 amount for the contact water from the central rock  
8 disposal area?

9 A Well, just to be precise about that. It's a 98 percent  
10 capture of loading. So that includes seepage, capture,  
11 and attenuation, but -- but --

12 Q Okay.

13 A -- generally speaking --

14 Q They do?

15 A -- you're correct.

16 Q Okay. Thank you.

17 So I would like -- I'm nearing the end. I would  
18 like, please, if we could look at a different document.  
19 Now we're going to look at Addendum 11, which is  
20 Registry 313, and look at a response you gave to a -- a  
21 Panel IR. We're going to look at PDF 332, please. And  
22 that's what we want to look at.

23 So this was -- Addendum 11 was submitted in  
24 March -- well, I'm not sure if it was March. In early  
25 2020; is that right?

26 A MR. HOUSTON: That's correct.



1 Q Thank you, sir.

2 So what we're seeing in the response you gave us  
3 this year, earlier, were for modelled selenium levels  
4 in Gold Creek at a variety of nodes on Gold Creek;  
5 right?

6 A MR. JENSEN: Excuse me. Yes, that's  
7 correct.

8 Q Okay. And I just wanted to ask your sense of -- if we  
9 would expect this was using, presumably, the 95 and  
10 98 percent capture rates for the different potential  
11 sources of capture that -- water that might escape into  
12 Gold Creek. And I wonder if you can give me your sense  
13 of -- if we also took the estimate of the capture rate  
14 from the proposed 95 or 98 down to, say, 80 percent,  
15 would we also expect to see those numbers approximately  
16 double for selenium in Gold Creek? Would that be --  
17 I'm drawing the analogy to the graph we looked at for  
18 your results on Blairmore Creek.

19 A Yeah, I think without running the numbers, that's --  
20 that's approximately right.

21 Q Yeah. Yes. And I know you haven't actually run that  
22 scenario. But we're sort of trying to draw the -- you  
23 know, if you think it's reasonable to sort of draw that  
24 inference; okay?

25 A Well, I mean, in -- in that sense it is. It is  
26 relatively linear. I mean, it's relatively -- so,

1           yeah, I think you -- I think your conceptual idea is  
2           correct.

3    Q    Okay. Thank you.

4                    Right. I've sort of put this to you, but just for  
5           completeness, have you -- are there any additional  
6           capture measures that you are exploring to determine if  
7           they're feasible?

8    A    I'll hand that off to Gary. Like I said, just -- just  
9           also to be clear, the purpose of -- of this  
10           modelling -- and I think I've said it a few times,  
11           so -- but it -- it really wasn't to demonstrate the  
12           effectiveness of, say, two -- two lines of interception  
13           wells. It really was to clearly define, you know, what  
14           the design basis needs to be to stay protective, so --  
15           but I'll hand it over to Gary -- to Mr. Houston, maybe,  
16           to comment on the design aspect.

17   A    MR. HOUSTON:                    So -- so, Mr. O'Gorman, what  
18           Mr. Jensen has just stated is correct. We -- we -- we  
19           consider that the -- the groundwater capture wells  
20           combined with a -- a good design of the -- of the  
21           ex-pit rock storage areas will get us where we're  
22           going, and -- and I -- I -- I don't want to sound --  
23           you know, I don't want to sound like I'm giving the --  
24           the team message here, but the -- the water -- the  
25           groundwater will move very slowly towards the -- the --  
26           the creeks and -- on -- on the order of years, to get

1 from -- into Gold Creek, for example, which is what  
2 we're looking at here.

3 So measuring the groundwater concentrations of  
4 selenium adjacent to the -- the ex-pit dumps will give  
5 us an early warning, and then I -- I think it's, you  
6 know, a matter of implementing solutions in a layered  
7 way, starting from most -- most cost-effective, like  
8 the groundwater capture wells, and -- and if needs be,  
9 going to more expensive methods to -- to achieve the  
10 objective that we set for ourselves.

11 Q Okay. I do have a series of questions to come back to  
12 later in my package about groundwater wells, but now is  
13 not the time for us to explore them.

14 So I think I'm good with this package of  
15 questions.

16 MR. O'GORMAN: And, Mr. Chair, looking at the  
17 time, it's, well, basically almost 3:00. This might be  
18 the good time for our afternoon break.

19 THE CHAIR: Okay. Thank you,  
20 Mr. O'Gorman.

21 It's, yeah, 3:00, so we'll break until 3:15.  
22 Thank you.

23 (ADJOURNMENT)

24 THE CHAIR: Okay. So just before we kind  
25 of get back into questions, thanks for everybody who  
26 sent emails to the secretariat staff about witness

1 availability and that. It doesn't appear that there's  
2 any showstoppers for not sitting tomorrow and  
3 commencing Monday, Tuesday. There is a Health Canada  
4 witness that's not available after the 25th who was  
5 going to participate in the air quality section, and I  
6 think Mr. Drummond copied the other participants on  
7 that, so I don't know if anybody had specific questions  
8 for that witness. My understanding is there will be  
9 other members of the Health Canada team on the Panel  
10 that could probably respond to most questions; but if  
11 anybody had any particular questions for that witness,  
12 we would probably need to know that in advance. Other  
13 than that, there doesn't seem to be any barriers, so  
14 unless something changes, I'm going to propose we don't  
15 sit tomorrow and we resume on Monday at 9 AM after we  
16 finish today.

17 MR. IGNASIAK: Mr. Chair, it's Martin  
18 Ignasiak.

19 THE CHAIR: Yeah.

20 MR. IGNASIAK: So that's fine with us,  
21 provided we -- we get through this panel today. We've  
22 got panel members here from -- from outside Calgary and  
23 so forth with travel requirements and, you know, with  
24 COVID restrictions -- so if we can get through this  
25 panel today -- we don't want them, though, to have to  
26 stick around till Monday is -- is our main concern.

1 And then we're fine with the rest of the water session  
2 beginning Monday; and then, over the course of the  
3 weekend, we'll take a look at what's remaining after  
4 the water session and -- and work with Mr. Drummond and  
5 others to make sure we can deal with the rest and --  
6 and with any witness limitations that come up for the  
7 other topics.

8 THE CHAIR: Okay. So that might create an  
9 issue that we -- we can't resolve, because my  
10 understanding is Mr. O'Gorman still has quite a bit to  
11 do. So it's not entirely clear to me we can finish  
12 this panel today, so we might need to sit tomorrow,  
13 then, to finish the panel if that's a limitation for  
14 the Benga witness panel.

15 MR. IGNASIAK: Yeah. I think if we have to  
16 sit for a couple hours tomorrow to finish this witness  
17 panel, we would -- we would prefer that even if we  
18 don't continue with the rest of the hearing until  
19 Monday.

20 THE CHAIR: Okay. Let's --

21 MR. IGNASIAK: Sorry. We're not trying to be  
22 difficult.

23 THE CHAIR: Yeah. I understand.

24 MR. IGNASIAK: We've just got people from --  
25 yeah.

26 THE CHAIR: Okay. So maybe we'll see

1           where we get to tonight, and then we'll see what's  
2           left, and, at a minimum, you know, we might need to sit  
3           tomorrow to finish off the Benga panel and then maybe  
4           not do any more than that tomorrow. So let's see where  
5           we end up today. And what we'll do is the Panel will  
6           take a quick break when Mr. O'Gorman finishes his  
7           questions. We'll see how much we have left before we  
8           all break for this evening.

9           MR. IGNASIAK:                    Yeah. And to the extent it  
10           might help, Mr. Chair, we're -- we're willing to also  
11           do part of this in writing if that's required. I leave  
12           that in our hands, but that's always another option.

13           THE CHAIR:                        Okay. Okay. Thank you.

14                    Okay. So go ahead, Mr. O'Gorman.

15           MR. O'GORMAN:                    Thank you, Mr. Chair. Am I  
16           on? Okay. Good.

17    Q   MR. O'GORMAN:                    Okay. Let's talk about the  
18           saturated backfill zones. Obviously this is a key  
19           measure you've proposed, and I don't think it's unfair  
20           of me to suggest that there have been questions raised  
21           by a number of participants through this process about  
22           the effectiveness at treating selenium. So we want to  
23           explore that a little bit, please.

24                    We're going to start -- and, Mr. Jensen, you  
25           almost got -- took us to it, but we want to start by --  
26           we have -- and I'll acknowledge some of these

1 questions -- and I'm going to try and maybe pick up my  
2 pace a bit. Some of the questions were constructed  
3 with the 99 percent treatment number in mind. I  
4 recognize you want to talk about the 15 milligrams per  
5 litre. In either case, there's a high level of  
6 treatment required from these saturated backfill zones,  
7 so if I don't adjust my language and I talk about  
8 99 percent, I'm sure you'll know what I mean and what  
9 I'm talking about.

10 So you did provide in Addendums 10 and 11 some  
11 case studies and engineering descriptions that we would  
12 like to examine this supporting evidence and also  
13 clarify some other aspects of this mitigation measure.

14 So let's go through some of them, please, and see  
15 what we can learn. We're going to start with  
16 Registry 42, Appendix 10, which is the geochemical  
17 reports. And we're going to go to PDF page 429, and it  
18 actually spreads over to page 430. So let's scan out.  
19 I'll assume the Benga panel can read this on their own  
20 screens.

