

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

---

GRASSY MOUNTAIN COAL PROJECT - BENGA MINING LIMITED

VOLUME 29

VIA REMOTE VIDEO

---

December 2, 2020

1	TABLE OF CONTENTS		
2			
3	Description		Page
4			
5	December 2, 2020	Morning Session	6170
6	Discussion		6173
7	JAMES YOUNG, Previously Sworn		6174
8	Direct Evidence of Livingstone Landowners Group		
9	(Wildlife, including migratory birds and species		
10	at risk, wildlife health, and human health risk		
11	assessment)		
12	JOHN DENNIS, Affirmed		6192
13	Mr. Brinker Cross-examines Livingston Landowners		6225
14	Group		
15	Alberta Energy Regulator Panel Questions		6229
16	Livingston Landowners Group		
17	Discussion		6236
18	Certificate of Transcript		6240
19			
20			
21			
22			
23			
24			
25			
26			

1 Proceedings Taken via Remote Video

2

---

3 December 2, 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

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 (Student-at-Law)	
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 C. Forster, CSR(A) Official Court Reporter  
20 \_\_\_\_\_  
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 will make  
8 best efforts to try and accommodate your concerns  
9 considering the need for an open and transparent public  
10 process.

11 So just before we start, Mr. Fitch, apologies for  
12 the false start with your witness panel yesterday and  
13 the abrupt ending to yesterday's session. The  
14 Government of Alberta was experiencing issues with its  
15 internet service, and that affected the AER systems  
16 which rely on it. Things do seem more stable this  
17 morning, so hopefully we'll get through the remainder  
18 of the hearing without any further issues.

19 Is there any other preliminary matters or business  
20 that we need to deal with before Mr. Fitch continues?

21 Hearing none, Mr. Fitch, I think you should just  
22 assume you're starting all over and go from there.

23 MR. FITCH: Indeed. Thank you, Mr. Chair.

24 JAMES YOUNG, Previously Sworn

25 Direct Evidence of Livingstone Landowners Group

26 (Wildlife, including migratory birds and species at

1 risk, wildlife health, and human health risk  
2 assessment)

3 Q MR. FITCH: Good morning, Dr. Young.

4 A DR. YOUNG: Good morning.

5 Q So I think we got you sworn and I got one question in  
6 to my examination, so we'll just back up and start with  
7 Question Number 1 all over again.

8 So to begin, sir, you can confirm that you were  
9 retained by the Livingstone Landowners Group to review  
10 the air quality assessment done for the Grassy Mountain  
11 Project, having particular regard to the assessment's  
12 consideration of Chinook winds?

13 A I was.

14 Q Okay. And can you confirm that you prepared a report  
15 for the LLG titled "Comments on Air Quality and  
16 Meteorology Concerning the Grassy Mountain  
17 Coal Project"?

18 A I did.

19 Q Okay.

20 MR. FITCH: And just for the record,  
21 Mr. Chair -- we don't need to bring it up -- but  
22 Dr. Young's report is Registry Document 552, starting  
23 at PDF page 53.

24 Q Dr. Young, can you confirm that your report was  
25 prepared by you or under your direction?

26 A DR. YOUNG: Yes, it was. It was prepared

1 by me.

2 Q Thank you.

3 And do you have any corrections or amendments you  
4 would like to make to your report?

5 A I do not.

6 Q Okay. And do you adopt your report as your evidence in  
7 this proceeding?

8 A I do.

9 Q Okay. And, sir, you can confirm that in your report,  
10 you acknowledged that as an independent expert witness,  
11 you are under a duty to give opinion evidence that is  
12 fair, objective, and nonpartisan? Dr. Young?

13 A Yes, I -- I --

14 Q Okay.

15 A Yes, I acknowledge that.

16 Q Thank you.

17 Now, Dr. Young, you provided a curriculum vitae  
18 which was attached as Appendix A to your report.  
19 Again, that's Registry Document 552. The CV starts at  
20 PDF page 559 -- sorry, 59. 59 I should say. You don't  
21 need to turn it up, but I will begin my examination of  
22 you by asking you to provide an overview of your  
23 credentials.

24 A Thank you, Mr. Fitch.

25 I am the president of (INDISCERNIBLE).

26 THE COURT REPORTER: I'm sorry, Dr. Young. I can't

1 hear you.

2 A DR. YOUNG: (INDISCERNIBLE)

3 Q MR. FITCH: Dr. Young, can you just --

4 THE COURT REPORTER: Sorry. Sorry. I can't hear  
5 the witness.

6 Q MR. FITCH: Yeah. You're kind of faint,  
7 Dr. Young. Is there a way you can amplify your voice  
8 either by getting closer to your microphone or using  
9 something?

10 A Does that help?

11 THE COURT REPORTER: It's garbled. Your sound is  
12 garbled.

13 Q MR. FITCH: Okay. Can we try again?

14 A DR. YOUNG: Okay. Sure. I am president  
15 of Jim Young Atmospheric Services Inc. which I created  
16 in March 2005.

17 Is that working better?

18 Q Yes.

19 A Okay. After 33 years in the private sector -- in the  
20 private sector, I was the vice president and senior air  
21 quality expert for SENES Consultants Limited, in  
22 Richmond Hill, Ontario. I was also in the federal  
23 government for a number of years, and the last position  
24 was acting director -- acting director general  
25 research, and that was for environment services,  
26 Environment Canada.

1 THE COURT REPORTER: I'm sorry. I'm sorry.

2 Q MR. FITCH: Sorry. Dr. Young, you're  
3 going to have to slow down. Your connection, it's a  
4 bit wonky, and so unless you speak slowly, it's very  
5 difficult to hear.

6 A DR. YOUNG: All right. Thank you.

7 Q Yeah.

8 A So I'll just go back.

9 In the federal government, I was acting director  
10 general of research in the atmospheric environment  
11 service of Environment Canada, and I was the chief of  
12 the air quality section for Environment New Brunswick.

13 I continue to enjoy working in air quality and  
14 weather services for both national and international  
15 clients, although I am trying to retire.

16 I have had a number of high-profile clients,  
17 including SENES Consultants, for about a 15-year  
18 period -- sorry, 25-year period; RWDI since 2015, where  
19 I'm their senior consultant following their  
20 weather-related services; and for Arcadis Canada as an  
21 air quality and weather advisor on legal cases.

22 In 2011 I was project manager for a state of the  
23 science study for the city of Toronto which developed  
24 climate statistics over the period 2040 to 2049 which  
25 included statistics relevant to future wind  
26 climatologies.

1 I was a Canadian technical secretary for the acid  
2 rain program from 1979 to 1982 and was the coauthor of  
3 a targeted acid rain strategy which Canada adopted in  
4 1983.

5 From January 1985 to December of 1996, I was the  
6 Canadian co-chairman of the International Air Quality  
7 Advisory Board of the International Joint Commission  
8 providing advice and guidance to the Commission on  
9 transboundary air emissions.

10 I'm the past president of the Air and Waste  
11 Management Association in Ontario and past president of  
12 the Canadian Meteorological Motion Graphics Society,  
13 and I am a professional engineer in the province of  
14 Ontario.

15 I have over 45 years of experience in applied  
16 atmospheric research, I have served on international  
17 scientific panels, and I am the author of over 100  
18 scientifically (INDISCERNIBLE) papers and articles.

19 THE COURT REPORTER: I'm sorry. Could you repeat  
20 that last part? "Scientific papers"?

21 A Scientific papers and articles.

22 I have liaised with governments, other nations,  
23 organizations, industry, universities, and the private  
24 sector. I have published a weekly blog on "Our Common  
25 Atmosphere" and a column for over five years in the  
26 Kincardine Independent.

1           In respect to winds -- the impacts of wind speed  
2           on dust, I have presented a paper on verification of  
3           open source fugitive emission estimates.

4           THE COURT REPORTER:           I'm sorry. I'm sorry. I'm  
5           having a hard time hearing you.

6    A    DR. YOUNG:                    I'm sorry. I -- I don't know  
7           quite what to do here. I've got a headset on. It's  
8           supposed to be state of the art.

9           MS. ARRUDA:                Mr. Young, it's Elaine Arruda,  
10          the hearing coordinator. I'm wondering -- beside the  
11          microphone icon in Zoom, there's a little up arrow.  
12          I'm wondering if you can click that and go into your  
13          audio settings.

14         DR. YOUNG:                    Sure.

15         MS. ARRUDA:                And check the input volume for  
16          your microphone, and if it's low, try to turn that up.

17         DR. YOUNG:                    Where do I start? "Audio  
18          Settings"?

19         MS. ARRUDA:                Yeah. And then the second  
20          sort of -- on the right-hand side, there should be  
21          something "microphone", and then there should be "input  
22          level volume" and a little slider there.

23         DR. YOUNG:                    "Input volume", yes, there is.  
24          I see it.

25         MS. ARRUDA:                See if you can turn that up.

26         DR. YOUNG:                    No, it appears I cannot.

1 MS. ARRUDA: Oh, okay. Can you tell me  
2 what your mic says? Is it -- is the side --

3 DR. YOUNG: It says, "microphone array,  
4 Realtek high-definition audio", and it's giving me an  
5 input level which is about halfway up, and the volume  
6 is about halfway up.

7 MS. ARRUDA: Yeah. I'm just wondering, you  
8 can't turn -- you can't slide that little slider --

9 DR. YOUNG: No.

10 MS. ARRUDA: -- on the volume?

11 DR. YOUNG: It doesn't seem to want to  
12 slide at all.

13 MS. ARRUDA: Okay.

14 MR. AGUDELO: Dr. Young, Elaine, this is  
15 Cesar Agudelo speaking. Dr. Young, if you click on  
16 "automatic" -- there's a box there that says  
17 "automatically adjust my volume".

18 DR. YOUNG: Yes.

19 MR. AGUDELO: If you unclick that so it's  
20 not checked --

21 DR. YOUNG: There we go.

22 MS. ARRUDA: Okay. You should be able to  
23 turn it up.

24 DR. YOUNG: Is that better now?

25 MS. ARRUDA: Maybe talk a bit more.

26 DR. YOUNG: Want it on (INDISCERNIBLE).

1 MS. ARRUDA: Still very muffled.

2 Q MR. FITCH: It's a bit muffled, yeah.

3 Well, I don't know what we can do. Why don't we carry  
4 on, and, Dr. Young, you're just going to have to  
5 concentrate on speaking slowly and enunciating to the  
6 best of your ability.

7 I think you were just telling us about a paper  
8 that you presented related to the impacts of wind speed  
9 on dust.

10 A Correct. That was in 1978 to the APCA meeting, and it  
11 was called "Verification of Open Source Fugitive  
12 Emission Estimates".

13 In 1980 I presented a paper on climatological wind  
14 speed profile relationships in Canada to the 15 Air  
15 Congress.

16 In 1982 I prepared an NRC paper on the effects of  
17 aerosols on atmospheric processes.

18 Q I take it NRC is the National Research Council?

19 A Yes, it is.

20 I have advised pit and quarry clients on dust  
21 control during windy conditions.

22 I have advised on the potential for and impacts of  
23 wind energy development --

24 THE COURT REPORTER: I'm sorry. I'm sorry. I  
25 missed. "Potential for"?

26 A DR. YOUNG: I have advised on the

1 potential for and the impacts of wind energy  
2 development.

3 And most recently I've undertaken many forensic  
4 meteorology studies and examined the effects on  
5 atmospheric parameters on weather-related accidents.

6 Q MR. FITCH: Thank you, Dr. Young. I'm  
7 sorry it turned into such a trial.

8 Will you now please provide the Hearing Panel with  
9 a summary of your written evidence?

10 A Thank you, Mr. Fitch.

11 Good morning, Mr. Chairman and Panel Members.

12 My examination looked at whether or not high wind  
13 speeds such as are seen in Chinooks have been examined  
14 correctly in the air quality assessment done for this  
15 project.

16 My assessment is that there was no serious  
17 consideration of high wind speeds with respect to dust.  
18 I have based this on the proponent's air quality  
19 assessment report and its replies to a number of  
20 information requests.

21 My first concern is that there seems to be a lack  
22 of understanding in the air quality assessment about  
23 the difference between gas dispersion and dust  
24 dispersion.

25 In Addendum Number 11, reference is made to the  
26 general equation 'C' is equal to 'Q' over 'U' for

1 dispersion which applies to both gases and dust.

2 Q Okay. So before you go on, Dr. Young.

3 MR. FITCH: Zoom Host, can we pull up  
4 Addendum 11, which should be Registry Document 313, and  
5 go to PDF page 10, towards --

6 Q MR. FITCH: So I'm looking at the bottom  
7 of the paragraph there, Dr. Young, and this is a  
8 preamble to an IR from the JRP, and it talks about --  
9 if we -- I think it's the second or third sentence, it  
10 states: (as read)

11 Benga again referenced the inverse  
12 relationship of 'C' equals 'Q' over 'U' --

13 MR. FITCH: No. Yeah, that's good. Thank  
14 you.

15 Q MR. FITCH: (as read)  
16 -- which suggests that the concentration of  
17 dust will decrease with increased wind speed.

18 Sir, is that the reference you mean?

19 A DR. YOUNG: Yes, it is.

20 Q Okay. Please proceed.

21 A This equation basically says that concentration of a  
22 pollutant at any point downwind is a function of the  
23 emission rate, 'Q', and the wind speed, 'U'.

24 For gases, the emission rate is a measure or an  
25 estimated quantity based on conservation of mass  
26 principles and is independent of wind speed. This

1 means that for gases, an increase in wind speed would  
2 result in a decrease in concentration downwind.

3 For windblown dust particles, emission rate is a  
4 function of wind speeds. In general, erosion of dust  
5 is proportional to wind speed to the third power.

6 THE COURT REPORTER: I'm sorry. "A third power"?

7 A DR. YOUNG: Yes.

8 If you substitute 'UQ' for 'Q' in the equation,  
9 you will find that 'C' is then proportional to wind  
10 speed squared. That is the concentration of dust at  
11 any point downwind increases through the square of the  
12 wind speed.

13 Put simply, an increase in wind speed will result  
14 in an increase in dust, whereas -- an increase in dust  
15 emissions, whereas the air quality assessment in  
16 Benga's own reply that was shown on the screen suggests  
17 the opposite.

18 Q Thank you.

19 A My second concern is the appropriateness of the  
20 equations used by the USEPA and others to estimate dust  
21 emissions.

22 Q Sir, before you carry on.

23 MR. FITCH: Zoom Host, can we pull up  
24 Registry Document 42, Consultant Report 1A, at PDF  
25 page 193.

26 Q MR. FITCH: Dr. Young, this is the -- I

1 take it this is the equation you just referred to?

2 A DR. YOUNG: Yes, it is.

3 Q All right. Carry on, please.

4 A This equation works well for estimating emissions over  
5 a longer period, like a year, that can underestimate  
6 dust emissions for an hour or a day because it -- based  
7 on the frequency of winds above a threshold speed  
8 rather than the actual wind speed.