21 So this was an example of some case studies that  
22 you submitted in your original EIA. You provided two  
23 examples of flooded pits that were used to treat mine  
24 water. One of these was the Sweetwater pit lake in  
25 Wyoming; the other was the Anchor Hill pit lake in  
26 South Dakota. These systems were shown to -- some of

1           this I'm going to put to you instead of asking you  
2           to -- to -- you know, you can -- ask you if you confirm  
3           it at the end.

4           I think these examples were shown to remove  
5           selenium at a high rate, potentially greater than  
6           95 percent. You did, however -- and the -- the words  
7           are on here. I'll ask you if you agree. It's  
8           actually -- if we scan down to page 430 and we see the  
9           line that begins with "Treatment of selenium in open  
10          water", if we can. Do we see that "Treatment of  
11          selenium in open water"? Supposed to be on page 430.

12       A   MR. HOUSTON:                    Third -- third line from the  
13          top.

14       Q   Right there. There it is. There it is. Right.

15           I'll let you read that: (as read)

16           Treatment of selenium in open water is more  
17          challenging.

18          I'll let you read the rest of the -- of the sentence.

19           And I guess I would ask you -- you say that  
20          treatment and flooded pits is significantly different  
21          from treatment using a saturated backfill zone.

22       A   MR. JENSEN:                    It's always difficult when you  
23          use qualifiers as "significant". But I would say that  
24          the basic process is the same. So the reduction  
25          process is the exact same. The -- the difference is  
26          really when it comes to mass transfer considerations



1 around absorption of partially reduced selenium. So,  
2 for example, selenite would still be present as a -- as  
3 a dissolved species in open water, whereas it would  
4 tend to absorb to minimum material in -- when you have  
5 backfill present. So there -- there's some -- some  
6 definite similarities, and then on -- on other levels  
7 they're not -- they're dissimilar.

8 Q Fair enough on you for my use of the word  
9 "significant", especially in an environmental  
10 assessment process. That's -- I should've -- I should  
11 have screened that out. Substantive differences.

12 Yes, I guess you're -- you are agreeing there are  
13 some substantive differences, although the process --

14 A That's right.

15 Q -- is fundamentally the same.

16 Could it be that you would see even better  
17 performance in a pit -- in a lake, given that the water  
18 would mix uniformly within the lake, whereas it may not  
19 in a saturated backfill zone?

20 A I mean, I wouldn't have any evidence to back -- back  
21 this up, but I would say that I would find that quite  
22 unlikely. It's -- mainly because of the mass -- the  
23 mass transfer consideration I just outlined.

24 But, I mean -- so, again, thermodynamically, I  
25 would say that you're -- you're up against similar  
26 limits when it comes to -- to just purely the reduction

1 part of the process. So it's -- I apologize. It's  
2 not -- it's not easy to quantify, but my expectation  
3 would be that -- that saturated backfills would perform  
4 better because of the mass transfer consideration.

5 Q How about the way that the carbon source was added  
6 between your plan of a -- slow and measured quantities  
7 of methanol being injected versus in these case  
8 studies? My understanding is the carbon was dumped in  
9 all at once. Would that make a difference in  
10 performance?

11 A Hmm. In terms of the ultimate performance, I wouldn't  
12 be able to say. What -- what I would say, though, is  
13 that one concern I would have with -- with sort of just  
14 an open body -- treatment of an open body of water is  
15 the potential for stratification and -- and, really,  
16 mixing. So I think by dosing gradually as water is --  
17 enters the system, it's much more akin to reactor  
18 control, if you will, where you -- you have much  
19 tighter control over the dose of your electron donor or  
20 carbon source that's added to each unit of water as it  
21 enters. So instead of having, say, if you will, a hot  
22 spot maybe in an area where your carbon source isn't  
23 mixed fully in -- into the lake, you'll -- at least in  
24 theory, you'll have a much more uniform distribution  
25 of -- of carbon when it's -- it's -- it's tightly  
26 controlled. So --

1 Q You think these differences, Mr. Jensen, we've talked  
2 about would make it a real challenge -- recognizing  
3 fundamentally the same process is in play, but it would  
4 make it a real challenge to predict the performance of  
5 one system by looking at the other?

6 A Well, I mean, yes. Well, in -- it -- keep in mind that  
7 these aren't -- the intention here really is more of  
8 circumstantial evidence. It's not so much to say,  
9 Look, this happened here; we expect the exact same  
10 performance over there. That -- that's precisely why  
11 time and time again we pointed to the need for -- for  
12 scaling up test work on-site and demonstrating  
13 site-specific performance. It -- it -- it's more of an  
14 indication that it -- that we're not -- you know, we're  
15 not completely out to lunch when we say that -- that  
16 the reduction down to these type of levels using this  
17 type of process that -- that that's within the realm of  
18 reality. That's -- that really is the context that  
19 we're -- that we are submitting these case studies.  
20 You know, too, it's -- it's circumstantial, to -- to be  
21 sure.

22 Q Okay. Thanks, Mr. Jensen.

23 So those were some old case studies you submitted.  
24 Now, let's jump forward to Addendum 10, when you were  
25 responding to Panel IRs. That's Registry Document 251,  
26 Package 5.

1 MR. O'GORMAN: And, Zoom Host, we're going to  
2 go to PDF 27.

3 Q MR. O'GORMAN: So while that's coming up --  
4 well, let's wait till we see it. It was the response  
5 to this information request from the Panel, 5.5. If we  
6 scan down to the bottom, essentially we ask you to give  
7 us more -- yeah, examples to support this treatment  
8 approach.

9 We did hear about some mechanical treatment  
10 measures. So if we could jump to PDF 40. PDF 40.  
11 Good.

12 On this page, if we scroll out, we see some  
13 fluidized bed reactor -- actually, they started to be  
14 described back on page 38. There was also Example E,  
15 which was the Wharf Resources' mine water treatment  
16 plant in Example F. A few pages earlier we heard about  
17 fluidized bed reactors. So -- which are operated at  
18 different mines. Just wanted to remind you we had seen  
19 those.

20 So I'm asking you, Mr. -- Mr. Jensen, I guess  
21 these are questions for you, but I'm happy to have  
22 others weigh in.

23 MR. O'GORMAN: And I hope I'm not speaking  
24 too fast, Ms. Court Reporter.

25 Q MR. O'GORMAN: But would you agree that these  
26 mechanical treatment systems are different enough from

1 SBZs that their performance is -- it's very challenging  
2 to predict the performance of one on the -- to the  
3 other?

4 A MR. JENSEN: You mean comparing --  
5 comparing a mechanical treatment system to a  
6 saturated --

7 Q M-hm.

8 A -- backfill system?

9 Q Yes.

10 A And -- and you mean -- by "performance", you mean the  
11 effluent concentration of selenium that you  
12 consistently can achieve?

13 Q The treatment, percentage, efficiency, effluent  
14 concentration, other various things we could come up  
15 with, but ...

16 A Yeah, I mean -- so I would say yes. I would --

17 Q Okay.

18 A -- I wouldn't want to draw a straight line from -- from  
19 one to the next.

20 Q Okay. That's fine.

21 Bioreactors. Something we heard about in this  
22 addendum. If you can look at PDF 37, please. Just a  
23 few pages back. Examples B and C from this -- if you  
24 scroll out -- maybe roll out a bit. We see some  
25 bioreactor examples. There's also one -- Example H on  
26 page 41. We don't need to bother jumping to it.

1           Bioreactors, my understanding, they contain an  
2           organic substrate, varying proportions of woodchips and  
3           hay, that sort of thing. In the bioreactor samples, do  
4           these organic constituents play a particularly  
5           important role in the selenium-removal process?

6    A    Oh -- oh, yes. I mean -- so the type of bioreactor I  
7           think we are referencing here is just like you said;  
8           it's typically you add some type of solid organic  
9           material. And that -- that's absolutely key. I  
10          mean -- so the purpose of that material is to produce  
11          that reducing environment that we need for a reduction  
12          of -- of primarily selenate and selenite. So, yes,  
13          its -- its --

14   Q    And --

15   A    -- organic material is key.

16   Q    Okay. And acknowledging that you do have introduced,  
17          you know, methanol into your SBZ -- but there's  
18          probably enough differences between the SBZ and the  
19          bioreactor-type examples that they're not -- at least  
20          not entirely comparable. Would you agree with that?

21   A    Oh, yes. I mean, I think -- I think there's probably  
22          greater similarities between active water treatment  
23          and -- and SBZs than -- than bioreactors and SBZs.

24                 Bioreactors --

25   Q    Okay.

26   A    -- you know, you -- you're lacking an element of

1 control in there that you -- that you include in the  
2 SBZ operation by -- by maintaining control over your  
3 carbon dosing. So, yeah, I would agree with that.

4 Q Okay. And I just want to -- okay. I'll move to the  
5 next.

6 If we look at page 36 and 37. You just need to  
7 scroll up one, actually. We see barrel and column  
8 studies that were suggested. You've described a couple  
9 of examples in this IR response of various barrel and  
10 column studies --

11 A M-hm.

12 Q -- Examples B and C in particular.

13 MR. O'GORMAN: I want to scan to the next  
14 page, Zoom Host, as well.

15 Q MR. O'GORMAN: Would you agree, Mr. Jensen,  
16 that these systems don't have the complexity of a  
17 full-scale saturated backfill zone? And I'll give you  
18 even -- well, actually, we'll answer that question  
19 first.

20 A MR. JENSEN: Oh, yeah, absolutely.

21 Q Right. And some of the differences, you agree, I  
22 think, would be that water would flow more evenly on a  
23 more controlled manner through a column than through a  
24 large pit filled with rocks; right?

25 A That's -- that, I don't know if -- if I'll agree with  
26 as readily. In fact, I mean, it's -- it's something

1 we've spent some time looking at, how you can design  
2 hydraulic control into -- you know, into a designed  
3 saturated backfill system. One option is, of course,  
4 to -- to -- as we've heard a few times, is to, you  
5 know, more or less blindly dump -- end dump into the  
6 pit and then deal with whatever comes out of it.

7 But I believe you also heard from Mr. Youl that  
8 we're considering options where there are some  
9 possibilities for -- for designing it a bit more  
10 carefully for hydraulic control. And, in my mind, this  
11 is one of the opportunities we have that's not  
12 available to operations, where they have to use what  
13 they have in terms of -- of -- of backfill dumps, that  
14 there is some opportunity here to -- to embed some  
15 hydraulic controls into a saturated backfill. You  
16 know, we haven't explored them to the -- to a full  
17 extent, but I -- I -- I really see that as a very  
18 interesting opportunity to -- to try and -- and take  
19 advantage of the fact that these things haven't been  
20 built yet. And it can -- as far as I can tell, it can  
21 all be done with mining equipment.

22 Q Okay. Thanks, Mr. Jensen.

23 So I'm going to ask you if you think -- we quickly  
24 spun through without getting into all the details of  
25 these example cases you -- you asked us to look at, but  
26 would you agree that the most relevant comparator for



1 the performance to expect from a saturated backfill  
2 zone would be other saturated backfill zones?

3 A Yes.

4 Q Okay. So I'm guessing you'd agree that maybe the most  
5 appropriate case studies that you submitted would be to  
6 look at the ones that are on PDF page 42, which our  
7 Zoom host will take us to.

8 So we see the Example A, Tumbler Ridge, and  
9 numbers from Biancan [phonetic] as I recall.

10 MR. O'GORMAN: And if you scroll down,  
11 Zoom Host.

12 Q MR. O'GORMAN: And the other one, Example B,  
13 Northern Canada, I think we -- are you able to tell us  
14 where Northern Canada is for Example B?

15 A MR. JENSEN: Yeah --

16 Q (INDISCERNIBLE - OVERLAPPING SPEAKERS) mine sites?

17 A Yeah. I'm just -- excuse me. I'm searching my memory  
18 here. I don't believe that this particular case study  
19 is -- I don't think I put this together. So I'm going  
20 to have to go and find the reference and see --

21 Q Okay. You know, we don't need you to find the  
22 reference for that one. It's not that important.

23 A Okay.

24 MR. O'GORMAN: Scroll down, though, please,  
25 Zoom Host. Keep going.

26 Q MR. O'GORMAN: Okay. So those are the two

1 examples that you gave us.

2 A MR. JENSEN: Yeah. Yeah.

3 Q So these, you would suggest, potentially the most  
4 important of the examples that were submitted; right?

5 A Well, I mean, if -- if we think of what's submitted as  
6 a whole, I would actually say no. The Biancan study  
7 that you're referencing there, in that particular  
8 situation, there was no attempt at all to -- as far as  
9 I recall, to add any -- any carbon. This is -- this is  
10 just what happened in the in situ environment without  
11 anyone doing anything. So -- so that was just the  
12 residual carbon that you already -- that was already  
13 present in the rock.

14 And so what's interesting about that is it goes to  
15 show -- and I don't want to overstate the case here or  
16 be, you know, unduly optimistic about these things, but  
17 it -- it remains true that we do see these processes  
18 occurring, not just in a setting like this, but in  
19 other settings really with or without any -- any  
20 special effort.

21 So what we do find is that by adding -- by taking  
22 control of the process and doing that by adding a  
23 labile carbon source, you really can achieve very good  
24 control of the systems.

25 So, no, I actually would not agree that these are  
26 very good reference. Again, it's -- it's -- I would

1 put these in the category of sort of circumstantial,  
2 you know, pieces of information that indicate that the  
3 general concept, is -- you know, it's -- it's present  
4 in -- not just in what we talk about here, but it is  
5 actually a wild -- widely recognized process.

6 Q Okay.

7 A I think that's more the --

8 Q So --

9 A -- intent.

10 Q Sorry. I didn't mean to cut you off. So, actually  
11 you --

12 A Sorry -- (INDISCERNIBLE - OVERLAPPING SPEAKERS)

13 Q So actually you would maybe argue that an even better  
14 comparator than these two examples would be Teck's  
15 Elkview operation as the most relevant to compare --

16 A I --

17 Q -- would you agree with that?

18 A I would say it's better, but I would still go back to  
19 what I've said many times, which is for these types of  
20 systems it really is necessary to -- to complete test  
21 work on-site to get a handle on exactly how your system  
22 would -- would perform.

23 Q Fair enough. But Teck's, of these examples, is also  
24 the one that is receiving supplementary organic carbon;  
25 right?

26 A Yes. Yeah.

1 Q Right.

2 A And it's --

3 Q Carbon dosing -- yeah.

4 A Yeah. It's a very -- it's a key feature of these  
5 systems.

6 Q Okay. So let's talk about SBZs that receive dosed --  
7 carbon doses. Okay. So a little bit of background.  
8 Let's --

9 MR. O'GORMAN: Zoom Host, if you want to haul  
10 up three one -- Document 313. We've -- 313 was  
11 Addendum 11 -- or was it Addendum -- yeah, it's  
12 Addendum 11, I think. We'll go to PDF 458.

13 Q MR. O'GORMAN: And while she's looking that  
14 up, I guess I would say -- all right. Every saturated  
15 backfill zone you've got a large excavated pit filled  
16 with rock. To that extent, they're more similar to  
17 each other than to, for example, a large pit filled  
18 with mine water; right?

19 A MR. JENSEN: As a general statement, yes.

20 Q Okay. The two examples that you cited -- well, we  
21 already talked, really, about the -- the careful  
22 adjusted dose of carbon. I think I can jump ahead just  
23 slightly in my planned questions here. Right.

24 Would you say, Mr. Jensen, that in terms of  
25 designing a saturated backfill zone, including  
26 determining its dimensions -- would you say that the

1 example with the dosed mine water is more directly  
2 applicable to the system you've got proposed at Grassy  
3 Mountain?

4 A I -- I apologize, Mr. O'Gorman. You're saying the  
5 example with the dose mine water, so -- being? Being  
6 Teck or ...

7 Q Yes, I mean Teck.

8 A Yes.

9 Q Maybe I should have used different words.

10 A Okay. No, absolutely. I mean, like I said, that --  
11 that -- that's a -- probably the key attribute to -- to  
12 look at.

13 Q Yeah. Okay. Okay. I think you've agreed with -- I'm  
14 just -- some of these questions you've agreed with, so  
15 now I'll jump down here to -- let's talk about Teck.

16 So in your submission -- this is on -- we're on  
17 313? Yes. Let's go to 227, please. Okay. That  
18 should be good.

19 So at the time you submitted this, you basically  
20 told us, Sorry, but publicly available data on  
21 performances not available. Does that sound right?

22 A Sorry. Yes. Correct.

23 Q Okay. But if we go to Document 503, Registry  
24 Document 503, and that is a document that you submitted  
25 as your hearing submission, I believe; correct?

26 A MR. HOUSTON: Correct.

1 Q And we look at page 35. So this is the middle of a  
2 presentation from -- let's look at 35 for now. We'll  
3 jump around a little bit here. A presentation from  
4 Teck about its Elk View saturated backfill zone, and  
5 this actually came up earlier in this hearing. Is that  
6 right, Mr. Jensen or Mr., you know, Houston?

7 A MR. JENSEN: Yes, it -- it looks like that  
8 way, yeah.

9 Q I do notice we -- the page that we landed on contains  
10 the answer to a question that was asked of you when  
11 this study came up earlier in the -- in the process  
12 when -- I'm not -- I can't -- I'm not going to call up  
13 the transcript, but I think you were looking at a  
14 different slide that showed the treatment levels  
15 achieved from Teck's Elkview operation, and I believe  
16 you were asked what percentage removal they were  
17 achieving, and the answer was, in this deck, in that it  
18 said greater than 90 percent of selenium was out; is  
19 that right? Do you remember that conversation? I  
20 think it was you, Mr. Houston.