9 This approach does not recognize an increase in  
10 dust amounts to higher speeds, so the fact that the  
11 proponent has used 'F' equal to 100 percent will only  
12 be conservative for total dust generated over a year,  
13 but the method does not give an indication of just how  
14 much dust is generated for any shorter period.

15 Q Okay. Thank you, sir.

16 MR. FITCH: Now, Zoom Host, if we can go  
17 to the next page in the same document, so that should  
18 be PDF page 194, and we're looking for Table A4-4.  
19 There we go.

20 Q MR. FITCH: Sorry. Go ahead, sir.

21 A DR. YOUNG: Looking at this work, I -- I  
22 used the Beaver Mines' hourly observing station data to  
23 try to reproduce what the proponent had done. I was  
24 able to approximately match the maximum daily PM 10  
25 emission amounts shown in Table A4-4 of the air quality  
26 report. So that would be in this table, the second row

1 from the bottom, be 527 kilograms on a 24-hour day.

2 I estimated the maximum daily emissions to be  
3 495 kilograms versus the proponent's prediction of  
4 527 per PM 10.

5 What this shows for PM 10 is just that my analysis  
6 of emissions approximately matches their emission  
7 numbers for the worst day based on the last 12 months  
8 of (AUDIO FEED LOST).

9 THE COURT REPORTER: I'm sorry. You have to --  
10 after -- you have to repeat that, after "worst day".

11 A DR. YOUNG: Matches their emission numbers  
12 for the worst day based on the last 12 months of  
13 observed data quoted from Beaver Mines.

14 But what my analysis also shows is that the daily  
15 maximum emissions can range from as high as 723 to as  
16 low as 231 kilograms in a single 12-month period.  
17 Emissions of 723 kilograms per day could mean at least  
18 a 37 percent increase in concentration of dust on the  
19 worst day above what the proponent has calculated.  
20 This suggests to me that the proponent has not looked  
21 at the worst case.

22 MR. FITCH: Zoom Host, can we go back to  
23 PDF 193? So just the preceding page. And that --  
24 that's good. We want to look at the bottom paragraph.  
25 There we go.

26 Q MR. FITCH: Thank you, Dr. Young. Carry

1 on.

2 A DR. YOUNG: My calculations are based on  
3 the proponent's estimate of open disturbed areas  
4 totalling 35 hectares. I listened to Mr. Rudolph's  
5 discussion of this issue during cross-examination and  
6 would say that he did not make a strong argument for  
7 the figure of 35 hectares being a reasonable worst-case  
8 scenario. This is an important parameter because if it  
9 is an error, it has a direct relationship to emissions.  
10 If it is too small by saying "50 percent", then  
11 emissions would increase by 50 percent.

12 Q Thank you, sir.

13 MR. FITCH: Now, Zoom Host, can we please  
14 pull up Exhibit 911.

15 Q MR. FITCH: So this is the Ono and Weaver  
16 paper on dust emissions from Owens Lake. Dr. Young, do  
17 you want to carry on?

18 A Yes. This paper reinforces my belief that the USEPA  
19 equation, Number 1, does not tell us what emissions  
20 will be on the actual windiest day; and, Number 2, it  
21 under-predicts emissions at high wind speeds.  
22 Therefore, the use of the standard equation in this  
23 case will underestimate emissions during a Chinook  
24 wind.

25 Q Thank you.

26 A My third concern is the data presented from the two

1 on-site monitoring stations.

2 MR. FITCH: Zoom Host, can we now go  
3 to Registry Document 251, which should be the tenth  
4 addendum, PDF page 24, and we're looking for  
5 Table 1.5-2. There we go.

6 Q MR. FITCH: Dr. Young.

7 A DR. YOUNG: Thank you.

8 I have a couple of concerns with this data.  
9 First, the proponent's measurements were only made at a  
10 height of 2 metres, not the standard 10 metres. If you  
11 look at the Beaver Mines data, which is at a standard  
12 10-metre height, you will see wind gusts as high as  
13 60 to 97 kilometres per hour over the past 12 months.

14 In addition, I note that monitoring from the  
15 Environment Canada Crowsnest station just this month  
16 shows maximum wind speeds of 91 and 97 kilometres per  
17 hour on two different days, which leaves me concerned  
18 about the representativeness of the on-site data.

19 Q So, Dr. Young, just before you carry on.

20 MR. FITCH: Zoom Host, can we call up  
21 Exhibit 914, please.

22 Q MR. FITCH: So, Dr. Young, you just  
23 mentioned that monitoring from the Environment Canada  
24 Crowsnest station just this month shows maximum wind  
25 speeds of 91 and 97 kilometres per hour on two days. I  
26 take it you're referring to the data that's contained

1 in this document, which is Exhibit 914?

2 A Yes, I am. I'm looking at the column on the right-hand  
3 side, and I can't quite see it because it ...

4 Move to the right a little bit, please. Okay.

5 Well, underneath all the individual, you know,  
6 pictures of people there are the numbers that I was  
7 referring to.

8 Q Right. So we see, for November 3rd, a maximum gust  
9 speed of 91 kilometres per hour; correct?

10 A I can't see that on my screen, sir. Sorry.

11 Q Okay. Anyways, it's in evidence. That's fine.

12 A Okay. I've got it.

13 Q Yeah. And then on November 5th, 97 kilometres per  
14 hour; correct?

15 A Yeah.

16 Q Okay. Can you carry on, then?

17 A My -- my second concern about the on-site monitoring is  
18 that a typical mon -- meteorological representation of  
19 a site requires a minimum of 75 percent of the  
20 available hours in each season to be gathered to ensure  
21 the data is representative of the site.

22 Here we have only two to three months of data from  
23 June through October in total, and it's only from one  
24 season. We know from the Beaver Mines site that the  
25 peak winds occur in the period November through  
26 January, so even the peak period has not been assessed

1 on the proponent's site.

2 While the proponent says that the monitoring data  
3 was not used in the model assessment, it has been used  
4 to make conclusions to this Panel about the absence of  
5 high winds -- high wind speeds on the site.

6 Q All right.

7 MR. FITCH: And, Zoom Host, can we go back  
8 to Registry Document 251, so that's Addendum 10, and go  
9 to PDF page 19.

10 Q MR. FITCH: So, Dr. Young, I see reference  
11 there to Benga noting that one-hour wind speeds in the  
12 range of 89 to 102 kilometres per hour have not been  
13 recorded at the four stations during the period  
14 examined. So that's your concern, that Benga is  
15 stating that high wind speeds have not been recorded  
16 on-site?

17 A DR. YOUNG: That's correct.

18 Q Okay. Carry on, please.

19 A So as you can see, Benga has reported that high wind  
20 speeds have not been recorded on-site, which is  
21 certainly at odds with the other observations in the  
22 same area, as well as the Chinook climatology in this  
23 area which suggests 20 to 35 days of Chinook winds each  
24 year.

25 Q Thank you, sir.

26 A In summary, my opinion is that high wind speeds

1 primarily due to Chinooks have not been considered  
2 carefully enough and will almost certainly result in  
3 a -- higher-than-predicted dust concentrations,  
4 37 percent or greater, downwind of the proposed  
5 facility.

6 Q Thank you, Dr. Young. And I appreciate you taking care  
7 to speak slowly and clearly.

8 MR. FITCH: So that concludes Dr. Young's  
9 direct evidence, Mr. Chair.

10 I'm now going to turn to the other member of our  
11 witness panel this morning, which is Dr. John Dennis.

12 Dr. Dennis, are you with us? John? I know he  
13 was -- I see him. There he is.

14 DR. DENNIS: Can you repeat that, please.  
15 I was just -- I just stepped away from my office.

16 MR. FITCH: No. That's okay.

17 So, Mr. Chair, the second member of the LLG's  
18 witness panel this morning is Dr. John Dennis, who you  
19 can now see on the screen.

20 Madam Court Reporter, I ask that Dr. Dennis be  
21 either sworn or affirmed.

22 JOHN DENNIS, Affirmed

23 Q MR. FITCH: Thank you, Dr. Dennis.

24 Can you confirm that you were retained by the  
25 Livingstone Landowners Group to review the human health  
26 risk assessment done for the Grassy Mountain

1 Coal Project?

2 A DR. DENNIS: Yes.

3 Q And, sir, can you confirm that you prepared a report  
4 titled "Review of Human Health Risk Assessment,  
5 Benga Mining, Grassy Mountain Coal Project"?

6 A Yes.

7 MR. FITCH: And, Mr. Chair, I note for  
8 the record that the report is found in Registry  
9 Document 552, starting at PDF page 64.

10 Q MR. FITCH: Dr. Dennis, can you confirm  
11 that your report was prepared by you or under your  
12 direction?

13 A Yes, prepared by me.

14 Q Thank you.

15 And do you have any corrections or amendments you  
16 would like to make to your report?

17 A I don't.

18 Q Okay. Do you report your -- sorry. Do you adopt your  
19 report as your evidence in this proceeding?

20 A I do.

21 Q Thank you.

22 Sir, can you confirm that you acknowledge as an  
23 independent expert witness that you are under a duty to  
24 give opinion evidence that is fair, objective, and  
25 nonpartisan?

26 A I do.

1 Q Thank you.

2 A Yes.

3 MR. FITCH: Mr. Chair, Dr. Dennis's  
4 curriculum vitae is attached as Appendix A to his  
5 report, Registry Document 552, starting at PDF page 80.

6 Q MR. FITCH: But for the purposes of today,  
7 Dr. Dennis, I will ask you simply to provide a brief  
8 overview of your credentials.

9 A Thank you, Mr. Fitch.

10 And before I begin, I hope I don't have the same  
11 technical issues some of the other witnesses have had.  
12 I do have some technology to help me speak slower, and  
13 this was Mr. Fitch's idea, so there's a reminder on my  
14 computer. If that fails, I have another piece of  
15 support to talk even slower.

16 But if I don't speak too -- slow enough and  
17 clearly enough, and I appreciate the -- the pains the  
18 court reporter has, please interrupt me, and I will try  
19 and do better.

20 My basic background from my education is a  
21 bachelor in biochemistry. I took that in Canada. I  
22 then, when I was a young man, moved to England and did  
23 a master's in industrial hygiene, followed by a PhD in  
24 medicine at the University of Newcastle's medical  
25 school.

26 I stayed in England for much of my working career.

1 For 20 years I was a professor. I taught pollution and  
2 health risk assessment; I supervised PhD students;  
3 taught master's and bachelor's programs in pollution  
4 and health, mainly occupational health, so the -- the  
5 exposure in the workplace and the diseases of the  
6 workplace and risk assessment there.

7 And -- and while I was there, I did consulting  
8 work or advisory work to the World Health Organization,  
9 to the United Nations, to the European Respiratory  
10 Society. These were fairly multi-year projects that I  
11 was involved with. I was exposed to a variety of  
12 pollution and health issues. I was one of the members  
13 of the British -- (AUDIO FEED LOST).

14 THE COURT REPORTER: I'm sorry. You broke up --  
15 sorry. You broke up there. I'm sorry. You broke up.  
16 "One of the members of"?

17 A DR. DENNIS: Oh, the British Occupational  
18 Hygiene Society which is a UK body that governs health  
19 and safety, occupational hygiene in UK industry.

20 There we were involved in advising on what  
21 exposure standards needed to be revised, what  
22 information should go into that revision, and sort of  
23 we -- talking about risk assessment at a very high,  
24 national level. These -- that -- that work -- the work  
25 in my university teaching and doing research, I think,  
26 gave me a good background in pollution and health risk

1 assessment.

2 And then after 20 years, I moved to Canada. I  
3 settled in Alberta. I set up a consultancy company. I  
4 needed to get my -- my -- I wanted to raise my kids in  
5 Canada; that's why we moved away from the UK.

6 And for the last 15 years, I have been running a  
7 biotech company with an aerosol -- aerosol aspect in  
8 respiratory disease, but much of my time has been  
9 involved in doing pollution and health risk assessment,  
10 environmental impact assessment reviews in the oil  
11 sands, from -- for power lines, for refineries. I'm  
12 fairly familiar with the Canadian and the Albertan  
13 environmental legislation and practices. And so I  
14 welcome the opportunity to be here and speaking to you.

15 Q MR. FITCH: Thank you, Dr. Dennis.

16 Now, you have prepared a PowerPoint presentation  
17 to guide your testimony this morning.

18 MR. FITCH: Zoom Host, that's Exhibit 935.  
19 If we can call that up.

20 Q MR. FITCH: All right. Dr. Dennis, do you  
21 want to start your presentation?

22 A Yeah, please.

23 This is a -- really just a -- the -- obviously the  
24 title -- the -- the -- the -- the title page. I'm  
25 going to be looking at the environmental impact  
26 assessment. Specifically I'm looking at the human

1 health risk assessment within it.

2 Next slide, please.

3 We have been listening to the hearing, and I've  
4 been sort of butterflying into the hearing proceedings  
5 over the course of the last weeks. I know and  
6 everybody knows that the EIA covers many topics.  
7 I'm -- I'm really only looking at the risks to human  
8 health and the human health assessment part of it,  
9 though I've skimmed on the air quality reports and some  
10 other aspects of the EIA, but I'm focusing on human  
11 health.

12 I reviewed the human health risk assessment -- the  
13 HHRA -- sections of the environmental impact  
14 assessment, as well as published literature, which  
15 isn't included in the EIA, which I consider to be  
16 highly relevant to the discussion on potential risks  
17 from Grassy Mountain.

18 And my main concern, which I'll be coming to  
19 towards the end of this short presentation, is that the  
20 project EIA does not address a large body of literature  
21 which has reported health issues associated with  
22 mountaintop mining practices, and this is of existing  
23 epidemiology that really should be in front of the  
24 Panel and should be considered as part of the process.

25 Next slide, please.

26 This is a -- a slide of the processes that the --

1           Benga has used to estimate the risk to human health.  
2           The schematic and -- and -- to the right is the -- I  
3           took that from the EIA. I think everybody has seen it  
4           in the EIA. All the arrows show the transmission paths  
5           for pollutants.

6           So starting at the left, you have a mine. The  
7           mine emits chemicals of concern to the air, to the  
8           water, to the soil. It deposits in the air and the  
9           water and the -- it deposits in the -- in the water and  
10          the soil. It may go into biota. It may be transformed  
11          during the practices. It may move to receptor sites,  
12          and humans and animals are exposed to the pollutants.