21 A MR. HOUSTON: I -- I'm failing to remember  
22 the exact conversation.

23 Q I don't think it's important enough to go to the  
24 transcript.

25 A Yeah. No, no. I -- I see the "greater than 90  
26 percent" here.

1 Q Okay. So I guess greater than 90 percent could be  
2 anywhere between 90 and 100; right?

3 A Yes.

4 Q But, notably, they didn't -- they did seem to present a  
5 lower bound on this.

6 I'm wondering if you would say -- and, again,  
7 these questions have been about comparing performance.  
8 I wonder if you would think that this removal rate or  
9 treatment -- efficiency rate is something that would be  
10 reasonable to expect at your saturated backfill zone?

11 A MR. JENSEN: If you're referring to the  
12 statement greater than 90 percent, then -- then yes.

13 Q Could it be as low as 90 percent?

14 A I wouldn't expect so, but it would be a matter of --  
15 again, like some of the field trials and whatever else  
16 we recommended, you know, you'd want to complete those  
17 to -- to confirm that. But, no, I -- I certainly  
18 wouldn't expect so.

19 Q All right.

20 A I mean, and -- and if I can add a little bit of  
21 context. What -- part of the difficulty we have in --  
22 in discussing some of these matters is that, you know,  
23 there's a limit to -- and doesn't -- this doesn't just  
24 refer to Teck, but -- but some other material we  
25 come -- we come across in our day-to-day practice -- we  
26 are privy to a good deal of -- of, you know,

1 confidential information from -- at other mine sites  
2 and clients. And so part of the difficulty we have in  
3 conveying our confidence around these things is that we  
4 do see other systems' -- result of other tests that  
5 aren't public but that we are privy to, and -- and that  
6 helps -- that helps us -- it doesn't help you, but it  
7 helps us, you know, with our confidence around some  
8 of -- of what we see. So it's -- we struggle a bit  
9 in -- in these instances here where obviously it's the  
10 evidence that -- that needs to speak for -- that needs  
11 to support our statements. But I can say from a  
12 professional point of view it's -- it's -- just from  
13 what I know, it's -- it's -- yeah, I have a lot of  
14 confidence that we'll -- that -- that, you know, we're  
15 speaking around the -- the 15 ppb or micrograms per  
16 litre. Like, I'm -- I have a great deal of confidence  
17 that the effluent will be down in that range.

18 Q Okay.

19 A I'll leave it at that.

20 A MR. HOUSTON: Mr. O'Gorman, if I could  
21 intrude -- and this kind of goes back to the  
22 calculations you led Mr. Jensen through earlier. If we  
23 go to PDF 42 in this document, what you'll see is that  
24 the influent they were starting with was quite low in  
25 terms of concentration. And so if you think about the  
26 15 parts per billion -- or the 15 micrograms per litre,



1 I'm sorry, as kind of the lower level of where we can  
2 get to with this treatment process, then the 90 -- or  
3 the greater 90 comes from -- or is -- is driven a lot  
4 by the influent concentration.

5 A MR. JENSEN: And if I can add, I mean, this  
6 is -- this is also an example of a system where it was  
7 installed after the fact. There was no -- you know,  
8 they recruited a historical backfill, you know, set up  
9 their -- their stations, and -- and that -- that's what  
10 happened here. There was no -- no opportunity at all  
11 for -- for managing the hydraulics or for -- it was --  
12 it was literally just, you know, let's see what  
13 happens, more or less, you know, when it came to at  
14 least hydraulic control.

15 So it -- you know -- so this is where -- again,  
16 some of the difficulty I just highlighted, it's -- you  
17 know, I'd love to go into more details, but,  
18 unfortunately, I'm --

19 Q Yeah.

20 A -- I can't.

21 Q Okay. Thank you both for those. I mean, I do feel  
22 like I -- I should, you know, very briefly respond to  
23 that, Mr. Jensen, only to point out you were right in  
24 what you said about, we do, as a Panel, need to look at  
25 what's on the record and the evidence that's presented  
26 to us. And we do appreciate that some results that may

1 be out there may be confidential and not public record,  
2 but they could as easily go in either direction in  
3 terms of whether there are results that would support  
4 your proposals versus results that would not support  
5 your proposals. We really can't speculate on those as  
6 a Panel. You appreciate that; right?

7 A Oh, yeah. Precisely. That -- that's my comment.

8 Q Okay.

9 A But -- but it -- I guess I was trying to convey --  
10 well, I --

11 Q Okay.

12 A I don't want to repeat myself.

13 Q Yeah. That's fine.

14 Okay. So, actually, this is a nice graph, because  
15 I do want to lead through some calculations.  
16 Calculations are my thing, as has probably become  
17 painfully apparent to this panel.

18 So this presentation that was included in your  
19 submission, it does -- if we need to go back and look  
20 at the number, we can. It was on page 36. But it  
21 received an inflow of 10,000 cubic metres per day of  
22 water with a maximum of .2 milligrams per litre of  
23 selenium or 200 micrograms if -- as I promised, we'll  
24 talk in micrograms today. Do you guys agree with that?  
25 Do you need to look at page 36 to confirm the  
26 10,000 cubic metre number?

1 A No. That -- that's fine. Yes, that's correct.

2 Q So a quick calculation says to me that they were taking  
3 in a maximum load of 2 kilograms per day of selenium.

4 Do you want to double-check that number, or do you take  
5 my word for it?

6 A I'll take -- I'll take your word for it, but it all  
7 sounds about right.

8 Q Okay. And, indeed, the figure shows over a period of  
9 some months a total amount of removal of 351 kilograms  
10 in Teck's program over, I'm thinking, 21 months,  
11 reading the graph; right?

12 A Correct.

13 Q Okay. For these next questions, we want to think about  
14 the -- what's Grassy Mountain have to deal with.

15 So I can draw these up or I can ask if you could  
16 just confirm without us looking for this -- for the  
17 registry documents. Do you agree that reasonable  
18 numbers to assume for the treatment that your SBZs will  
19 need to handle would be a maximum of 30,000 cubic  
20 metres per day and a median of, say, 15,000 cubic  
21 metres per day?

22 A Yeah. I've -- that sounds about right. So --

23 Q I could take you to the documents to show, if you want,  
24 but --

25 A Oh, I don't think you have to. It's -- it's -- it's --  
26 yeah, I -- I would agree with that.

1 Q Okay. Thank you.

2 So if we had -- you know, the conservative case  
3 that you've presented to us would be estimating -- and  
4 then I recognize we had this conversation in the source  
5 term conversation. You didn't necessarily say you  
6 calculated a set of numbers that showed  
7 1.5-milligrams-per-litre input, but you proposed that  
8 to us as our conservative upper case to evaluate, so  
9 we're going to evaluate that conservative upper case.

10 So if you had an inflowing selenium concentration  
11 of 1,500 micrograms per litre, do you want to do some  
12 quick math and give me a sense of what the resulting  
13 selenium loading will be into your backfill zones,  
14 considering both the median and the maximum flow --  
15 expected inflow rates?

16 A Yeah. You bet I can do that. So let's see. 15,  
17 2,000, 30,000 -- and you want to use 1,200 or 1,500?

18 Q I'd like to use 1,500. I recognize you showed us a  
19 figure that had 1,200. That wasn't a conservative  
20 95th percentile number, and that was only one of your  
21 ponds. So let's go with the -- the -- the 1,500 that  
22 we've -- we can draw from your assertion that you had  
23 in the original documents 99 percent treatment  
24 resulting in 15 as the outflow?

25 A Yeah. So I have between 22-and-a-half and 45 kilos per  
26 day.

1 Q Right. That's what we came up with as well, so we're  
2 all good at math here.

3 22-and-a-half to 45 kilograms per day would be a  
4 10-to-20-times-per-day higher selenium load than Teck's  
5 project at Elkview that they're reporting on in your  
6 figure; right?

7 A Yes.

8 Q Okay. So based on that, do you expect that the SBZ at  
9 Grassy Mountain would need to be 10 to 20 times bigger  
10 than the one at Elkview in order to remove selenium as  
11 well or better as that operation?

12 A No, I certainly would not. I mean, we're -- we're  
13 already talking about volumes and retention times that  
14 are orders of magnitude greater than -- than what's  
15 required to remove these loadings. So if -- just  
16 for -- as a point of comparison, if we -- if we think  
17 down to the scale of an active water treatment plant  
18 through a scale of gravel bed reactors up to a full  
19 saturated backfill, I mean, in reality -- so if we  
20 think of gravel bed reactors, which is the identical  
21 process to what we're talking about -- it really is. I  
22 mean, the -- the only difference is that you have it --  
23 you place -- you tend to use uniform rock to get better  
24 hydraulic control. But if you look at mean retention  
25 time -- and you can factor in dead space and -- and --  
26 and put some efficiencies into dead -- you know,

1           whatever you might have to subtract due to -- if  
2           there's any dead space.  You know, on the order of  
3           certainly less than a week, you can get more or less  
4           complete removal in -- in those systems.  Now we scale  
5           up to a system where we have several months.

6           I mean, the most likely outcome is that the vast  
7           majority of the treatment in these -- these systems  
8           will happen within a short distance of your injection  
9           point, and the rest of the volume of the saturated rock  
10          fill will really be more of a -- you know, unreactive  
11          volume where -- so that your -- your water takes a  
12          torturous path through the -- the media.  So, no, I --  
13          no, I -- I definitely would not agree with that  
14          statement.

15        Q    Do you think they could be the same size as Teck's  
16              facility and achieve the same results with a 10 to  
17              20 times higher loading of selenium?

18        A    Yeah, I would think so.  And, again, I have to be a  
19              little bit careful here.  I have good reasons to --  
20              yeah, so we're into the same problem here with -- with  
21              the -- the lack of information on the record.  So I'll  
22              just leave it at that.  I'll just say, yes, it's -- it  
23              is quite conceivable that the same volume could --  
24              could handle that same load, absolutely.

25        A    MR. HOUSTON:                    What -- what -- what is on the  
26              record, Mr. O'Gorman, is that Teck is planning to

1 double the -- the throughput in -- in the existing SRF,  
2 so -- so that is on the record.

3 A MR. JENSEN: Excuse me, Mr. O'Gorman, my  
4 colleague is pointing out that on page 36, if we can --  
5 if you would, Zoom Host ...

6 Oh. Steve, do you want to -- do you want to speak  
7 to this? I don't really see ...

8 A MR. DAY: Yeah. Mr. Gorman [sic], what  
9 I -- Mr. O'Gorman, what I thought it would be useful  
10 to -- it sounds like you're sort of thinking about the  
11 scale and how much of the system you need. And -- and  
12 on what -- on what this figure shows from the Teck  
13 presentation is that they're only using a small portion  
14 of the -- the -- the backfill kind of area to -- to  
15 operate their system. So it's -- because a lot of  
16 the -- the -- a lot of the processes that -- that  
17 Mr. Jensen is speaking about occur very close to the  
18 injection points. You don't need a -- you don't need  
19 to kind of -- you don't need the full -- full extent of  
20 the -- the -- the backfill zone to -- to get anything  
21 to happen.

22 Q Okay. So -- thank you.

23 Are you saying Teck overdesigned this system?

24 A No. They just recognized that they could -- based on  
25 modelling that they did, that they could figure out  
26 that they needed this part -- they could use that part

1 of the backfill to achieve what they needed to achieve.  
2 And recall that the backfill is not a -- it's not a --  
3 it's some legacy feature. It's not something that  
4 they -- they set out where they -- they designed the --  
5 the well field for treatment around -- around what they  
6 needed.

7 Q So you believe the same size treatment facility, the  
8 volumetric elements of the SBZ are not a core component  
9 of how effectively they worked -- they work?

10 A Well, I think that -- sorry. Soren, did you want to --  
11 Mr. Jensen, did you want to say something?

12 A MR. JENSEN: Yeah. I mean, I'd say at the  
13 magnitude of -- that we are operating within here, I  
14 would say yes, it's -- it's not a -- given the volume  
15 we have -- we have available is, you know, probably an  
16 order of magnitude higher than what we would ever  
17 conceive of -- of defining in terms of a design. So --  
18 so, yeah, I'd -- I'd say volume -- think of it as a  
19 reactor volume is -- is the least of our concerns.

20 Q Okay.

21 A At least, you know, for long term.

22 Short term, like, you know, in the initial phases  
23 of the project, we might have to be a little bit more  
24 careful with how we manage that. But certainly long  
25 term, yeah, it -- it wouldn't be a serious  
26 consideration.



1 Q You haven't really explored that, though, and justified  
2 that in any of the materials that you've sent us; is  
3 that right?

4 A MR. HOUSTON: Well, we have talked about  
5 retention times, Mr. O'Gorman, and certainly as  
6 Mr. Jensen mentioned in -- in the first phase of the  
7 first backfill, retention times are in the scale of one  
8 to three months. But, again, once we get full  
9 build-out and have the entire three stages of the SBZ,  
10 the -- the retention times go up to the -- you know, in  
11 the range of a year, and that's well more than is  
12 required for the reaction.

13 Q Okay. And we'll -- and certainly, yeah, I -- I am  
14 aware of that, Mr. Houston. I listened to the  
15 conversation you had with Mr. Fitch about the -- the  
16 residence times issue of water flowing through the SBZ,  
17 so you -- you have? Or you have talked about that  
18 aspect of it, yes.

19 Okay. So you're saying you're going to get the  
20 same result for 10 to 20 times more inflow for the --  
21 with the same size of a system. Fair enough.

22 A MR. JENSEN: No. No, not -- not inflow.  
23 Loading. But -- but --

24 Q Loading.

25 A -- in terms of flow, we are, you know, 15 to 30. It's,  
26 I'd say, 1-and-a-half to 3 times --

1 Q Right.

2 A -- hydraulically.

3 Q Yeah.

4 A But -- but I will say, I mean, for -- you know, when we  
5 go and design other biological treatment systems, for  
6 example, for -- let's say just for nitrate treatment or  
7 for ammonia treatment, it's not -- like, the hydraulic  
8 capacity isn't -- isn't necessarily a -- well, for the  
9 process itself, it's not really a design factor. It  
10 comes down to -- to surface area of -- like, surface  
11 reaction area.

12 Q Sure.

13 A So that -- that's the design. And -- and so if you  
14 start to back out your kinetics based on your surface  
15 reaction area, like I said, you're orders of magnitude  
16 higher than -- than anything you'd ever design for.

17 Q Okay.

18 A So it's -- it's -- so I -- I wouldn't want to leave  
19 it -- you with the impression that somehow we are  
20 trying to do ten times the amount of treatment in --  
21 you know, it -- I think that's -- that's not a -- a  
22 fair characterization.

23 Q Okay. Oh, I'll kind of jump forward, then, a little  
24 bit. You know, some of the -- is it -- would you say,  
25 Mr. Jensen, that it's -- you can confirm at the very  
26 least that your system is larger than the Elkview

1 system, right, even if not 10 to 20 times larger?

2 A Hydraulically, yes, it is.

3 Q Okay.

4 A And -- and loading and (INDISCERNIBLE - OVERLAPPING  
5 SPEAKERS) --

6 Q So in a larger system --

7 A -- also.

8 Q Also loadings, yes. And I did misspeak myself earlier.  
9 I didn't mean 10 to 20 times the flow. I did mean the  
10 loadings, but ...

11 So just with it being larger, just to clarify, I  
12 mean, are there greater challenges in design complexity  
13 on this -- what I would suggest might be a key issue of  
14 ensuring that the water flows evenly, recognizing,  
15 Mr. Houston, you challenged, I think, Mr. Fitch, on him  
16 describing flows. But let's -- let's just say it using  
17 those words for now. You do need to ensure that the  
18 water flows evenly through the entirety of the larger  
19 system compared to one that is smaller. Does that  
20 introduce extra complexities?

21 A Well, first of all, I -- I would disagree with the  
22 notion that you have to ensure that it flows evenly.  
23 Again, with this massive excess of -- of reaction  
24 volume that we have in the surface area that we have,  
25 we don't have to control that particularly tightly  
26 'cause it's -- again, the -- it's -- it's so

1       overdesigned -- not overdesigned, but back to the same  
2       point I made earlier. That said, I think it is  
3       imminently desirable to -- you know, now that we have  
4       the opportunity to -- to think about the hydraulics and  
5       how hydraulically the system will operate -- and, you  
6       know, my expectation is that some thought and effort  
7       will be put in to design the hydraulics around this. I  
8       mean, that's -- it's really a luxury we have of a  
9       system that hasn't been built yet. So, you know, you  
10      can think of -- of hydraulic design at different  
11      scales. I wouldn't say complexity increases at a  
12      greater scale. You know, you can have very large  
13      settling ponds, and they're, you know, roughly  
14      speaking, not much more complex than a small settling  
15      pond. It's -- I think it's a matter of, you know,  
16      putting the right design parameters together and -- and  
17      then see what you can do -- how you can work with  
18      the -- the mining material to -- to improve hydraulic  
19      performance. But on that one point that -- there's --  
20      there's definitely no need to be too precise or too  
21      perfect on that.

22    Q    Okay. The spread of the methanol through the system  
23        adds a little bit of extra complexity or no?

24    A    I mean, if you compare the -- if you compare to any  
25        other type of -- or reactor -- reactor op -- operation  
26        and dosing system, it's very -- I mean, it really is

1 one of the attractive features about this system,  
2 which -- you know, I see it as far more attractive  
3 than -- than, say, a mechanical treatment plant because  
4 it is -- it's quite robust to even fluctuations in --  
5 in methanol addition, and it -- it's got inertia in the  
6 system. And it's -- if you see examples of -- of the  
7 gravel bed systems that -- I'm having a -- what are  
8 they called -- the -- Geosyntec -- thank you -- that  
9 they put together, I mean, they're -- they're really  
10 simple systems. You have a methanol tank and a  
11 metering pump, and then you have a couple of  
12 feed-forward control systems. It's -- from a reactor  
13 point of view and from a control point of view, this is  
14 a -- it's -- certainly is not complex.

15 Q Okay. There's some other differences that you've got  
16 to factor in when you're trying to consider your  
17 designs, and I'm thinking about things like composition  
18 of the mine water, climatic differences, that sort of  
19 thing. And will they have a -- have an impact on the  
20 transferability from the one to the other -- one system  
21 to the other?