13          That's how the emissions are modelled,  
14          mathematically modelled. They're identified going to  
15          the bullet points on the left-hand side of the screen.  
16          The -- the nature and concentration of emissions are  
17          guesstimated based on prior experience and known  
18          engineering and -- and chemical process. They are  
19          mathematically modelled to look at the dispersion, the  
20          dilution of these pollutants as they move across the  
21          landscape. They are estimated as to what kind of  
22          concentrations will be deposited at receptor sites and  
23          community and recreational areas in and around the --  
24          the region, and (AUDIO FEED LOST) --

25          THE COURT REPORTER:            I'm sorry. You cut out.

26          Q    DR. DENNIS:                -- humans are expected --

1 THE COURT REPORTER: I'm sorry. You cut out.

2 Q MR. FITCH: Dr. Dennis, you sort of cut  
3 out as you were addressing the fourth bullet there.

4 A DR. DENNIS: The modelled numbers are  
5 compared to estimated safe doses that are established  
6 by regulatory bodies, safe exposure limits. If the  
7 model value is lower than the safe exposure limit,  
8 there's no risk; if it's higher, there's risk; if it's  
9 the same, it's red-flagged.

10 So in the risk assessment process of hazard  
11 quotient -- I heard Health Canada mention this  
12 yesterday -- hazard quotients is 1; it's right on the  
13 edge of being an issue. I heard the preference for .2.  
14 But when you have a -- a level that's near the -- a  
15 predicted level that's near the established exposure  
16 level, then that flags up the need for further  
17 refinement of the model, some reevaluation of  
18 assumptions that might underlie the model, perhaps the  
19 removal of some conservative parts of those assumptions  
20 to see if the -- it's reasonable to get the estimated  
21 number nearer the -- the accepted exposure value.

22 Next slide, please.

23 The discussions that have gone on in the hearing  
24 have talked about some of the hazard quotients and  
25 cancer risks that have been derived from the project.  
26 I don't want to spend too much time talking about the

1 detailed results of the human health risk assessment  
2 other than to say it's a fairly linear and standard  
3 approach to doing a human health risk assessment using  
4 this process.

5 But the basic conclusion of the risk assessment  
6 from Benga is that the Grassy Mountain Coal Project  
7 will have no impact, no significant health impact, or  
8 it's not expected to have any significant health impact  
9 to surrounding community members, to people living  
10 around -- in the region of the mine.

11 And there are a number of areas that this is  
12 expressed within the report, but this is one of the  
13 cut-and-pastes from the EIA, from the human health risk  
14 assessment, which I think has been tabled and discussed  
15 before. A conclusion of no impact.

16 Next slide, please.

17 I have a -- problems; I have concerns with the  
18 conclusion of no significant health impact based on  
19 what I know about the complexities of how to assess  
20 risk and linearity and limitations of the report.  
21 There are many uncertainties and complexities inherent  
22 in human health risk assessment. The EIA relies solely  
23 on modelled data. That's a very -- a very narrow scope  
24 of inquiry. The project does not address real-world  
25 health studies which have reported health impacts  
26 associated with similar mining operations. And I want

1 to bring the Panel's attention to those and share my  
2 opinion of why they're relevant.

3 Next slide, please.

4 So just to address those three points that I  
5 had -- I had introduced. The complexity I see of the  
6 multi-step human health risk assessment process,  
7 there's many steps involved. Each of them involves  
8 assumptions, guesstimates. Just going through these  
9 list of bullet points on the slide, we need to identify  
10 the chemical emissions and -- and all the chemical  
11 emissions, and -- and we may have a good idea of what  
12 they are. Sometimes we don't, but Benga seems to have  
13 a pretty good handle on that.

14 We need to -- to estimate the emission  
15 concentrations to air, land, and water. So how much of  
16 this material is coming out into air, land, and water?  
17 And in terms of atmospheric pollution, what particle  
18 size is it? Particle size is very important in terms  
19 of how it's transported in the atmosphere and how it's  
20 received by the human host and -- and in the  
21 environment.

22 The estimation of dilution rates as this -- these  
23 various pollutants move across the landscape. We just  
24 heard from Mr. Young -- Dr. Young who talked about the  
25 complexity of mathematically modelling high winds  
26 situations. And I've driven through the Crowsnest

1 Pass, and I know how windy it can get and how extreme  
2 the weather can be. And that might confound the  
3 application of most of the air modelling systems  
4 that -- et cetera, that -- that I've been associated  
5 with and -- and know a little bit about.

6 We need to estimate the amount of exposure, the  
7 dose, the how much -- how -- what volume of material  
8 (AUDIO FEED LOST).

9 THE COURT REPORTER: I'm sorry. You're cutting  
10 out.

11 A DR. DENNIS: -- it entailed --

12 THE COURT REPORTER: I'm sorry. I'm sorry.

13 Q MR. FITCH: Dr. Young [sic], you cut out  
14 during your discussion about dose.

15 A DR. DENNIS: Thank you.

16 And it's -- it's Dennis. Don't worry, Gavin.

17 Q Oh, sorry, Dr. Dennis. Yeah.

18 A Yeah.

19 Q My apologies.

20 A No problem.

21 We need to estimate the dose of exposure. Not as  
22 straightforward as the human health risk assessment  
23 might have you believe. It's complicated. Many  
24 factors associating it. It's a multi-step process.  
25 Once we've got that dose, we need to compare it to a  
26 safe level.

1           So let's talk about the safe -- safe level. How  
2 do we derive safe levels to chemicals? The most  
3 powerful is through epidemiological studies where human  
4 beings have been exposed to that pollutant and health  
5 effect is being seen. We often find those in the  
6 occupational setting. Workers in the occupational  
7 setting in particular industries are often exposed to  
8 fairly high levels of particular pollutants, and  
9 they're monitored by the health and safety processes  
10 within industry for compensation for other reasons. So  
11 we often derive our epidemiological human exposure  
12 studies from the work environment.

13           When we don't have human data, we have to rely on  
14 animal studies to guess what the toxicity is, to guess  
15 what that chemical -- how that might relate to human  
16 beings. And -- and sometimes there's no published  
17 information on particular chemicals. I've been  
18 involved with some of those in England. And when  
19 there's no established literature, you really have to  
20 guess. You -- sometimes if it's, say, a weird looking  
21 aldehyde, you -- you start using similar exposure  
22 limits to other aldehydes, hoping that there's nothing  
23 else strange going on, so you use what we call a  
24 "surrogate chemical".

25           We heard from Health Canada, and I've been aware  
26 of this for some years, that our standards for air

1 quality are not necessarily protective of health.  
2 They're -- they're guides to -- to -- to be ceiling  
3 exposures to what -- that we shouldn't be exposed past  
4 that. They're not "pollute up to" standards. Nobody  
5 is meant to be exposed to all those different chemicals  
6 up to the standard. I think you'd have a very  
7 individual -- very ill individual if -- if they were.  
8 They're -- they're guides.

9 Many of the exposure limits that we have, we can  
10 talk about them as being safe limits, but they're  
11 really -- many of them are intended to be, Well, we --  
12 we really want to keep the exposures as low as we can  
13 because we still have residual risk.

14 It gets really complicated when you're not just  
15 looking at exposure to one chemical but you're looking  
16 at exposure to two chemicals or three chemicals or five  
17 chemicals or ten chemicals, and invariably we are. It  
18 gets very complicated when we're looking at healthy  
19 people and extremely complicated when we're looking at  
20 ill people, people with respiratory problems. I think  
21 of 15 percent of the kids in -- in Alberta have asthma,  
22 about 8 percent of adults have asthma. They're  
23 particularly sensitive to a whole range of pollutants,  
24 and there are many other -- other illnesses that affect  
25 somebody's sensitivity to pollution. "Sensitivity" is  
26 the wrong word. Vulnerability.

1           There's potential synergism between chemicals. So  
2 if you have one chemical that's a respiratory irritant  
3 and another chemical that's a respiratory irritant, if  
4 you were exposed to both often, you might expect a -- a  
5 doubling of effect if the -- both of the units are  
6 exposure of 1; 1 plus 1 is 2.

7           Synergism is when one chemical, perhaps something  
8 that affects the functioning of the liver, is --  
9 presents to a human being and then another chemical  
10 comes along -- around, which normally the liver  
11 would -- would detoxify, but perhaps the liver's  
12 compromised, so you have an exposure to that chemical  
13 where 1 plus 1 is 3, and that's synergism. And that is  
14 not taken to [sic] account in the -- Benga's  
15 submission.

16           And on the -- on the -- on the back of all of  
17 that, we have ever-evolving understanding of the health  
18 impacts of pollution on healthy and compromised people.  
19 It's not like our exposure standards are staying still.  
20 They're continually being revised and reviewed as new  
21 literature comes up, as new understanding comes up, as  
22 new animal data comes forward, as a new understanding  
23 of exposure to mixtures comes forward. It's  
24 complicated.

25           We've seen in the past sort of paradigm shifts in  
26 our understanding. PCBs, they weren't a problem in the

1 '60s. They were a real problem by the time the '70s  
2 rolled up as evidence amounts to what the environmental  
3 impact is, what the health -- impact on health is. It  
4 takes a while for industry and government and the  
5 establishment to move past (AUDIO FEED LOST).

6 THE COURT REPORTER: I'm sorry. You are cutting  
7 out.

8 A DR. DENNIS: -- to the next. You see it in  
9 the PCBs I mentioned; you've seen it with asbestos.  
10 Sorry.

11 THE COURT REPORTER: I'm sorry. You cut out again.

12 A DR. DENNIS: We've seen it with PCBs,  
13 asbestos, lead, benzene, hexavalent chromium. The  
14 Erin Brockovich story that turned into a movie, became  
15 quite famous, a -- a soluble form of -- of chromium.  
16 There -- there -- that's an interesting example because  
17 chromium as a metal has various oxidative states. So  
18 as a pure metal, not terribly toxic. As a soluble  
19 metal in its -- as Chromium 6, very toxic;  
20 carcinogenic. As Chromium 3, not very toxic.

21 We worked with welders -- and my PhD was on  
22 welders and asthma -- where we saw welders who had  
23 become sensitized to chromium and stainless steel  
24 welding constrict the respiratory tract by turning and  
25 touching, with wet hands, a stainless steel tap. So  
26 they become very, very sensitive to -- to certain

1 pollutants. I'm digressing.

2 The point is: Paradigm shifts occur. It takes a  
3 while for the establishment to absorb the new  
4 understanding and move past that. Human health risk  
5 assessment is a complex process.

6 Next slide, please.

7 So Benga's human health risk assessment is narrow  
8 in scope. It relies solely on mathematical modelling,  
9 comparing some guesstimated values to published data.

10 Other bodies use a more holistic, more  
11 sophisticated, a more broad interpretation of health,  
12 and a more broad interpretation of how we should impact  
13 potential health from projects. It -- that process is  
14 often called "health impact assessment", "human health  
15 impact assessment", or "HIA". Health Canada supports  
16 that. The World Health Organization supports that.  
17 The US CDC and EPA support that process.

18 And in this process, you don't just rely on  
19 modelled data, but you certainly want to see that model  
20 data because it's a really good first pass at what  
21 pollutants might become a problem, but you also want to  
22 look at what other -- other information you've got  
23 available. And the most powerful information we can  
24 have available are assessments of the direct measures  
25 of health.

26 Is there -- if you've got an exposed human

1 population, has there been an increase in cancer  
2 incidents? Has there been increase in any other toxic  
3 aspect or illnesses in the community? As well as  
4 indirect measures of health. Do we have -- can we  
5 assess what blood concentrations are or changes in  
6 physiology of human tissues? We want to use whatever  
7 information we have available to feed into the  
8 understanding of what the impacts might be. We don't  
9 want to rely on one narrow scope of assessment.

10 Next slide, please.

11 We have that kind of information available. It  
12 wasn't addressed in the human health risk assessment of  
13 Benga's EIA. It wasn't addressed anywhere else in the  
14 EIA, to my knowledge. But in the northeast United  
15 States of America, there is a mountain chain, the  
16 Appalachian Mountains. It has a -- similar, I think,  
17 coal seams and certainly mining operations that we've  
18 seen proposed for Grassy Mountain. We've had  
19 mountaintop removal coal mining going on since the  
20 1960s. It accelerated from the 1990s to present. It's  
21 still going on. There's a very large population base,  
22 a lot of mines. And there's been many health studies  
23 associating living near, working in, being exposed to  
24 those mining operations with human health impacts.

25 Next slide.

26 There are the -- to my knowledge, around 30-plus

1 studies which have been published reporting health  
2 problems in these areas, and this is a chronological  
3 list of some of them. I don't want to go into any  
4 detail on any one of these papers. I can if people  
5 would like to. But perhaps starting in 2007 and -- and  
6 the -- the author of this report, Michael Hendryx, is  
7 one of the main authors in -- one of the main authors  
8 of this literature list and one of the -- one of the  
9 go-to gurus for health impact. He's a statistics  
10 epidemiologist, a professor in the States.

11 They looked at hospitalization patterns and  
12 published early indications that there might be an  
13 issue. They looked at health indicators of residents,  
14 third bullet point. Looked at mortality rates, how --  
15 what age do you die? How often do people die at  
16 certain age groups? And Number 4, looked at lung  
17 cancer (AUDIO FEED LOST).

18 THE COURT REPORTER: I'm sorry. You're cutting  
19 out. I'm sorry.

20 A DR. DENNIS: Thank you.

21 I will look at my Post-it even harder.

22 Q MR. FITCH: No. It's just, every now and  
23 again, your audio goes a bit wonky.

24 So you were on the four -- you were just  
25 mentioning lung cancer on that fourth point.

26 A Yeah. Let me just do -- just one break. I just want

1 to open a door and try and get a stronger signal. I  
2 did actually measure the strength of my signal this  
3 morning, so I think I'm thinking -- sitting in the best  
4 place, but if it cuts out again, I might move my  
5 computer.

6 The -- the fourth paper addresses lung cancer  
7 mortality; the fifth paper, heart and respiratory and  
8 kidney disease. These are looking at the disease rate  
9 in communities you would associate to being living near  
10 coal mining operations versus, perhaps, the state  
11 average or communities that are living distant from  
12 coal mining operations. Mortality, heart disease,  
13 cancer mortality, and health and quality of life, human  
14 cancer.

15 Next study -- next slide.

16 I'm going to show you some -- one single graph  
17 that summarizes one of the papers on this patient --  
18 Paper Number 13 on fetal birth weight and problems  
19 with -- with neonates. Health and quality of life,  
20 more birth defects, chronic cardiovascular disease,  
21 cancer rates, cancer mortality, adult tooth loss in  
22 Paper 21, drinking water violations.

23 And the next slide, please.

24 Depression, mental issues, respiratory symptoms.  
25 "COPD" is chronic obstructive pulmonary disease.  
26 Tumour formation. I'm just going through my

1 highlighted yellow flags. Blood inflammation, public  
2 health impacts, and syndromes, multiple in -- in --  
3 in -- illness syndromes. When the medical community  
4 doesn't really know what something is, they call it a  
5 "syndrome". It's a real health issue, but they don't  
6 really have any other handle, so they call it a  
7 "syndrome".