22 A Sorry. I'm -- I'm not trying to be difficult. I just  
23 want to make sure I understand. When you say one  
24 system to another, you mean (INDISCERNIBLE -  
25 OVERLAPPING SPEAKERS) --

26 Q From Teck to Grassy Mountain. From Teck to Grassy

1 Mountain.

2 A I mean, they're very similar climatic systems, and  
3 they're, you know, within -- and -- and what we tend to  
4 see in -- in large reservoirs like this is that the  
5 swings in terms of temperature and -- and other  
6 factors -- and -- and not only that, the range  
7 within -- so if we look at the stoichiometry of dosing  
8 carbon -- so that's one -- one of the things we looked  
9 at in these barrel tests; it was one of the -- the  
10 primary goals of that test. We know that there --  
11 there's quite a range of -- you know, again, we don't  
12 have to be surgically precise about any of this.  
13 Not -- not that -- not that we couldn't try to be. But  
14 it -- it -- it's a fairly forgiving system when it  
15 comes to all of the factors you just listed as far as  
16 we can tell.

17 Q Okay. So comparability of Teck's results from Elkview  
18 to Grassy Mountain, are you comfortable -- what's your  
19 degree of comfort that they are highly comparable and  
20 transferable versus there are a number of unsig -- you  
21 know, important uncertainties in being able to make  
22 that comparison of the performance of the one versus  
23 the other system?

24 A I would say both. I would say that in terms of -- of  
25 the performance when it comes to selenium removal, I  
26 mean, quite honestly, my expectation is that the

1 Teck -- the Grassy system would be better 'cause you  
2 can design it from the ground up. So some of the -- I  
3 don't know how much they speak to some of the -- the  
4 challenges they had to overcome at -- at Teck, but --  
5 but, you know, it's -- it's -- again, that's the  
6 benefit of starting from scratch.

7 On the other hand, there are certainly  
8 uncertainties that we want to address. We discussed  
9 some earlier today, the potential to mobilize metals  
10 from materials at -- at Grassy. That's an important  
11 one. What else can we point to?

12 I mean, no, there -- there's -- there's no  
13 question there's site-specific questions that have to  
14 be answered and addressed on-site, but when I -- but on  
15 the particular point of selenium and nitrate removal,  
16 for that matter, I would -- I would express a high  
17 degree of confidence.

18 Q A high degree of confidence in what?

19 A In the performance of removing selenium and nitrate.

20 Q To achieve 99 percent removal? Do you have high degree  
21 of confidence in that?

22 A Yeah. Or to achieve 15 micrograms per litre of  
23 selenium in the effluent and less than 1 milligram per  
24 litre of nitrate nitrogen in the effluent, yes.

25 Q Okay. Thank you, Mr. Jensen.

26 You put it at high, not even moderate?

1 A No. I -- I put it at high.

2 Q Okay. Scanning down.

3 Okay. The gravel bed reactors that were discussed  
4 in your proposal -- sorry, in some of your materials --  
5 and I'm not going to haul it up -- you agree that the  
6 materials suggested gravel bed reactors would be a -- a  
7 consideration for the project?

8 A MR. HOUSTON: I guess -- I guess I'll jump  
9 in here. Mr. Jensen and Mr. Day didn't work on that.  
10 The -- the basic work for the gravel bed reactors was  
11 done by another -- another consultant. But, yes,  
12 certainly it's a -- it's an alternative we've put  
13 forward, either as an add-on or to -- to bolster the --  
14 the performance of the -- the SBZ.

15 Q Okay. But it's -- sorry. It's getting late in the  
16 day. You're not committing to do -- to building one;  
17 right --

18 A We have --

19 Q -- or are you?

20 A We -- we have committed to building one if the SBZ  
21 doesn't perform as we have expected. So, yes, we have  
22 committed to either a gravel bed reactor or, you know,  
23 a -- a mechanized treatment facility if -- if the SBZ  
24 doesn't perform as we expect it will.

25 Q Okay. Let's say if you get to a point where you don't  
26 have one of those backup systems in place and you have



1 effluent coming out of your saturated backfill zones  
2 that is not meeting your desired performance target of  
3 having a -- 15 microgram per litre of selenium. What  
4 do you do?

5 A Well, first of all, there will be an array of  
6 monitoring wells through the SBZ that will be looking  
7 at the -- the parameters, the selenium content, the  
8 oxygen content, the nitrate content at various points  
9 in the SBZ.

10 As Mr. Jensen mentioned, we expect the bulk of the  
11 reaction to happen very close to the inlet, and  
12 we're -- we would expect to see somewhere in the SBZ  
13 that the water quality has reached a level that is --  
14 is -- is appropriate for discharge into the  
15 environment.

16 So this wouldn't happen as a surprise. It would  
17 be something that we would see coming. We have talked  
18 about diverting water that is off spec to the raw water  
19 pond and eventually recycling through the -- the SBZ,  
20 you know, if -- if need be.

21 Q Okay. Any chance that you would have to stop  
22 operations if you weren't meeting -- you know, I'm  
23 asking you to -- you discovered the selenium is coming  
24 out too high, and you didn't act in time to get your  
25 treatment plant built?

26 A I guess in the -- in the worst case, Mr. O'Gorman,

1       that's where we could end up. But stopping operations  
2       wouldn't necessarily stop the -- the selenium from  
3       coming into the system; it's -- it's separate from the  
4       actual coal mining. And so we -- we would need to --  
5       and -- and I -- I think one of the important things  
6       here is that these things are -- are developing slowly.  
7       We're -- we're not going to have all of the mine -- or  
8       the ex-pit dumps formed in the first few years, and so  
9       the -- the selenium content in the influent water is  
10      going to develop slowly. The -- the SBZ has some  
11      inertia to it, as Mr. Jensen pointed out. So there are  
12      time -- time elements here that kind of mitigate  
13      against suddenly waking up one day and finding out  
14      you've -- you've got an issue.

15                But I -- I think that watching those trends  
16      develop, we would have to make a decision at some point  
17      to implement a gravel bed reactor or to take steps to  
18      bring in a -- a -- you know, a box treatment plant such  
19      as one that Teck has installed at the West Line Creek.

20      Q        Okay. I did want to bring up one specific number in  
21      your analysis and ask you to speak about it. And it is  
22      on page -- just one second. Okay. It is on -- this  
23      document -- sorry. Let's go to 251, CIAR 251, and  
24      page 43. That -- that -- that figure is good.

25                So one of the two saturated backfill zone examples  
26      you gave us -- this was the Biancan study -- you gave

1 us some projected selenium removal rates in that  
2 system. Does that look right to you? And you can see  
3 the numbers?

4 A MR. HOUSTON: Yes.

5 A MR. JENSEN: Yes. Oh, sorry.

6 Q I'm curious if -- if you can tell us if those look like  
7 reasonable comparisons to transfer over to what you  
8 would expect to see?

9 A Mr. O'Gorman, no, not at all. I mean, these -- again,  
10 these are removal rates from a system where you added  
11 nothing. You -- it -- it's just passive attenuation,  
12 if you will. It's -- it's -- there's no attempt to add  
13 any kind of accelerant into the system, and, you know,  
14 the second you start to do that, these removals rates,  
15 they go up by orders of magnitude. So, no, I would not  
16 say so.

17 Q What value did you use --

18 A Well, one -- we didn't use --

19 Q -- for projected removal rates?

20 A One of the difficulties in -- isn't -- in calculating  
21 the -- the expected rates is precisely that -- we  
22 probably have to look to the -- the Geosyntec work to  
23 see what they expect. That's probably the best source  
24 of information we can point to when it comes to the  
25 kinetics and removal 'cause it -- you know, we -- like  
26 I said before, these reactions tend to go to completion

1           within a relatively small subset of the -- of the  
2           volume of the -- of the saturated backfill. So it's a  
3           long response to say I can't give you an exact number.  
4           We'd have to go and calculate it and -- or maybe derive  
5           it from some of Geosyntec's work.

6    Q       Would it be --

7           THE COURT REPORTER:           I'm sorry. Whose work?

8           MR. O'GORMAN:                 Geosyntec, he said.

9    A       MR. JENSEN:                 Geosyntec. Yeah. I  
10           apologize. I was mumbling.

11   Q       MR. O'GORMAN:                Okay. But it would be fair, I  
12           think, to get a comparable value from a large-scale,  
13           real-life-type system to compare; right?

14   A       Well, so, yes, I mean, that -- that would be another  
15           purpose of -- of running field-scale tests at Grassy.  
16           But I -- I will say in the same breath that -- that  
17           the -- the particular kinetics of reducing selenium --  
18           again, I mean, on the list of things we worry about,  
19           that's not really on that list 'cause it's -- again,  
20           because of this order of magnitude consideration in  
21           terms of how much available reactor volume we have  
22           it -- compared to what we need. So it's -- it -- it's  
23           not something we're horribly concerned with, but it --  
24           it's -- it's certainly something that will be  
25           calculated as part of the development.

26   Q       Okay. I'll move on from there.

1           Let's go to asking you about research and  
2           development. First of all, do you want to summarize  
3           for us again the R&D plan that you have to get you to  
4           this desired level of treatment that you want to see  
5           your system produce?

6    A   MR. HOUSTON:                    So we've -- we've talked about  
7           the column tests and the barrel tests, and -- and we  
8           may -- we may extend some of that laboratory-scale work  
9           even further. But the next scale up would be to do  
10          a -- a field-scale pilot test on-site, and this -- this  
11          would be at a scale where we could start to understand  
12          a little bit better some of the -- the parameters that  
13          we've been discussing, you know, the arsenic, the --  
14          the rate of reaction in -- in an in situ situation. So  
15          those -- that would be the -- the next significant  
16          step. And -- and I think after that we -- we would  
17          move to the actual Phase 1 of the SBZ, and -- and as we  
18          implement that, of course, we're going to build in the  
19          information that we gather from the pilot scale. But  
20          I -- I think we would look at that initial phase as an  
21          opportunity to build in some optionality in terms of  
22          inlet and outlet parameters and other design features  
23          if there -- if there remains some uncertainty about  
24          what might be required and to allow ourselves in the  
25          implementation of that Phase 1 -- and, remember, we're  
26          still -- we're not up to the -- the maximum flow rates

1 or the maximum loading rates because the ex-pit dumps  
2 are still being formed and -- and the -- the massive  
3 rock and the surface area to get those maximum loadings  
4 aren't there.

5 But -- so in that first phase of the first SBZ, we  
6 could build in some redundancy or optionality to  
7 continue to test the process as we operate that first  
8 full-scale SBZ, and that would help to drive  
9 engineering decisions that we could implement on the  
10 subsequent phases of -- of the SBZ.

11 Q Okay. And you planned for the first SBZ to start  
12 operating when?

13 A I believe it's -- it's going to be ready for operation  
14 after four years of mining. Yeah, Year 4 of mining.  
15 Yeah.

16 Q Year 4 of mining. A couple of years of construction  
17 time --

18 A M-hm.

19 Q -- post approval?

20 A It's ...

21 Q Okay.

22 A Yeah.

23 Q Okay. I just wanted to wrap up on this sort of theme.  
24 So just if you -- if something happened -- let's say  
25 partway through mine life, you -- market conditions  
26 change with your project, and someone decides, I think

1 we're about done mining coal on Grassy Mountain. You  
2 are -- you know, you've been proceeding to develop  
3 according to your mine plan, you have a partially  
4 constructed -- depends on the year this hypothetical  
5 event happened, obviously. You have a partially  
6 constructed saturated backfill zone treatment system  
7 that was predicated maybe on mining continuing. What  
8 happens? What happens with the selenium and the  
9 continued operation of that saturated backfill zone?

10 A My lawyer told me never to answer hypothetical  
11 questions, Mr. O'Gorman, but as a -- as a thought  
12 experiment. Yeah. No. We -- we would --

13 MR. IGNASIAK: I'm not objecting.

14 A MR. HOUSTON: Obviously a lot depends on at  
15 what stage everything is at and what -- what are the  
16 long-term requirements. As we go through, though,  
17 and -- and as we're doing our annual reclamation  
18 estimates for the MFSP program, part of that -- part of  
19 that estimate is the -- the estimate of costs for  
20 long-term management, maintenance of -- of an SBZ  
21 and -- and the selenium treatment process. So -- so  
22 there -- there would be -- you know, there -- there  
23 would be some allowance for that in our -- in our  
24 annual planning, and that would be part of the  
25 reclamation liability.

26 Q MR. O'GORMAN: Okay. Fair enough. One

1 second. I'm scanning down here. Right.

2 I sort of asked this. I -- but I do need to come  
3 back just to make sure. Well, no, I did actually -- I  
4 put this question to you out of order 'cause it sort of  
5 seemed to come up. But it is -- you know, the  
6 follow-up to that and my hypothetical, as you say,  
7 about a partially completed saturated backfill zone,  
8 does a partially saturated backfill zone produce  
9 15 microgram-per-litre effluent, or do you need the  
10 full meal deal for it to produce those kinds of  
11 results?

12 A Yeah. So you -- you would need to -- I -- I don't know  
13 what you mean by "partially completed", but obviously  
14 you need the methanol injection, the pumping, the  
15 pipes, injection wells, extraction wells, so you would  
16 need to complete at least a -- a cell of the SBZ to  
17 have a -- a reactor and a process that you can manage.

18 Q Okay. Can I ask you a few questions, please, about  
19 your pilot scale -- your pilot treatment that you are  
20 pursuing? You have a column test study; right? Are  
21 they ongoing?

22 A The -- the exact study that we had commissioned is --  
23 is completed, and the report is written, so that --  
24 that is -- that is completed, but there -- there are  
25 other parameters that we may wish to continue to  
26 examine through additional column tests.



1 Q Okay. And you -- you -- you are going to proceed with  
2 a field scale -- a field-scale study; is that right?

3 A Yes.

4 Q Okay. When do you see that beginning?

5 A It would begin with the start of construction, so we --  
6 we need to, you know, have equipment on -- on-site,  
7 roads built, things like that, and then we would  
8 proceed directly to that field-scale trial.

9 Q How long does a field-scale trial need to run to reduce  
10 [sic] results that you're confident to let you inform  
11 the design of the -- the full system?

12 A MR. JENSEN: Excuse me. I would say that,  
13 at a minimum, you'd -- you'd want to run it for -- for  
14 a year, but I would also say, after a year, you would  
15 have a pretty good sense of -- of -- you'd have a -- at  
16 least a decent answer to most of the questions  
17 you're hoping to -- to answer at least initially.

18 Q Okay. So at the end of that year of your pilot study,  
19 do you have results that suggest, yes, we're confident  
20 that we can achieve 15 micrograms per litre, or would  
21 you be able at that point to have a result that  
22 convinced you you have been overly optimistic and  
23 potentially make a decision, We've got to go another  
24 direction here and ask for approval to build a  
25 treatment plant of some sort? Does it -- does -- does  
26 your one-year field-scale study up front answer that

1 question for you, or is it only a -- you know, you  
2 decide that later?

3 A No. That would be my expectation. After a year, I  
4 think you -- well, I mean, also I have an expectation  
5 that -- that -- that that study would replicate,  
6 really, what we've seen in many other settings. So  
7 it's -- so I would say after a year, you would -- well,  
8 you always have to be careful when you're talking  
9 absolutes; right? It's -- on the balance of  
10 probability, I would say, yes, after a year, you would  
11 have enough information to -- to make that decision on  
12 the balance of probability. Just, as an engineer, I  
13 don't -- I never want to talk in absolutes.

14 Q Okay. There is one thing that's interesting that came  
15 up during the hearing I wanted to ask about.

16 Mr. Houston, you talked a number of times about one of  
17 the ways you could tweak and refine the operation, not  
18 the SBZ -- well, that you could tweak and refine the  
19 operation, adjust it. For example -- I think this --  
20 this came up as an example -- you could potentially  
21 change the amount of methanol dosed into the system.  
22 Does that sound familiar?

23 A MR. HOUSTON: I -- I think we've written  
24 about that in -- in a few IRs about some of the levers  
25 we have to pull in -- in managing the operation, yes.

26 Q Okay. So, Mr. Jensen, I wanted to get your sense of

1       how much flexibility there is in your SBZ and the  
2       operation of it after it's constructed as far as  
3       significant changes one way or the other in the amount  
4       of methanol dosing you might apply to tweak the results  
5       in performance.

6       A   MR. JENSEN:                   Well, I think that's one of  
7       the interesting things about -- I mean, again, if -- if  
8       we think of an -- an SBZ as a -- as a reactor -- which  
9       it is; it's a reactor -- there's a couple of -- of  
10      control approaches that you commonly look at. One is a  
11      feed-forward control where you have some analysis of --  
12      by the -- and, by the way, selenium isn't really an  
13      important factor when it comes to dosing. It really is  
14      nitrate that's driving 'cause nitrate and dissolved  
15      oxygen in the water are the dominant consumers of  
16      electrons.

17               And so what you do -- what you typically would do  
18      is have a -- a feed-forward control system so you have  
19      a measurement of nitrate -- nitrate concentrations that  
20      enters your system. That would be part of your dosing.  
21      Then you would have a secondary measurement -- well,  
22      not secondary. Then your feedback control mechanism  
23      would be a -- an -- ORP measurements, a measurement  
24      located a suitable distance from your injection site,  
25      so you can -- you can control ORP at that point. And  
26      then you would have a secondary injection -- you could

1 even do tertiary -- tertiary injection system that  
2 if -- if you get into a situation where your ORP --  
3 your oxygen reduction potential, starts to increase,  
4 you could then give it a boost, if you will,  
5 downstream.

6 So there's all -- all kinds of -- like, the  
7 control is one of these things that -- that is really  
8 attractive about the system, is that you -- and -- and  
9 I would say as a final point of control, if you get  
10 halfway through the system and you're not satisfied  
11 with the performance, there is some ability -- some  
12 limited ability to -- to extract the water and pump it  
13 back to the beginning of your saturated zone, but in  
14 thinking about that, that would be constrained by  
15 season and other things, and we'd have to be conscious  
16 of the -- of the need to return water back to the  
17 creek, so -- but certainly in terms of control,  
18 that's -- I -- I think of it as one of the attractive  
19 part of the systems. Maybe 'cause I'm a chemical  
20 engineer turned environmental engineer, but that --  
21 yeah, that -- anyways, I'm rambling, so --

22 Q Could you -- could you potentially introduce too much  
23 methanol? And by "too much", I mean taking it to a  
24 point where it would be detrimental to selenium  
25 removal.