8 I want to say that these are -- these 30-odd  
9 papers here -- I was an academic. I've spent quite a  
10 lot of research money in my decades as being an  
11 academic. It's hard to attract research funding. I  
12 found it very hard to attract research funding. I  
13 probably got -- for every three or four grants I wrote,  
14 I got perhaps one, and then the reviewers would hassle  
15 me about some of the expenditure or some of its design.  
16 Obtaining money to do research is a peer-reviewed  
17 process. It's not easy. You are competing against  
18 your colleagues. Grant funders don't want to give away  
19 money for studies that are unmerited, that will -- will  
20 misguide the scientific community.

21 Once you've got the funding, you spend the money  
22 with colleagues, with a number of research students and  
23 other -- and other clinicians or epidemiologists,  
24 whoever is involved, and you seek to execute the  
25 objectives of the study. Then you publish the study,  
26 and you publish the study -- you are not publish -- if

1 you are not publishing studies in peer-reviewed  
2 journals where your colleagues are reviewing it and --  
3 and -- and improving the paper and bouncing the paper  
4 if it doesn't have integrity, you don't get -- you  
5 don't get more money for research. You have to have  
6 integrity in -- in the whole process.

7         So there's -- there's integrity in the process for  
8 writing the research grant in the first place, there's  
9 integrity in executing a research grant, and there's  
10 integrity in publishing a research grant.

11         I see these dozens of papers, and it leads me to  
12 conclude there's something going on in relation to the  
13 epidemiology of -- in terms of establishing health  
14 impact in coal mining operations.

15         Next slide, please.

16         Because I have not done this work, I don't know  
17 the academics who have done this work. I reached out  
18 to Michael Hendryx, who's a prof in the States --  
19 fairly busy guy now 'cause he's -- he's the head of his  
20 department -- to talk to him about -- on the -- on the  
21 phone to talk to him about what he thought about this  
22 decade of research, and he shared this view with me  
23 which I wanted to reproduce here. I include his --  
24 he -- he sent me an email, which I -- I -- I think is  
25 very valuable, and -- and a very seminal authoritative  
26 summary written by one of the -- one of the -- one of

1 the main authors of a number of these papers, and I put  
2 it in Appendix B of my report in its entirety.

3 The -- the summary view is that mountaintop  
4 removal, coal mining (AUDIO FEED LOST) --

5 THE COURT REPORTER: I'm sorry. You're cutting  
6 out.

7 Q MR. FITCH: Sorry, Dr. Dennis.

8 Dr. Dennis, just as you were starting your summary  
9 view, you cut out again.

10 A DR. DENNIS: I'm going to move and see if I  
11 can do a better job. Hopefully -- hopefully a  
12 different area of -- my location will improve it for  
13 you.

14 Can you hear me?

15 Q Yes.

16 A Okay. I hope this is better.

17 The -- the health problems that look to be  
18 associated with mountaintop removal are higher cancer  
19 rates, higher heart and -- and lung disease rates,  
20 higher kidney disease rates, higher rates of birth  
21 defects, and higher rates of impaired functioning --  
22 other higher lung functioning -- physiologic  
23 functioning due to health problems.

24 And that -- the pattern of these results suggest  
25 that they are not caused by confounding variables like  
26 age or smoking or the selection of a biased population

1 base. They're not -- they don't seem to be associated  
2 with obesity or underlying health occasions that the --  
3 the epidemiology has accounted for many of these  
4 confounding variables.

5 The health problems seem to be most severe in  
6 areas where mining is -- where the amount of mining is  
7 greatest, and it seems to be worsening in recent years,  
8 and they are present for men and well and children, and  
9 they reflect more than just occupational exposure.

10 Next slide, please.

11 Is this audio better? Is it clearer?

12 Q Yeah. So far it's -- so far so good. Why don't you  
13 carry on.

14 A Okay. Roger that.

15 The US government got involved a few years ago in  
16 the controversy and the public outcry around health  
17 effects with mountaintop mining. They commissioned a  
18 meta-analysis of the data. And this is one of the most  
19 powerful things that we can do. We do it in medicine a  
20 lot when we want to -- when we want to assess the  
21 effects of a particular drug or treatment -- a certain  
22 treatment approach, many published -- papers are  
23 published perhaps on one case, one patient, or a -- a  
24 few patients from a clinic, and -- but they're  
25 published in many different areas, in many different  
26 countries, so you can then assemble all that data and

1 do a metaanalysis of the paper. So you're not doing  
2 original research; you're reviewing, in a critical way,  
3 all the papers that have been published, and that's  
4 what the US government -- the US federal government  
5 decided to do with these 30-odd studies in the  
6 Appalachian Mountain areas which were reporting on  
7 human health issues. And that was published recently,  
8 in 2017, and it was titled "A Systematic Review of  
9 Community Health Impacts of Mountaintop Removal  
10 Mining".

11 I thought this was another important paper to have  
12 in front of the Panel, so I reproduced it in my [sic]  
13 entirety in Appendix C. It was nine pages of academic  
14 paper if people would like to look at some of the  
15 detail. I won't talk about a lot of the detail except  
16 for one example figure.

17 Next slide, please.

18 Ah. No, I won't. First I'll introduce how they  
19 did it. What the -- a group of scientists  
20 commissioned -- federal scientists who -- and probably  
21 co-opted academic scientists as part of this work, what  
22 they had -- they did was they captured, through  
23 literature searches, library literature searches, over  
24 3,000 studies, and they whittled these studies down to  
25 include the 33 most relevant human health studies that  
26 looked at health aspects of humans associated with coal

1 mining. 29 of these studies were reported from -- in  
2 communities and 4 were occupational, i.e., the  
3 workforce.

4 So each paper, and there's 33 that they capture,  
5 was -- was reviewed by, first, one -- in parallel, one  
6 person and then another person. These were qualified  
7 reviewers, and they weren't sharing their results.  
8 They were reviewing each paper according to some strict  
9 criteria to assess the -- the viability of the results,  
10 to assess any potential bias in the paper, the  
11 weaknesses of the study, the integrity of the  
12 conclusions, the appropriateness of the methods,  
13 et cetera.

14 If -- at the end, they had a score sheet. If they  
15 had a discrepancy between the two reviewers, then a  
16 third person was brought in. So this is a very, very  
17 powerful way of reviewing a mass of papers that are in  
18 the literature to see if there's a consistent message  
19 coming out.

20 Next slide, please.

21 So this is one graph I did want to show you. This  
22 one is really focusing on the Ahem publication of 2011  
23 that looked at birth defects in communities associated  
24 with MTR mining. So the way that this -- these results  
25 were being expressed in the paper and were, that you  
26 have (AUDIO FEED LOST).

1 THE COURT REPORTER: I'm sorry.

2 Q MR. FITCH: Sorry, Dr. Dennis. You cut  
3 out again there just as you started to talk about the  
4 graph that we can see on -- on your slide.

5 A DR. DENNIS: Right. The --

6 Q Can you start again?

7 A Yeah. The -- the -- the bottom black dots show a --  
8 a -- a measure of 1. This is the kind of -- a unit --  
9 an adjusted prevalence ratio of 1 means you don't have  
10 an increased level of disease or decreased level of  
11 disease. The greens [sic] triangle show the prevalence  
12 of certain birth defects in communities associated with  
13 coal mining operations, and the bar on either side of  
14 it, those -- that bracketed bar, is the 95 percent  
15 confidence interval. So we're all, you know, working  
16 with stats. We know there's variability, so we're  
17 looking at mean values and the spread of that mean  
18 value.

19 My Stats 101 understanding which can get -- is  
20 that if the -- if the confidence interval don't overlap  
21 with your line of identity, you have significant  
22 difference. And most of these reported birth defects  
23 show that we do have an increased health impact, an  
24 increased number of birth defects.

25 So if you looked at the first one, any con -- the  
26 first green triangle, any congenital abnormality, the

1 value looks like it's about 1 and a half. Adjust the  
2 prevalent ratio of 1, the next vertical white line is  
3 2, so it's about 1 and a half. And sometimes -- going  
4 down the list. The fourth one down, "Circulatory,  
5 Respiratory, Congenital Abnormalities", looks like the  
6 value is 3, so three times higher.

7 That was one of the papers that was reviewed by  
8 the US federal group. It looked like -- it looks like,  
9 to me, there is something going on. There is  
10 weaknesses with every paper. One of the main  
11 weaknesses that the federal government found was the  
12 lack of exposure data.

13 If you go to the next slide, please.

14 Summary of the analysis study. It did identify  
15 over 30 studies associating human health impacts with  
16 mining. MTR -- mountaintop removal -- mining  
17 recognized that each of the studies contained  
18 limitations. Most of the studies didn't have very good  
19 exposure data. It's really expensive and very  
20 difficult to collect in an epidemiologic study, health  
21 study, exposure data. It probably would cost you -- I  
22 don't know -- five to ten times more than the actual  
23 clinical work in doing it at least. And so that was  
24 the main limitation of the study, that they were often  
25 retrospective studies looking at where do you live and  
26 what kind of health impacts are you seeing in those

1 hospitals, those clinics, in that population near where  
2 you live.

3 But their -- the -- the -- the federal government  
4 concluded, Hey, we can't say with any certainty -- we  
5 can't say with any certainty, but it looks like there's  
6 something going on. And there's been no unequivocal  
7 study to -- yet. But these are relative --

8 Q So, Doctor --

9 A Yes.

10 Q Dr. Dennis, before we move on to the next slide, the  
11 author of Benga's human health risk assessment,  
12 Mr. Mitchell, talked a little bit during his testimony  
13 about this -- these -- this evidence, if I can call it  
14 that, from -- from Appalachia, and he said,  
15 essentially, there's just so much noise in these  
16 studies that they couldn't really come up with anything  
17 conclusive. Can you comment on that? Do you agree?

18 A No. Every study will have limitations, and any one of  
19 these studies, in isolation, you could say, Well, it's  
20 just the one study. There's just too many of them.  
21 They're all showing the same thing. I've been involved  
22 in designing epidemiological studies. On my PhD, we  
23 did the epidemiology of asthma in welders. You know,  
24 what -- does welding cause asthma? Took us three  
25 years. We spent 2-and-a-half-million pounds in 1987.  
26 And we -- and we -- and we didn't show it. It was a

1 negative result. But we really would have benefited  
2 for -- having more people in our study.

3 It's hard to do epidemiology and get an  
4 unequivocal result. There is noise associated with --  
5 with every study.

6 Academics don't want to wander into the world and  
7 create problems when there isn't one. I don't know any  
8 academics that do that. There are too many authors  
9 involved in these various studies, too many coauthors,  
10 too many granting bodies, too many journal -- journals  
11 publishing and reviewing the data to tell me that these  
12 studies should be dismissed.

13 So for anybody to say, Oh, there's just too much  
14 noise, I would love to have that debate. I think if  
15 that's a solid view and it can be defended, let's have  
16 the debate. But these studies weren't included at all  
17 in the human health -- human health risk assessment.  
18 I think that's an oversight. I think that these  
19 studies are highly relevant. I think they are the  
20 definitive -- definitive human health data that we  
21 have. Does mountaintop removal processes impact the  
22 health of the population living near them? How else  
23 are you going to collect the data?

24 I think modelling only is a -- is a long reach and  
25 a very limited scoped way of trying to assess that  
26 health effect. This is -- this is the gold standards,

1 and there's too many of these -- there's too many of  
2 these studies to dismiss.

3 So that's my response, Mr. Fitch. They [sic] are  
4 just too many of these studies all pointing in the same  
5 direction. Each of them does have limitation. Each of  
6 them has noise. All epidemiology does. But that's the  
7 game that we play in trying to understand how pollution  
8 impacts health.

9 Q All right. Thank you, sir.

10 A Next slide, please.

11 I want to talk a little bit about the  
12 precautionary principle. I saw it mentioned again and  
13 again and again in the EIA and certainly in the human  
14 health risk assessment. The precautionary principle  
15 says, Hey, because we don't really know everything,  
16 because this is kind of complicated, because we don't  
17 know how mixtures behave and what the exposure really  
18 is, let's put in layers of protection to our assessment  
19 so as we do the screening, we can flag up things that  
20 are a problem. If there's a problem, we can maybe  
21 remove some of those layers of protection and -- and  
22 evaluate it further, but that's a great way of  
23 screening chemicals.

24 You don't want to hurt people if you can avoid it,  
25 but you also want to progress and -- and get on with  
26 business of life. Okay. In [sic] the precautionary

1 principle was applied here, I would think that these  
2 health studies should be included in the assessment.  
3 They should be considered, debated, refuted if it's  
4 justified, but they should be included in the  
5 assessment. To ignore them, to leave them out, to keep  
6 your scope narrow on modelled assessment and ignore  
7 this gold standard epidemiological work I think is  
8 crazy.

9 I think that we should assume that there -- these  
10 studies may have merit until the time that we can  
11 dismiss them and say, Hey, no, they don't have merit  
12 for these reasons. There's been a bigger study done,  
13 or other reviewers have found problems with these  
14 studies so that the -- the -- the conclusion should be  
15 dismissed.

16 But to my mind, they're valid studies, they were  
17 done with integrity, they were published with  
18 integrity, they have a message to say, and I think we  
19 should pay attention to it. This is an area of the  
20 world that has the most mountaintop mine -- mountaintop  
21 removal mining on coal that I know of. It's a huge  
22 pollution base. It's the best data that we have. It's  
23 good epidemiology showing that there are health issues.  
24 And I don't know -- we don't know and I don't know what  
25 environmental constraints those mining operations have.  
26 That hasn't been examined at what time -- at mining

1 operations in the States.

2 Next slide, please.

3 So in summary, what I've been saying, just to go  
4 through these bullet points, that in the project EIA,  
5 it concludes that health impacts are not expected and  
6 based its conclusion of no impact on modelled data. It  
7 does not take into account published human studies  
8 reporting health impacts from similar existing  
9 operational mountaintop removal mining operations in  
10 the Appalachian area of the United States.

11 And there are many reasons why modelled data  
12 cannot predict with certainty human health impacts.  
13 I've listed some of them in my presentation. The human  
14 health risk assessment contained in the project EA  
15 presents only a partial picture. It doesn't -- does  
16 not mention nor take into account the plethora of  
17 available -- I would call it the "real-world human  
18 health studies" -- real-world human health studies  
19 associated with these mining operations.

20 And I think that the epidemiology that has been  
21 published associating mountaintop removal coal mining  
22 with health should be considered to be at least of  
23 equal, if not higher value than any modelled data of a  
24 mine that's not yet built.

25 And my job is to inform the Panel of my  
26 professional objective opinion of -- as a third party

1 as to -- with no stake in the game, like, is this -- is  
2 this human health risk assessment real? Is it a good  
3 one? It's certainly linear. I do believe it's limited  
4 in scope -- scope. I do believe the Panel should  
5 acknowledge, recognize there are -- there's other  
6 evidence available in the world that provides much more  
7 authoritative assessment of potential health impacts  
8 from these kind of mining operations rather than just  
9 modelled data alone.

10 And the next slide, please.

11 I just wanted to leave something more pleasant up.  
12 This is showing a -- one of -- a local -- picture of a  
13 local resident, father and son walking around, just to  
14 remind myself and everybody that we're talking about  
15 human health. What we're trying to do is protect the  
16 health of the population that live there. That --  
17 that's what we're about here. And we have to balance  
18 that up with economic development and all the other  
19 issues that are going on.

20 I think the Panel has -- has got a complex task to  
21 do. I wanted to make sure that they had at least all  
22 the -- another view of health that's not so linear and  
23 dismissal -- dismissive as the -- as -- as Benga's,  
24 There is no impact from this project. I suspect that's  
25 not the case. Thank you.

26 Q Thank you, Dr. Dennis.

1 MR. FITCH: Mr. Chair, that concludes the  
2 direct evidence of this witness panel. They are now --  
3 both Dr. Young and Dr. Dennis are now available for  
4 cross-examination by Benga and questions from other  
5 participants, including the Panel.

6 THE CHAIR: Okay. Thank you, Mr. Fitch.

7 Mr. Ignasiak or Mr. Brinker, does Benga have  
8 questions for this witness panel?

9 MR. BRINKER: Yes, we do, Mr. Chair.

10 THE CHAIR: Okay. I'm going to suggest  
11 that maybe we take our break now. I think staff were  
12 going to have a look at Dr. Young's audio settings and  
13 just see if there was anything further they could do  
14 just to ensure that he doesn't continue to experience  
15 issues when he's answering questions.

16 So let's take a 15-minute break now. It's 10:14,  
17 and we'll resume at 10:30. And if Mr. Young can stand  
18 by, staff are going to see if they can help with the  
19 audio settings.

20 MR. FITCH: Thank you, sir.

21 (ADJOURNMENT)

22 THE CHAIR: We're ready to go. So go  
23 ahead, Mr. Brinker.

24 Mr. Brinker Cross-examines Livingston Landowners Group

25 Q MR. BRINKER: Just to start, good morning,

26 Dr. Dennis and Dr. Young. Thank you for joining us

1           this morning. Can you hear me okay?

2    A    DR. DENNIS:                    I can.

3    Q    Okay. Perfect.

4           Dr. Young, can you hear me okay?

5    A    DR. YOUNG:                    Yes, I can. Can you hear me

6           all right?

7    Q    Yes, I can. Perfect.

8           So, Dr. Young, just a couple questions for you.

9           Dr. Young, you currently live and work in Ontario. Do

10          I have that right?

11   A    Yes, you do.

12   Q    Okay. I believe I saw in a form you attached to your

13          report in CIAR 552 that you work in Tiverton, Ontario.

14          Is that right?

15   A    That's correct. That's (AUDIO FEED LOST).

16   Q    Sorry. I think I've lost your audio there.

17          THE CHAIR:                    Yeah. Hold on a sec. I also

18          don't see the court reporter.

19          THE COURT REPORTER:         Sorry.

20          THE CHAIR:                    Did you catch that,

21          Madam Court Reporter? Were you there?

22          THE COURT REPORTER:         Yes.

23          THE CHAIR:                    Okay. Thank you.

24          MR. FITCH:                    I can't see --

25   Q    MR. BRINKER:                    Sorry, Dr. Young --

26          MR. FITCH:                    -- Dr. Young at this point.

1 MR. AGUDELO: I can see him, and I think his  
2 audio -- his video is streaming.

3 Dr. Young, can you speak for a second?

4 A DR. YOUNG: Yes. Hello. I'm here.

5 MR. AGUDELO: Okay. So can you see him now?

6 Q MR. BRINKER: Yeah, I see you, Dr. Young.

7 Sorry. I'll re-ask that last question. You  
8 just -- you glitched out a little bit there.

9 So you said you work currently in Tiverton,  
10 Ontario; is that right?

11 A Yes. That is where I am current living, and I'm trying  
12 to retire, so I'm not actually doing all that much  
13 work.

14 Q Okay. And looking at your CV in the Livingstone Group  
15 submission, I just want to get a handle on where you  
16 worked in the past. You did your PhD at the University  
17 of Waterloo in Kitchener, Ontario; is that right?

18 A That's correct.

19 Q Okay. And then you spent a couple years working in  
20 New Brunswick; is that -- is that also right?

21 A Sorry. You broke up there. I didn't quite catch that.

22 Q I'll repeat that, Dr. Young.

23 A You broke up there. I didn't hear your question.

24 Q I'll repeat my question now for you, Dr. Young.

25 So after you finished your PhD, you spent a couple  
26 years working in New Brunswick; is that correct?

1 A Yes. I -- I worked for Environment Canada for the  
2 first couple of years. Then I moved to (AUDIO FEED  
3 LOST).

4 Q Sorry, Dr. Young. I think you cut out there for a  
5 little bit. Could you repeat that?

6 A Yes. When I first graduated, I joined the --  
7 Environment Canada in their research group. I worked  
8 there for a couple of years. Then I went to  
9 Environment New Brunswick to run their air quality  
10 program. Then I came back to Ontario to join a  
11 consulting company, and then I went back to Environment  
12 Canada.

13 Q Okay. So since that time, have you worked primarily in  
14 Ontario?

15 A My -- I've been headquartered in Ontario, but I have  
16 worked on projects around the world.

17 Q Okay. So, Dr. Young, can you tell me when you were  
18 retained to put together the report on this project?

19 A Yes. I'd have to look it up to be sure, but it was  
20 within the last two to three months.

21 Q Okay. And did you have a chance to come to Alberta  
22 between the time you were retained and the time you  
23 completed your report?

24 A I did not.

25 Q Okay. When was the last time you were in Alberta?

26 A It was probably during my work career. I would guess

1 maybe ten years ago at the -- maybe even longer. I'm  
2 not sure.

3 Q Okay. Have you ever been to the Crowsnest Pass?

4 A I have not.

5 Q Okay. So you've never been on the project site?

6 A I have not been on the project site.

7 Q Okay. Those are all the questions I have for you,  
8 Dr. Young.

9 And I don't have anything for you, Dr. Dennis.

10 MR. BRINKER: So that's it for me,  
11 Mr. Chair.

12 THE CHAIR: Okay. Thank you, Mr. Brinker.

13 Ms. LaCasse or Ms. Kapel Holden, any questions for  
14 this panel?

15 MS. LACASSE: No, we don't have any  
16 questions, Mr. Chair. Thank you.

17 THE CHAIR: Okay. Thank you.

18 Mr. Lambrecht?

19 MR. LAMBRECHT: Mr. Chair, I have no questions  
20 for this panel, and I thank them for their evidence and  
21 participation in the Joint Review Panel process.

22 THE CHAIR: Okay. Thank you.

23 Mr. O'Gorman, any questions?

24 MR. O'GORMAN: Thank you, Mr. Chair. I do  
25 just have one question, and it's for Dr. Young.

26 Alberta Energy Regulator Panel Questions Livingston

1 Landowners Group

2 Q MR. O'GORMAN: Good morning. Good morning,  
3 Dr. Young. Good afternoon, I guess, in Ontario.

4 So I think --

5 A DR. YOUNG: I'm --

6 Q Right.

7 (INDISCERNIBLE - OVERLAPPING SPEAKERS)

8 THE COURT REPORTER: I'm sorry?

9 Q MR. O'GORMAN: I think --

10 THE COURT REPORTER: I didn't hear what the witness  
11 said.

12 A DR. YOUNG: I said it was -- it's just  
13 slightly afternoon here, sir.

14 Q MR. O'GORMAN: So just one question for you.  
15 I think you indicated that you listened late last week  
16 when your counsel Mr. Fitch was examining Benga and  
17 their experts on the air -- on the issues related to  
18 your expertise on air issues. Is that right?

19 A DR. YOUNG: Yes, sir. That is correct.

20 Q Okay. So I'm not going to haul up the transcript, but  
21 there was something that was said I'd just like your  
22 view on. I hesitate to put words into Mr. Rudolph's  
23 mouth, Benga's witness, you know, speaking to most of  
24 their air quality work. I don't think -- I don't think  
25 I'm about to mischaracterize what he said, so I -- you  
26 know, I'll be -- someone correct me if I -- if I get

1           this wrong.

2           When Mr. Fitch was asking him about this issue  
3 around whether -- windblown dust emissions and whether  
4 the windblown dust -- in your paper, you talk about  
5 that should vary with the cube of the wind speed, and  
6 they had a conversation about that, and Mr. Fitch asked  
7 Mr. Rudolph if he agreed with that, and there was  
8 reference to a paper that you folks filed and ...

9           One of the things that I took from that  
10 conversation was that I think I heard Mr. Rudolph  
11 express that using that approach wouldn't necessarily  
12 be appropriate for regulatory applications such as  
13 this.

14           Do you remember that being said, that aspect of  
15 that conversation?

16   A   Yes, sir. I remember him saying that.

17   Q   Okay. So I guess what I would put to you is two -- two  
18 parts. I assume you would argue -- would you argue  
19 that it is appropriate to factor in -- into thinking  
20 about windblown dust that the dust source term for  
21 emissions would -- should vary with the cube of the  
22 wind speed?

23           And I guess I'll -- the second part of that  
24 question is if you do -- if you do agree that that  
25 should be used in regulatory applications, why? Why  
26 would you argue that that's something that should have

1           been done here?

2    A    Sir, I was not -- I was not actually arguing for the  
3           cube of the wind speed to be used.  What I was mainly  
4           suggesting was that the dust is lifted up by the wind  
5           speed cubed but that the regulatory version that has  
6           been used is a conglomeration of many, many studies,  
7           and they are -- they were looking for simple factors in  
8           order to look at dust and dust generation.  And when  
9           you do that, you have to ignore some parts of the  
10          physics to do that.

11                 So, for example, the frequency factor, anything  
12           above a wind speed of 5.36 metres per second, was found  
13           to be representative of those days that would produce  
14           high dust.  And if you look -- as I say, if you look at  
15           a yearlong, that would give a very good estimation.

16                 The problem is:  When you are looking at  
17           individual days, you can find that the -- that  
18           simplistic equation doesn't work very well.  For  
19           regulatory purposes, most of the time it works.  In  
20           this situation, we (AUDIO FEED LOST) at Chinook days  
21           (AUDIO FEED LOST) doesn't work with a high wind speed,  
22           so I was trying to show you (AUDIO FEED LOST) that  
23           situations like high wind speeds properly --  
24           notwithstanding -- (AUDIO FEED LOST).

25           MR. FITCH:                         Sorry.  Dr. Young, it's

26           Mr. Fitch.  So just when you started the key part of

1 your answer, your audio started to go wonky. Maybe you  
2 can go back and start again at the point where you were  
3 saying, basically, what you were trying to show in this  
4 case.

5 A DR. YOUNG: Sorry. I'll try again.

6 Okay. What I was trying to show was that the  
7 (AUDIO FEED LOST) approach underestimates emissions at  
8 high wind speeds. I'm just suggesting that in this  
9 particular case, when you have Chinook winds, which are  
10 basically high wind speeds, that there's no reason to  
11 believe that the regulatory equation will work any  
12 better at this -- for this location than it did at  
13 Owens Lake.

14 Q MR. O'GORMAN: Okay. That's all I needed to  
15 know. Thank you, Dr. Young. I appreciate your time.

16 Dr. Dennis, you as well.

17 Thank you, both, for appearing before us,  
18 submitting your written reports. We appreciate the  
19 work you folks did.

20 MR. O'GORMAN: And I have no further  
21 questions, Mr. Chair.

22 THE CHAIR: Okay. Mr. Matthews, any  
23 questions?

24 A DR. YOUNG: Thank you very much.

25 MR. MATTHEWS: Yeah, just a minor question  
26 for Dr. Dennis.

1 Q MR. MATTHEWS: You know, in the area where  
2 the project is located, we have a mine -- significant  
3 coal mining community adjacent to or to the west in the  
4 Elk Valley, and from what we understand, a significant  
5 number of the population from Blairmore work in the  
6 valley -- the Elk Valley neighbourhood, I guess.

7 How would you differentiate between the health  
8 effects on the community if you have a migrant -- or  
9 migratory, if you will, workforce going between one  
10 area where there's active coal mining and an area  
11 currently where we don't have any coal mining? How  
12 would you differentiate that in the future when mine --  
13 when -- let's say, Grassy does get approved. How would  
14 you differentiate the health effects?

15 A DR. DENNIS: I think it would be probably  
16 impossible to do because the population isn't big  
17 enough to do it.

18 Look -- if I could just sort of sidetrack a little  
19 bit and talk about COVID. You know, I think we've all  
20 been watching with interest the vaccines that have been  
21 developed. Pfizer tested 30,000 people, 15,000 in each  
22 arm, of those who got a placebo and those who got a  
23 vaccine. In the placebo arm, 8 people got COVID, and  
24 in the vaccinated arm, I think 600 people got COVID, so  
25 there's a 95 percent, you know, success rate. But you  
26 needed 30,000 people to differentiate that. And even

1 with the -- that -- the 95 percent, there's still a  
2 spread around the prediction. Well, is that going to  
3 be true of the general population? We don't know yet.  
4 It still could be skewed one way or the other, which is  
5 why the FDA requires 30,000 people in a very, very  
6 carefully controlled study.

7 I don't think you will ever be able to tease out  
8 the health effects on coal mining in any of those  
9 communities. The population will be too small. You  
10 have to rely on data from other sources, which is why I  
11 think the Appalachian data is so useful, because there  
12 are a -- millions of -- millions of people in the  
13 population base there.

14 So, Mr. Matthews, I don't think -- I don't think  
15 you could ever see it. I don't think you could ever  
16 see it. It'll just be lost. And if somebody has a  
17 cancer or whatever -- they can have an argument, and  
18 it's going to cause them stress, and it's going to  
19 cause a controversy, but you'll never be able show it  
20 one way or the other.

21 Q That's great. Thank you. Thank you for your answer,  
22 Dr. Dennis.

23 And thank you, Dr. Young, for your contribution  
24 today. I have no further questions.

25 THE CHAIR: Thank you, Mr. Matthews.

26 Gentlemen, I have no further questions for you,

1 so, again, on behalf of the Panel, I'd like to thank  
2 you both, Dr. Young and Dr. Dennis, for the written  
3 submissions and your participation here today. It will  
4 be helpful to the Panel, so thank you.

5 Mr. Fitch, any re-direct?

6 MR. FITCH: No, sir, no re-direct.

7 (WITNESSES STAND DOWN)

8 Discussion

9 MR. FITCH: And I believe that we have the  
10 distinction of having put forward the final witnesses  
11 in this five- to six-week-long hearing, so like others  
12 before me, I would like to take this opportunity to  
13 thank you, sir, and the Panel Members and Panel staff  
14 and the court reporters and everyone working behind the  
15 scenes to essentially pull off this virtual hearing. I  
16 think, notwithstanding last night and a few glitches  
17 this morning, it's actually gone remarkably smoothly.  
18 So thank you for that. And thank you for giving the  
19 Livingstone Landowners Group the opportunity to  
20 participate.