26 A Oh, yeah. Absolutely. If you take it too far, you get

1           into the realm of -- of sulfate reduction, and at that  
2           point, it starts to produce sulfide, and, you know, now  
3           you're into a situation where you potentially would  
4           start to -- to solubilize selenium again.

5           But I would say that there's -- like, to get to  
6           that point, you have to overdose by quite a bit, and  
7           there's also -- there's an iron buffer in -- in there  
8           that -- that -- well, actually, no. That doesn't help  
9           you.

10           I will say I have a past of designing bioreactors  
11           specifically for -- for sulphur or, you know, sulphate  
12           reduction, so a much more reducing environment, and the  
13           control measures for that is -- is if we ended up with  
14           conditions that were too reducing, we would add some  
15           feragyan [phonetic] to sequester that, but it's --  
16           it's -- it would have to be -- you know, you'd really  
17           have to -- to just really overdose the system  
18           consistently for a long period of time, and you would  
19           have to ignore some of your early warning signs and --  
20           and some of your ORP measurements. So it's really like  
21           any -- any treatment process. You can actually  
22           overdose and get into a detrimental range. But I don't  
23           see that as -- as a particular challenge in this case.

24    Q    Okay. I only have a couple of questions left, so --  
25           and then I think we will be at a close. So I -- I have  
26           put you through your test, Mr. Jensen.

1           On this -- on this -- on this -- to wrap up the  
2 potential -- well, okay. I'll -- I'll take you -- you  
3 agreed that you could potentially introduce too much  
4 methanol.

5           I have one extra question on the SBZs. Mr. Youl,  
6 you described yesterday, I think it was -- I'm not  
7 going to haul up the transcript, but you described how  
8 the SBZ fills up with waste rock. I think if I could  
9 characterize it, you sort of implied that you'd have  
10 trucks of waste rock that'll tip at the edge of the  
11 pit, with larger rocks expected to go to the bottom and  
12 a finer material left higher up along the edges. Does  
13 that sound right?

14 A   MR. YOUL:                   That sounds correct, yeah.

15 Q   So can you tell me if the SRF was constructed the same  
16 way? Does anyone know?

17 A   I may have to defer to someone else on that one.

18 A   MR. HOUSTON:               So as far as I know,  
19 Mr. O'Gorman, the SRF at Teck, it was an existing pit  
20 that had been backfilled and basically reclaimed, and  
21 then wells were drilled into it, and they began the --  
22 the process. And that -- that's what Mr. Jensen  
23 mentioned [sic] by we have the opportunity to actually  
24 make this SBZ intentionally instead of using an  
25 existing pit.

26 Q   Okay.

- 1 A Just -- just, Mr. Day, do you ...
- 2 A MR. DAY: No, I have nothing else to  
3 add. You covered it well.
- 4 Q Okay. My final question was actually not even about  
5 the SBZ but about your -- we've talked just a little  
6 about your fallback plan of a -- a plant -- excuse  
7 me -- a treatment plant. I did just want to -- I think  
8 you have said to us that you think you can commission,  
9 construct, and get into operation a -- a plant to treat  
10 the selenium if the SBZ doesn't work as you planned  
11 within three years. I could find that if I needed to,  
12 but does that sound like what you've told us,  
13 Mr. Houston?
- 14 A MR. HOUSTON: I -- I think that's what we've  
15 said, Mr. O'Gorman.
- 16 Q Okay. So there are some submissions on the record that  
17 suggest that's highly optimistic and that other plants  
18 took five years to get up and running, for example, and  
19 I just wonder if you can give us some sort of sense of  
20 your confidence in the three-year number?
- 21 A My understanding when you look at the five-year number  
22 that was -- was discussed, that was another operator  
23 we -- we know all too well, so I'm -- I'm going from  
24 the public documentation, but our understanding is that  
25 part of that time frame was due to a -- I guess, a need  
26 to go back to the drawing board and -- and add a --

1 a -- a -- another process on the back end of that plant  
2 to -- well, advance oxidation process to remove some of  
3 the other species of selenium from the water. And so I  
4 understand that that took up a year and a half or two  
5 years of that -- that time frame. So ...

6 Q Okay.

7 A Yeah.

8 Q And remind us: If the SBZ doesn't perform as hoped and  
9 even in your optimistic -- well, I'm sorry. I'll take  
10 that back. Even in your suggested case of three years  
11 to commission, build, and start up operating the  
12 fallback mechanism, what happens to the water that's  
13 elevated in selenium? Do you have enough storage  
14 capacity on-site to store that amount of water?

15 A No. And, again, I -- I think the potential to suddenly  
16 be surprised one day and -- and have to, you know,  
17 react in a short time frame is -- is not a likely  
18 scenario. As I've mentioned, the -- the selenium, the  
19 ex-pit rock dumps, the -- the loading, everything is  
20 going to build up over a period of -- long period of  
21 time. We'll be able to look at the -- the initial  
22 results to understand that, you know, we're on track or  
23 we're offtrack, and so there will be -- there will be a  
24 buildup. We won't wait till the very last minute to --  
25 to -- to make that decision.

26 I -- I would also suggest that it's more likely



1           that the first reaction would be to put in a gravel bed  
2           reactor which would -- would, I think, be an even  
3           shorter time frame to -- to get up and running. And --  
4           and we have had some discussions with Geosyntec on, you  
5           know, what dimensions that might be. In fact, it's  
6           in -- it's one of our IRs, what dimensions that might  
7           be and -- and how long that might take to -- to get up  
8           and running. So it -- it could be done on a shorter  
9           time frame.

10        Q    Mr. Houston, Mr. Jensen, Mr. Day, it's been a long day.  
11            We've talked a lot in this last bit about selenium. I  
12            feel the need to end with maybe just a little bit of  
13            levity. And if our -- my -- our -- our -- our counsel  
14            doesn't shoot me for this, I will say that I shared  
15            with our subject-matter experts that in 1988, as a  
16            third-year chemistry undergrad, I wrote a paper on  
17            selenium, and I, as I recall, received an 'A' on it.  
18            So I might have started out ahead of -- chronologically  
19            I started out ahead of all of us here on selenium. I'm  
20            going to confess that I remember nothing from that  
21            paper beyond that I did well on it a lifetime ago.

22            With that, I do thank you all for your -- for your  
23            answers today. Much appreciated. And we'll -- I will  
24            have more questions for you. I will say that I have  
25            worked my way through some of the longest packages of  
26            questions for you. I definitely have a good 'nother

1 couple of hours or three hours to get through, but we  
2 can't do it today.

3 So, Mr. Chair, over to you.

4 THE CHAIR: Okay. Thank you,  
5 Mr. O'Gorman.

6 So the Panel's just going to take a quick break  
7 just to talk about the plan for tomorrow. It seems  
8 like what we need to do is come back tomorrow to finish  
9 the Benga panel and perhaps not go farther than that  
10 tomorrow in terms of the other participants. But I  
11 just want to confer with my colleagues briefly, and  
12 we'll be -- we'll be back in a moment.

13 (ADJOURNMENT)

14 THE CHAIR: Okay. Yeah. Apologies for  
15 the brief delay.

16 So we just talked about, kind of, the game plan.  
17 And I think we agree we would like to finish the Benga  
18 panel tomorrow to accommodate, you know, the travel  
19 needs of the panel. It's been a long week.

20 We'll propose to start at 10 rather than 9. The  
21 schedule does say 9, but we have been starting  
22 Saturdays at 10. So we don't anticipate a full day,  
23 although Mr. O'Gorman does have a few hours of  
24 questions, as he tells me. So be prepared for that.

25 We won't start direct from any of the other  
26 participants tomorrow. We'll just finish the Benga

1 panel so that we can release that panel. And so that  
2 would mean that on Monday morning, starting at 9 AM, we  
3 would start with the Government of Canada panel  
4 available -- well, both direct and available for cross,  
5 and then followed by the order that we have, which  
6 would be CPAWS after that and then the Coalition  
7 starting on Monday.

8 Any questions about that?

9 Any other business before we break?

10 Okay. Thank you, everyone. Have a good evening,  
11 and we'll see you again tomorrow.

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13 PROCEEDINGS ADJOURNED UNTIL 10:00 AM, NOVEMBER 21, 2020

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1 CERTIFICATE OF TRANSCRIPT:

2

3 I, Angela Porco, certify that the foregoing pages  
4 are a complete and accurate transcript of the  
5 proceedings, taken down by me in shorthand and  
6 transcribed from my shorthand notes to the best of my  
7 skill and ability.

8 Dated at the City of Calgary, Province of Alberta,  
9 this 20th day of November 2020.

10

<Original signed by>

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14 Angela Porco, CSR(A)

15 Official Court Reporter

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