21 THE CHAIR: Okay. Yeah. Thank you very  
22 much, Mr. Fitch. And we appreciate everyone's  
23 cooperation in these unusual times, so thanks for that.

24 Mr. Ignasiak or Mr. Brinker, does Benga intend to  
25 present any reply evidence?

26 MR. BRINKER: No, sir, Mr. Chair.

1 THE CHAIR: Okay. Thank you.

2 So with that, that brings us to the end of the  
3 evidentiary portion of the hearing, with a few minor  
4 items still to be dealt with.

5 So the Panel's intention would be once we receive  
6 the ACO report and the responses to any outstanding  
7 undertakings and any related follow-up to those  
8 undertakings, we would then close the evidentiary  
9 record at that time.

10 My understanding is that there's currently  
11 three -- three undertakings outstanding. One is  
12 Number 10, and that's the one related to Dr. Rasouli,  
13 and Benga already spoke to that. So I think the intent  
14 will be if we do not receive a response to that by the  
15 close of the record, we will just consider it not  
16 responded to. And I understand Benga is -- is fine  
17 with that approach.

18 The other two are Undertakings Number 27 and 28,  
19 and they related to the undertakings that I requested  
20 on Monday, and my understanding is those are probably  
21 going to be submitted shortly. So those should not  
22 delay the close of the record.

23 If there is any follow-up required to those final  
24 two undertakings, the Panel would propose that it be  
25 done in writing, and it'll be done in an expeditious  
26 manner so as to -- not to interfere with closing of the

1 record probably later this week or, at latest, early  
2 next week once we have the ACO report.

3 So the Panel will close the record of the  
4 proceeding, of course, once it has received written  
5 final argument from Benga and the other participants,  
6 as outlined in the schedule that we discussed and  
7 posted. So, again, anticipated that the record for the  
8 proceeding would be closed either late on January 15th  
9 or very shortly thereafter once all the final argument  
10 has been received.

11 Following that, the Panel will review the evidence  
12 and prepare its report, which will include its  
13 assessment of the effects of the project, the Panel's  
14 decision in its capacity as the Panel of AER hearing  
15 commissioners, and its recommendations to the federal  
16 minister of Environment and Climate Change under  
17 SEIA 2012.

18 Before we adjourn, are there any other matters  
19 that the participants want to raise at this time?

20 MR. BRINKER: Mr. Chair, I just have a few  
21 words to share, not a matter, but I just want to --

22 THE CHAIR: Sure.

23 MR. BRINKER: -- echo Mr. Fitch's  
24 sentiments. I just wanted to -- on behalf of myself,  
25 Mr. Ignasiak, and Benga to thank the Panel and all the  
26 Panel staff and court reporters for conducting the

1 hearing in such unusual and difficult circumstances  
2 giving up, I know, several evenings and several  
3 Saturdays over the last month. So we thank you for  
4 that.

5 THE CHAIR: Okay. Thank you, Mr. Brinker.

6 Okay, hearing none, the Panel would like to thank  
7 everyone for their participation in the hearing, and,  
8 again, the Panel appreciated everyone's willingness to  
9 participate in this new world of online hearings and  
10 kind of roll with some of the minor glitches we  
11 experienced that were all made necessary by the current  
12 COVID-19 pandemic. I think we made a bit of history  
13 here in terms of conducting such a large and complex  
14 hearing in a -- in a fully online format.

15 So with that, thank you, everyone, and the hearing  
16 is now adjourned.

17

---

18 PROCEEDINGS CONCLUDED

19

20

21

22

23

24

25

26

1 CERTIFICATE OF TRANSCRIPT:

2

3 I, Claire Forster, certify that the foregoing  
4 pages 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 2nd day of December 2020.

10

11

<Original signed by>

12

13

—

14 Claire Forster, CSR(A)

15 Official Court Reporter

16

17

18

19

20

21

22

23

24

25

26

<b>1</b>	<b>1982</b> 6179:2 6182:16 <b>1983</b> 6179:4 <b>1985</b> 6179:5 <b>1987</b> 6219:25 <b>1990s</b> 6208:20 <b>1996</b> 6179:5 <b>1A</b> 6185:24	<b>3</b>	<b>6</b>	<b>abnormality</b> 6217:26 <b>abrupt</b> 6174:13 <b>absence</b> 6191:4 <b>absorb</b> 6207:3 <b>academic</b> 6211:9,11 6215:13,21 <b>academics</b> 6212:17 6220:6,8 <b>accelerated</b> 6208:20 <b>accepted</b> 6199:21 <b>accidents</b> 6183:5 <b>accommodate</b> 6174:8 <b>account</b> 6205:14 6223:7,16 <b>accounted</b> 6214:3 <b>accurate</b> 6240:4 <b>acid</b> 6179:1,3 <b>acknowledge</b> 6176:15 6193:22 6224:5 <b>acknowledged</b> 6176:10 <b>ACO</b> 6237:6 6238:2 <b>acting</b> 6177:24 6178:9 <b>active</b> 6234:10 <b>actual</b> 6186:8 6188:20 6218:22 <b>addendum</b> 6183:25 6184:4 6189:4 6191:8 <b>addition</b> 6189:14 <b>address</b> 6197:20 6200:24 6201:4 <b>addressed</b> 6208:12,13
<b>1</b> 6175:7 6188:19 6199:12 6205:6, 13 6217:8,9 6218:1,2,3 <b>1.5-2</b> 6189:5 <b>10</b> 6184:5 6186:24 6187:4,5 6189:10 6191:8 6237:12 <b>10-metre</b> 6189:12 <b>100</b> 6179:17 6186:11 <b>101</b> 6217:19 <b>102</b> 6191:12 <b>10:14</b> 6225:16 <b>10:30</b> 6225:17 <b>11</b> 6183:25 6184:4 <b>12</b> 6187:7,12 6189:13 <b>12-month</b> 6187:16 <b>13</b> 6210:18 <b>15</b> 6182:14 6196:6 6204:21 <b>15,000</b> 6234:21 <b>15-minute</b> 6225:16 <b>15-year</b> 6178:17 <b>15th</b> 6238:8 <b>19</b> 6191:9 <b>193</b> 6185:25 6187:23 <b>194</b> 6186:18 <b>1960s</b> 6208:20 <b>1978</b> 6182:10 <b>1979</b> 6179:2 <b>1980</b> 6182:13	<b>2</b>	<b>3</b> 6205:13 6206:20 6218:6 <b>3,000</b> 6215:24 <b>30</b> 6218:15 <b>30,000</b> 6234:21, 26 6235:5 <b>30-odd</b> 6211:8 6215:5 <b>30-plus</b> 6208:26 <b>313</b> 6184:4 <b>33</b> 6177:19 6215:25 6216:4 <b>35</b> 6188:4,7 6191:23 <b>37</b> 6187:18 6192:4 <b>3rd</b> 6190:8	<b>6</b> 6206:19 <b>60</b> 6189:13 <b>600</b> 6234:24 <b>60s</b> 6206:1 <b>64</b> 6193:9	
		<b>4</b>	<b>7</b>	<b>70s</b> 6206:1 <b>723</b> 6187:15,17 <b>75</b> 6190:19
			<b>8</b>	<b>8</b> 6204:22 6234:23 <b>80</b> 6194:5 <b>89</b> 6191:12
			<b>9</b>	<b>91</b> 6189:16,25 6190:9 <b>911</b> 6188:14 <b>914</b> 6189:21 6190:1 <b>935</b> 6196:18 <b>95</b> 6217:14 6234:25 6235:1 <b>97</b> 6189:13,16,25 6190:13 <b>9:00</b> 6173:21
		<b>5</b>	<b>A</b>	<b>A4-4</b> 6186:18,25 <b>ability</b> 6182:6 6240:7 <b>Abnormalities</b> 6218:5
	<b>2</b> 6188:20 6189:10 6199:13 6205:6 6218:3 <b>2-and-a-half-</b> <b>million</b> 6219:25 <b>20</b> 6191:23 6195:1 6196:2 <b>2005</b> 6177:16 <b>2007</b> 6209:5 <b>2011</b> 6178:22 6216:22 <b>2012</b> 6238:17 <b>2015</b> 6178:18 <b>2017</b> 6215:8 <b>2020</b> 6240:9 <b>2040</b> 6178:24 <b>2049</b> 6178:24 <b>21</b> 6210:22 <b>231</b> 6187:16 <b>24</b> 6189:4 <b>24-hour</b> 6187:1 <b>25-year</b> 6178:18 <b>251</b> 6189:3 6191:8 <b>27</b> 6237:18 <b>28</b> 6237:18 <b>29</b> 6216:1 <b>2nd</b> 6240:9	<b>4</b> 6209:16 6216:2 <b>42</b> 6185:24 <b>45</b> 6179:15 <b>495</b> 6187:3		

<b>addresses</b> 6210:6	<b>agreed</b> 6231:7	<b>anticipated</b> 6238:7	<b>argue</b> 6231:18,26	6238:13
<b>addressing</b> 6199:3	<b>Agudelo</b> 6181:14,15,19 6227:1,5	<b>APCA</b> 6182:10	<b>arguing</b> 6232:2	<b>assessment's</b> 6175:11
<b>adjacent</b> 6234:3	<b>ahead</b> 6186:20 6225:23	<b>apologies</b> 6174:11 6202:19	<b>argument</b> 6188:6 6235:17 6238:5,9	<b>assessments</b> 6207:24
<b>adjourn</b> 6238:18	<b>Ahem</b> 6216:22	<b>Appalachia</b> 6219:14	<b>arm</b> 6234:22,23, 24	<b>associate</b> 6210:9
<b>adjourned</b> 6239:16	<b>air</b> 6175:10,15 6177:20 6178:12, 13,21 6179:6,9, 10 6182:14 6183:14,18,22 6185:15 6186:25 6197:9 6198:7,8 6201:15,16 6202:3 6203:26 6228:9 6230:17, 18,24	<b>Appalachian</b> 6208:16 6215:6 6223:10 6235:11	<b>array</b> 6181:3	<b>associating</b> 6202:24 6208:23 6218:15 6223:21
<b>ADJOURNME NT</b> 6225:21	<b>Alberta</b> 6174:14 6196:3 6204:21 6228:21,25 6229:26 6240:8	<b>appearing</b> 6233:17	<b>arrow</b> 6180:11	<b>Association</b> 6179:11
<b>adjust</b> 6181:17 6218:1	<b>Albertan</b> 6196:12	<b>appears</b> 6180:26	<b>arrows</b> 6198:4	<b>assume</b> 6174:22 6222:9 6231:18
<b>adjusted</b> 6217:9	<b>aldehyde</b> 6203:21	<b>Appendix</b> 6176:18 6194:4 6213:2 6215:13	<b>Arruda</b> 6180:9, 15,19,25 6181:1, 7,10,13,22,25 6182:1	<b>assumption's</b> 6199:18,19 6201:8
<b>adopt</b> 6176:6 6193:18	<b>aldehydes</b> 6203:22	<b>application</b> 6202:3	<b>art</b> 6180:8	<b>asthma</b> 6204:21, 22 6206:22 6219:23,24
<b>adopted</b> 6179:3	<b>amendments</b> 6176:3 6193:15	<b>applications</b> 6231:12,25	<b>articles</b> 6179:18, 21	<b>atmosphere</b> 6179:25 6201:19
<b>adult</b> 6210:21	<b>America</b> 6208:15	<b>applied</b> 6179:15 6222:1	<b>asbestos</b> 6206:9, 13	<b>atmospheric</b> 6177:15 6178:10 6179:16 6182:17 6183:5 6201:17
<b>adults</b> 6204:22	<b>amount</b> 6202:6 6214:6	<b>applies</b> 6184:1	<b>aspect</b> 6196:7 6208:3 6231:14	<b>attached</b> 6176:18 6194:4 6226:12
<b>advance</b> 6174:6	<b>amounts</b> 6186:10,25 6206:2	<b>appreciated</b> 6239:8	<b>aspects</b> 6197:10 6215:26	<b>attention</b> 6201:1 6222:19
<b>advice</b> 6179:8	<b>amplify</b> 6177:7	<b>approach</b> 6186:9 6200:3 6214:22 6231:11 6233:7 6237:17	<b>assemble</b> 6214:26	<b>attract</b> 6211:11, 12
<b>advised</b> 6182:20, 22,26	<b>analysis</b> 6187:5, 14 6218:14	<b>appropriateness</b> 6185:19 6216:12	<b>assess</b> 6200:19 6208:5 6214:20 6216:9,10 6220:25	<b>audio</b> 6173:24 6180:13,17 6181:4 6187:8 6195:13 6198:24 6202:8 6206:5 6209:17,23 6213:4 6214:11 6216:26 6225:12, 19 6226:15,16 6227:2 6228:2 6232:20,21,22,24 6233:1,7
<b>advising</b> 6195:20	<b>animal</b> 6203:14 6205:22	<b>approved</b> 6234:13	<b>assessed</b> 6190:26	<b>author</b> 6179:17 6209:6 6219:11
<b>advisor</b> 6178:21	<b>animals</b> 6198:12	<b>approved</b> 6234:13	<b>assessment</b> 6175:2,10 6183:14,16,19,22 6185:15 6191:3 6192:26 6193:4 6195:2,6,23 6196:1,9,10,26 6197:1,8,12,14 6199:10 6200:1, 3,5,14,22 6201:6 6202:22 6207:5, 7,14,15 6208:9, 12 6219:11 6220:17 6221:14, 18 6222:2,5,6 6223:14 6224:2,7	
<b>advisory</b> 6179:7 6195:8	<b>answering</b> 6225:15	<b>approach</b> 6186:9 6200:3 6214:22 6231:11 6233:7 6237:17		
<b>AER</b> 6174:15 6238:14		<b>applied</b> 6179:15 6222:1		
<b>AER's</b> 6173:26		<b>applies</b> 6184:1		
<b>aerosol</b> 6196:7		<b>appreciated</b> 6239:8		
<b>aerosols</b> 6182:17		<b>approach</b> 6186:9 6200:3 6214:22 6231:11 6233:7 6237:17		
<b>affect</b> 6204:24		<b>appropriateness</b> 6185:19 6216:12		
<b>affected</b> 6174:15		<b>approved</b> 6234:13		
<b>affects</b> 6205:8		<b>approved</b> 6234:13		
<b>affirmed</b> 6192:21,22		<b>approximately</b> 6186:24 6187:6		
<b>afternoon</b> 6230:3,13		<b>Arcadis</b> 6178:20		
<b>age</b> 6209:15,16 6213:26		<b>area</b> 6191:22,23 6213:12 6222:19 6223:10 6234:1, 10		
<b>agree</b> 6219:17 6231:24		<b>areas</b> 6188:3 6198:23 6200:11 6209:2 6214:6,25 6215:6		

<b>authoritative</b> 6212:25 6224:7	<b>begin</b> 6175:8 6176:21 6194:10	<b>blood</b> 6208:5 6211:1	<b>busy</b> 6212:19	6228:26
<b>authors</b> 6209:7 6213:1 6220:8	<b>behalf</b> 6236:1 6238:24	<b>Board</b> 6179:7	<b>butterflying</b> 6197:4	<b>carefully</b> 6192:2 6235:6
<b>automatic</b> 6181:16	<b>behave</b> 6221:17	<b>bodies</b> 6199:6 6207:10 6220:10	<hr/> <b>C</b> <hr/>	<b>carry</b> 6182:3 6185:22 6186:3 6187:26 6188:17 6189:19 6190:16 6191:18 6214:13
<b>automatically</b> 6181:17	<b>beings</b> 6203:4,16	<b>body</b> 6195:18 6197:20	<b>calculated</b> 6187:19	<b>case</b> 6187:21 6188:23 6214:23 6224:25 6233:4,9
<b>average</b> 6210:11	<b>belief</b> 6188:18	<b>bottom</b> 6184:6 6187:1,24 6217:7	<b>calculations</b> 6188:2	<b>cases</b> 6178:21
<b>avoid</b> 6221:24	<b>benefited</b> 6220:1	<b>bouncing</b> 6212:3	<b>Calgary</b> 6240:8	<b>catch</b> 6226:20 6227:21
<b>aware</b> 6203:25	<b>Benga</b> 6184:11 6191:11,14,19 6193:5 6198:1 6200:6 6201:12 6225:4,7 6230:16 6236:24 6237:13, 16 6238:5,25	<b>box</b> 6181:16	<b>call</b> 6189:20 6196:19 6203:23 6211:4,6 6219:13 6223:17	<b>caused</b> 6213:25
<hr/> <b>B</b> <hr/>	<b>Benga's</b> 6185:16 6205:14 6207:7 6208:13 6219:11 6224:23 6230:23	<b>bracketed</b> 6217:14	<b>called</b> 6182:11 6207:14	<b>ceiling</b> 6204:2
<b>bachelor</b> 6194:21	<b>benzine</b> 6206:13	<b>break</b> 6209:26 6225:11,16	<b>camera</b> 6174:1	<b>certainty</b> 6219:4, 5 6223:12
<b>bachelor's</b> 6195:3	<b>bias</b> 6216:10	<b>bring</b> 6175:21 6201:1	<b>Canada</b> 6177:26 6178:11,20 6179:3 6182:14 6189:15,23 6194:21 6196:2,5 6199:11 6203:25 6207:15 6228:1, 7,12	<b>CERTIFICATE</b> 6240:1
<b>back</b> 6175:6 6178:8 6187:22 6191:7 6205:16 6228:10,11 6233:2	<b>biased</b> 6213:26	<b>brings</b> 6237:2	<b>Canadian</b> 6179:1,6,12 6196:12	<b>certify</b> 6240:3
<b>background</b> 6194:20 6195:26	<b>big</b> 6234:16	<b>Brinker</b> 6225:7, 9,23,24,25 6226:25 6227:6 6229:10,12 6236:24,26 6238:20,23 6239:5	<b>cancer</b> 6199:25 6208:1 6209:17, 25 6210:6,13,14, 21 6213:18 6235:17	<b>Cesar</b> 6181:15
<b>balance</b> 6224:17	<b>bigger</b> 6222:12	<b>British</b> 6195:13, 17	<b>captured</b> 6174:2 6215:22	<b>cetera</b> 6202:4 6216:13
<b>bar</b> 6217:13,14	<b>biochemistry</b> 6194:21	<b>broad</b> 6207:11,12	<b>capacity</b> 6238:14	<b>chain</b> 6208:15
<b>base</b> 6208:21 6214:1 6222:22 6235:13	<b>biota</b> 6198:10	<b>broadcast</b> 6174:4	<b>capture</b> 6216:4	<b>Chair</b> 6173:23 6174:23 6175:21 6192:9,17 6193:7 6194:3 6225:1,6, 9,10,22 6226:17, 20,23 6229:11, 12,16,17,19,22,24 6233:21,22 6235:25 6236:21, 26 6237:1 6238:20,22 6239:5
<b>based</b> 6183:18 6184:25 6186:6 6187:7,12 6188:2 6198:17 6200:18 6223:6	<b>biotech</b> 6196:7	<b>Brockovich</b> 6206:14	<b>care</b> 6192:6	<b>checked</b> 6181:20
<b>basic</b> 6194:20 6200:5	<b>birds</b> 6174:26	<b>broke</b> 6195:14,15 6227:21,23	<b>career</b> 6194:26	
<b>basically</b> 6184:21 6233:3, 10	<b>birth</b> 6210:18,20 6213:20 6216:23 6217:12,22,24	<b>brought</b> 6216:16		
<b>Beaver</b> 6186:22 6187:13 6189:11 6190:24	<b>bit</b> 6178:4 6181:25 6182:2 6190:4 6202:5 6209:23 6219:12 6221:11 6227:8 6228:5 6234:19 6239:12	<b>Brunswick</b> 6178:12 6227:20, 26 6228:9		
	<b>black</b> 6217:7	<b>built</b> 6223:24		
	<b>Blairmore</b> 6234:5	<b>bullet</b> 6198:15 6199:3 6201:9 6209:14 6223:4		
	<b>blog</b> 6179:24	<b>business</b> 6174:19 6221:26		

<b>chemical</b> 6198:18 6201:10 6203:15,24 6204:15 6205:2, 3,7,9,12	<b>climatology</b> 6191:22	<b>commissioners</b> 6238:15	<b>concentration</b> 6184:16,21 6185:2,10 6187:18 6198:16	<b>Congential</b> 6218:5
<b>chemicals</b> 6198:7 6203:2,17 6204:5,16,17 6205:1 6221:23	<b>clinic</b> 6214:24	<b>Common</b> 6179:24	<b>concentrations</b> 6192:3 6198:22 6201:15 6208:5	<b>conglomeration</b> 6232:6
<b>chief</b> 6178:11	<b>clinical</b> 6218:23	<b>communities</b> 6210:9,11 6216:2,23 6217:12 6235:9	<b>concern</b> 6183:21 6185:19 6188:26 6190:17 6191:14 6197:18 6198:7	<b>Congress</b> 6182:15
<b>children</b> 6214:8	<b>clinicians</b> 6211:23	<b>community</b> 6198:23 6200:9 6208:3 6211:3,20 6215:9 6234:3,8	<b>concerned</b> 6189:17	<b>connection</b> 6178:3
<b>Chinook</b> 6175:12 6188:23 6191:22, 23 6232:20 6233:9	<b>clinics</b> 6219:1	<b>company</b> 6196:3, 7 6228:11	<b>concerns</b> 6174:5, 7,8 6189:8 6200:17	<b>conservation</b> 6184:25
<b>Chinooks</b> 6183:13 6192:1	<b>close</b> 6237:8,15, 22 6238:3	<b>compare</b> 6202:25	<b>conclude</b> 6212:12	<b>conservative</b> 6186:12 6199:19
<b>chromium</b> 6206:13,15,17, 19,20,23	<b>closed</b> 6238:8	<b>compared</b> 6199:5	<b>concluded</b> 6219:4 6239:18	<b>consideration</b> 6175:12 6183:17
<b>chronic</b> 6210:20, 25	<b>closer</b> 6177:8	<b>comparing</b> 6207:9	<b>concludes</b> 6192:8 6223:5 6225:1	<b>considered</b> 6192:1 6197:24 6222:3 6223:22
<b>chronological</b> 6209:2	<b>closing</b> 6237:26	<b>compensation</b> 6203:10	<b>conclusion</b> 6200:5,15,18 6222:14 6223:6	<b>consistent</b> 6216:18
<b>CIAR</b> 6226:13	<b>co-chairman</b> 6179:6	<b>competing</b> 6211:17	<b>conclusions</b> 6191:4 6216:12	<b>constraints</b> 6222:25
<b>Circulatory</b> 6218:4	<b>co-adopted</b> 6215:21	<b>complete</b> 6240:4	<b>conclusive</b> 6219:17	<b>constrict</b> 6206:24
<b>circumstances</b> 6239:1	<b>coal</b> 6175:17 6193:1,5 6200:6 6208:17,19 6210:10,12 6212:14 6213:4 6215:26 6217:13 6222:21 6223:21 6234:3,10,11 6235:8	<b>completed</b> 6228:23	<b>consultancy</b> 6196:3	<b>consultant</b> 6178:19 6185:24
<b>city</b> 6178:23 6240:8	<b>coauthor</b> 6179:2	<b>complex</b> 6207:5 6224:20 6239:13	<b>consultants</b> 6177:21 6178:17	<b>Consultants</b> 6177:21 6178:17
<b>Claire</b> 6240:3,14	<b>coauthors</b> 6220:9	<b>complexities</b> 6200:19,21	<b>conditions</b> 6182:21	<b>consulting</b> 6195:7 6228:11
<b>clearer</b> 6214:11	<b>colleagues</b> 6211:18,22 6212:2	<b>complexity</b> 6201:5,25	<b>conducting</b> 6238:26 6239:13	<b>contact</b> 6174:5
<b>click</b> 6180:12 6181:15	<b>collect</b> 6218:20 6220:23	<b>complicated</b> 6202:23 6204:14, 18,19 6205:24 6221:16	<b>confidence</b> 6217:15,20	<b>contained</b> 6189:26 6218:17 6223:14
<b>clients</b> 6178:15, 16 6182:20	<b>column</b> 6179:25 6190:2	<b>compromised</b> 6205:12,18	<b>confirm</b> 6175:8, 14,24 6176:9 6192:24 6193:3, 10,22	<b>continually</b> 6205:20
<b>climate</b> 6178:24 6238:16	<b>COMMENTED</b> 6173:21	<b>computer</b> 6194:14 6210:5	<b>confound</b> 6202:2	<b>continue</b> 6178:13 6225:14
<b>climatological</b> 6182:13	<b>comment</b> 6219:17	<b>con</b> 6217:25	<b>confounding</b> 6213:25 6214:4	<b>continues</b> 6174:20
<b>climatologies</b> 6178:26	<b>Comments</b> 6175:15	<b>concentrate</b> 6182:5	<b>congenital</b> 6217:26	<b>contribution</b> 6235:23

<p><b>control</b> 6182:21</p> <p><b>controlled</b> 6235:6</p> <p><b>controversy</b> 6214:16 6235:19</p> <p><b>conversation</b> 6231:6,10,15</p> <p><b>cooperation</b> 6236:23</p> <p><b>coordinator</b> 6180:10</p> <p><b>COPD</b> 6210:25</p> <p><b>correct</b> 6182:10 6190:9,14 6191:17 6226:15 6227:18,26 6230:19,26</p> <p><b>corrections</b> 6176:3 6193:15</p> <p><b>correctly</b> 6183:14</p> <p><b>cost</b> 6218:21</p> <p><b>Council</b> 6182:18</p> <p><b>counsel</b> 6174:5 6230:16</p> <p><b>countries</b> 6214:26</p> <p><b>couple</b> 6189:8 6226:8 6227:19, 25 6228:2,8</p> <p><b>court</b> 6176:26 6177:4,11 6178:1 6179:19 6180:4 6182:24 6185:6 6187:9 6192:20 6194:18 6195:14 6198:25 6199:1 6202:9,12 6206:6,11 6209:18 6213:5 6217:1 6226:18, 19,21,22 6230:8, 10 6236:14 6238:26 6240:15</p>	<p><b>covers</b> 6197:6</p> <p><b>COVID</b> 6234:19, 23,24</p> <p><b>COVID-19</b> 6239:12</p> <p><b>crazy</b> 6222:8</p> <p><b>create</b> 6220:7</p> <p><b>created</b> 6177:15</p> <p><b>credentials</b> 6176:23 6194:8</p> <p><b>criteria</b> 6216:9</p> <p><b>critical</b> 6215:2</p> <p><b>cross-examination</b> 6188:5 6225:4</p> <p><b>Cross-examines</b> 6225:24</p> <p><b>Crowsnest</b> 6189:15,24 6201:26 6229:3</p> <p><b>CSR(A)</b> 6240:14</p> <p><b>cube</b> 6231:5,21 6232:3</p> <p><b>cubed</b> 6232:5</p> <p><b>current</b> 6227:11 6239:11</p> <p><b>curriculum</b> 6176:17 6194:4</p> <p><b>cut</b> 6198:25 6199:1,2 6202:13 6206:11 6213:9 6217:2 6228:4</p> <p><b>cut-and-pastes</b> 6200:13</p> <p><b>cuts</b> 6210:4</p> <p><b>cutting</b> 6202:9 6206:6 6209:18 6213:5</p> <p><b>CV</b> 6176:19 6227:14</p>	<p style="text-align: center;"><b>D</b></p> <p><b>daily</b> 6186:24 6187:2,14</p> <p><b>data</b> 6186:22 6187:13 6188:26 6189:8,11,18,26 6190:21,22 6191:2 6200:23 6203:13 6205:22 6207:9,19,20 6214:18,26 6218:12,19,21 6220:11,20,23 6222:22 6223:6, 11,23 6224:9 6235:10,11</p> <p><b>Dated</b> 6240:8</p> <p><b>day</b> 6186:6 6187:1,7,10,12, 17,19 6188:20 6240:9</p> <p><b>days</b> 6189:17,25 6191:23 6232:13, 17,20</p> <p><b>deal</b> 6174:20</p> <p><b>dealt</b> 6237:4</p> <p><b>debate</b> 6220:14, 16</p> <p><b>debated</b> 6222:3</p> <p><b>decade</b> 6212:22</p> <p><b>decades</b> 6211:10</p> <p><b>December</b> 6179:5 6240:9</p> <p><b>decided</b> 6215:5</p> <p><b>decision</b> 6238:14</p> <p><b>decrease</b> 6184:17 6185:2</p> <p><b>decreased</b> 6217:10</p> <p><b>defects</b> 6210:20 6213:21 6216:23 6217:12,22,24</p>	<p><b>defended</b> 6220:15</p> <p><b>definitive</b> 6220:20</p> <p><b>delay</b> 6237:22</p> <p><b>Dennis</b> 6192:11, 12,14,18,20,22,23 6193:2,10 6194:7 6195:17 6196:15, 20 6198:26 6199:2,4 6202:11,15,16,17 6206:8,12 6209:20 6213:7, 8,10 6217:2,5 6219:10 6224:26 6225:3,26 6226:2 6229:9 6233:16, 26 6234:15 6235:22 6236:2</p> <p><b>Dennis's</b> 6194:3</p> <p><b>department</b> 6212:20</p> <p><b>deposited</b> 6198:22</p> <p><b>deposits</b> 6198:8,9</p> <p><b>Depression</b> 6210:24</p> <p><b>derive</b> 6203:2,11</p> <p><b>derived</b> 6199:25</p> <p><b>design</b> 6211:15</p> <p><b>designing</b> 6219:22</p> <p><b>detail</b> 6209:4 6215:15</p> <p><b>detailed</b> 6200:1</p> <p><b>detoxify</b> 6205:11</p> <p><b>developed</b> 6178:23 6234:21</p> <p><b>development</b> 6182:23 6183:2 6224:18</p> <p><b>die</b> 6209:15</p>	<p><b>difference</b> 6183:23 6217:22</p> <p><b>differentiate</b> 6234:7,12,14,26</p> <p><b>difficult</b> 6178:5 6218:20 6239:1</p> <p><b>digressing</b> 6207:1</p> <p><b>dilution</b> 6198:20 6201:22</p> <p><b>direct</b> 6174:25 6188:9 6192:9 6207:24 6225:2</p> <p><b>direction</b> 6175:25 6193:12 6221:5</p> <p><b>director</b> 6177:24 6178:9</p> <p><b>discrepancy</b> 6216:15</p> <p><b>discussed</b> 6200:14 6238:6</p> <p><b>discussion</b> 6173:22 6188:5 6197:16 6202:14 6236:8</p> <p><b>discussions</b> 6199:23</p> <p><b>disease</b> 6196:8 6210:8,12,20,25 6213:19,20 6217:10,11</p> <p><b>diseases</b> 6195:5</p> <p><b>dismiss</b> 6221:2 6222:11</p> <p><b>dismissal</b> 6224:23</p> <p><b>dismissed</b> 6220:12 6222:15</p> <p><b>dismissive</b> 6224:23</p> <p><b>dispersion</b> 6183:23,24 6184:1 6198:19</p>
---	---	--	---	--

<b>distant</b> 6210:11	<b>early</b> 6209:12 6238:1	<b>engineer</b> 6179:13	<b>equation</b> 6183:26 6184:21 6185:8 6186:1,4 6188:19,22 6232:18 6233:11	6193:19,24 6206:2 6219:13 6224:6 6225:2 6229:20 6236:25 6238:11
<b>distinction</b> 6236:10	<b>easy</b> 6211:17	<b>engineering</b> 6198:18	<b>equations</b> 6185:20	<b>evidentiary</b> 6237:3,8
<b>disturbed</b> 6188:3	<b>echo</b> 6238:23	<b>England</b> 6194:22,26 6203:18	<b>Erin</b> 6206:14	<b>examination</b> 6175:6 6176:21 6183:12
<b>Doctor</b> 6219:8	<b>economic</b> 6224:18	<b>enjoy</b> 6178:13	<b>erosion</b> 6185:4	<b>examined</b> 6183:4,13 6191:14 6222:26
<b>document</b> 6175:22 6176:19 6184:4 6185:24 6186:17 6189:3 6190:1 6191:8 6193:9 6194:5	<b>edge</b> 6199:13	<b>ensure</b> 6190:20 6225:14	<b>error</b> 6188:9	<b>examining</b> 6230:16
<b>door</b> 6210:1	<b>education</b> 6194:20	<b>entailed</b> 6202:11	<b>essentially</b> 6219:15 6236:15	<b>execute</b> 6211:24
<b>dose</b> 6202:7,14, 21,25	<b>effect</b> 6203:5 6205:5 6220:26	<b>entirety</b> 6213:2 6215:13	<b>established</b> 6199:5,15 6203:19	<b>executing</b> 6212:9
<b>doses</b> 6199:5	<b>effects</b> 6182:16 6183:4 6214:17, 21 6234:8,14 6235:8 6238:13	<b>enunciating</b> 6182:5	<b>establishing</b> 6212:13	<b>Exhibit</b> 6188:14 6189:21 6190:1 6196:18
<b>dots</b> 6217:7	<b>efforts</b> 6174:8	<b>environment</b> 6177:25,26 6178:10,11,12 6189:15,23 6201:21 6203:12 6228:1,7,9,11 6238:16	<b>establishment</b> 6206:5 6207:3	<b>existing</b> 6197:22 6223:8
<b>doubling</b> 6205:5	<b>EIA</b> 6197:6,10, 15,20 6198:3,4 6200:13,22 6208:13,14 6221:13 6223:4	<b>environmental</b> 6196:10,13,25 6197:13 6206:2 6222:25	<b>estimate</b> 6185:20 6188:3 6198:1 6201:14 6202:6, 21	<b>expect</b> 6205:4
<b>downwind</b> 6184:22 6185:2, 11 6192:4	<b>Elaine</b> 6180:9 6181:14	<b>epidemiologic</b> 6218:20	<b>estimated</b> 6184:25 6187:2 6198:21 6199:5, 20	<b>expected</b> 6198:26 6200:8 6223:5
<b>dozens</b> 6212:11	<b>Elk</b> 6234:4,6	<b>epidemiologic</b> 6218:20	<b>estimates</b> 6180:3 6182:12	<b>expeditious</b> 6237:25
<b>drinking</b> 6210:22	<b>email</b> 6212:24	<b>epidemiological</b> 6203:3,11 6219:22 6222:7	<b>estimating</b> 6186:4	<b>expenditure</b> 6211:15
<b>driven</b> 6201:26	<b>emission</b> 6180:3 6182:12 6184:23, 24 6185:3 6186:25 6187:6, 11 6201:14	<b>epidemiologist</b> 6209:10	<b>estimation</b> 6201:22 6232:15	<b>expensive</b> 6218:19
<b>drug</b> 6214:21	<b>emissions</b> 6179:9 6185:15,21 6186:4,6 6187:2, 6,15,17 6188:9, 11,16,19,21,23 6198:13,16 6201:10,11 6231:3,21 6233:7	<b>epidemiologists</b> 6211:23	<b>European</b> 6195:9	<b>experience</b> 6179:15 6198:17 6225:14
<b>due</b> 6192:1 6213:23	<b>emits</b> 6198:7	<b>epidemiology</b> 6197:23 6212:13 6214:3 6219:23 6220:3 6221:6 6222:23 6223:20	<b>evaluate</b> 6221:22	<b>experienced</b> 6239:11
<b>dust</b> 6180:2 6182:9,20 6183:17,23 6184:1,17 6185:3,4,10,14, 20 6186:6,10,12, 14 6187:18 6188:16 6192:3 6231:3,4,20 6232:4,8,14	<b>end</b> 6197:19 6216:14 6237:2	<b>equal</b> 6183:26 6186:11 6223:23	<b>evenings</b> 6239:2	<b>experiencing</b> 6174:14
<b>dozens</b> 6212:11	<b>ending</b> 6174:13	<b>equals</b> 6184:12	<b>ever-evolving</b> 6205:17	<b>expert</b> 6176:10 6177:21 6193:23
<b>drinking</b> 6210:22	<b>energy</b> 6182:23 6183:1 6229:26		<b>everyone's</b> 6236:22 6239:8	<b>expertise</b> 6230:18
<b>driven</b> 6201:26			<b>evidence</b> 6174:25 6176:6,11 6183:9 6190:11 6192:9	
<b>drug</b> 6214:21				
<b>due</b> 6192:1 6213:23				
<b>dust</b> 6180:2 6182:9,20 6183:17,23 6184:1,17 6185:3,4,10,14, 20 6186:6,10,12, 14 6187:18 6188:16 6192:3 6231:3,4,20 6232:4,8,14				
<b>duty</b> 6176:11 6193:23				
<hr/> <b>E</b> <hr/>				
<b>EA</b> 6223:14				

**experts** 6230:17  
**explain** 6174:7  
**exposed** 6195:11  
6198:12 6203:4,7  
6204:3,5 6205:4  
6207:26 6208:23  
**exposure** 6195:5,  
21 6199:6,7,15,  
21 6202:6,21  
6203:11,21  
6204:9,15,16  
6205:6,12,19,23  
6214:9 6218:12,  
19,21 6221:17  
**exposures**  
6204:3,12  
**express** 6231:11  
**expressed**  
6200:12 6216:25  
**extreme** 6202:1  
**extremely**  
6204:19

---

**F**


---

**facility** 6192:5  
**fact** 6186:10  
**factor** 6231:19  
6232:11  
**factors** 6202:24  
6232:7  
**fails** 6194:14  
**faint** 6177:6  
**fair** 6176:12  
6193:24  
**fairly** 6195:10  
6196:12 6200:2  
6203:8 6212:19  
**false** 6174:12  
**familiar** 6196:12  
**famous** 6206:15  
**father** 6224:13  
**FDA** 6235:5

**federal** 6177:22  
6178:9 6215:4,20  
6218:8,11 6219:3  
6238:15  
**feed** 6187:8  
6195:13 6198:24  
6202:8 6206:5  
6208:7 6209:17  
6213:4 6216:26  
6226:15 6228:2  
6232:20,21,22,24  
6233:7  
**fetal** 6210:18  
**figure** 6188:7  
6215:16  
**filed** 6231:8  
**final** 6236:10  
6237:23 6238:5,9  
**find** 6185:9  
6203:5 6232:17  
**fine** 6190:11  
6237:16  
**finished** 6227:25  
**Fitch** 6174:11,20,  
21,23 6175:3,20  
6176:24 6177:3,  
6,13 6178:2  
6182:2 6183:6,10  
6184:3,6,13,15  
6185:23,26  
6186:16,20  
6187:22,26  
6188:13,15  
6189:2,6,20,22  
6191:7,10  
6192:8,16,23  
6193:7,10  
6194:3,6,9  
6196:15,18,20  
6199:2 6202:13  
6209:22 6213:7  
6217:2 6221:3  
6225:1,6,20  
6226:24,26  
6230:16 6231:2,6  
6232:25,26

6236:5,6,9,22  
**Fitch's** 6194:13  
6238:23  
**five-** 6236:11  
**flag** 6221:19  
**flags** 6199:16  
6211:1  
**focusing** 6197:10  
6216:22  
**folks** 6231:8  
6233:19  
**follow-up**  
6237:7,23  
**foregoing** 6240:3  
**forensic** 6183:3  
**form** 6206:15  
6226:12  
**format** 6239:14  
**formation**  
6210:26  
**Forster** 6240:3,  
14  
**forward**  
6205:22,23  
6236:10  
**found** 6193:8  
6211:12 6218:11  
6222:13 6232:12  
**fourth** 6199:3  
6209:25 6210:6  
6218:4  
**frequency**  
6186:7 6232:11  
**front** 6197:23  
6215:12  
**fugitive** 6180:3  
6182:11  
**fully** 6239:14  
**function** 6184:22  
6185:4  
**functioning**  
6205:8 6213:21,  
22,23

**funders** 6211:18  
**funding** 6211:11,  
12,21  
**future** 6178:25  
6234:12

---

**G**


---

**game** 6221:7  
6224:1  
**garbled** 6177:11,  
12  
**gas** 6183:23  
**gases** 6184:1,24  
6185:1  
**gathered**  
6190:20  
**gave** 6195:26  
**Gavin** 6202:16  
**general** 6177:24  
6178:10 6183:26  
6185:4 6235:3  
**generated**  
6186:12,14  
**generation**  
6232:8  
**Gentlemen**  
6235:26  
**give** 6176:11  
6186:13 6193:24  
6211:18 6232:15  
**giving** 6181:4  
6236:18 6239:2  
**glitched** 6227:8  
**glitches** 6236:16  
6239:10  
**go-to** 6209:9  
**gold** 6220:26  
6222:7  
**good** 6173:23  
6175:3,4 6183:11  
6184:13 6187:24  
6195:26 6201:11,  
13 6207:20

6214:12 6218:18  
6222:23 6224:2  
6225:25 6230:2,3  
6232:15  
**government**  
6174:14 6177:23  
6178:9 6206:4  
6214:15 6215:4  
6218:11 6219:3  
**governments**  
6179:22  
**governs** 6195:18  
**graduated**  
6228:6  
**grant** 6211:18  
6212:8,9,10  
**granting** 6220:10  
**grants** 6211:13  
**graph** 6210:16  
6216:21 6217:4  
**Graphics**  
6179:12  
**Grassy** 6175:10,  
16 6192:26  
6193:5 6197:17  
6200:6 6208:18  
6234:13  
**great** 6221:22  
6235:21  
**greater** 6192:4  
**greatest** 6214:7  
**green** 6217:26  
**greens** 6217:11  
**group** 6174:25  
6175:9 6192:25  
6215:19 6218:8  
6225:24 6227:14  
6228:7 6230:1  
6236:19  
**groups** 6209:16  
**guess** 6203:14,20  
6228:26 6230:3  
6231:17,23  
6234:6

**guesstimated** 6198:17 6207:9  
**guesstimates** 6201:8  
**guidance** 6179:8  
**guide** 6196:17  
**guides** 6204:2,8  
**gurus** 6209:9  
**gust** 6190:8  
**gusts** 6189:12  
**guy** 6212:19

---

**H**

---

**half** 6218:1,3  
**halfway** 6181:5,6  
**handle** 6201:13  
6211:6 6227:15  
**hands** 6206:25  
**hard** 6180:5  
6211:11,12  
6220:3  
**harder** 6209:21  
**hassle** 6211:14  
**haul** 6230:20  
**hazard** 6199:10,  
12,24  
**head** 6212:19  
**headquartered**  
6228:15  
**headset** 6180:7  
**health** 6175:1  
6192:25 6193:4  
6195:2,4,8,12,18,  
26 6196:9  
6197:1,8,11,12,  
21 6198:1  
6199:11 6200:1,  
3,7,8,13,18,22,25  
6201:6 6202:22  
6203:4,9,25  
6204:1 6205:17  
6206:3 6207:4,7,  
11,13,14,15,16,25  
6208:4,12,22,24  
6209:1,9,13  
6210:13,19  
6211:2,5 6212:13  
6213:17,23  
6214:2,5,16  
6215:7,9,25,26  
6217:23 6218:15,  
20,26 6219:11  
6220:17,20,22,26  
6221:8,14  
6222:2,23  
6223:5,8,12,14,  
18,22 6224:2,7,  
15,16,22 6234:7,  
14 6235:8  
**healthy** 6204:18  
6205:18  
**hear** 6177:1,4  
6178:5 6213:14  
6226:1,4,5  
6227:23 6230:10  
**heard** 6199:11,13  
6201:24 6203:25  
6231:10  
**hearing** 6174:1,  
18,21 6180:5,10  
6183:8 6197:3,4  
6199:23 6236:11,  
15 6237:3  
6238:14 6239:1,  
6,7,14,15  
**hearings** 6239:9  
**heart** 6210:7,12  
6213:19  
**hectares** 6188:4,  
7  
**height** 6189:10,  
12  
**helpful** 6236:4  
**Hendryx** 6209:6  
6212:18  
**hesitate** 6230:22  
**hexavalent**  
6206:13

**Hey** 6219:4  
6221:15 6222:11  
**HHRA** 6197:13  
**HIA** 6207:15  
**high** 6183:12,17  
6187:15 6188:21  
6189:12 6191:5,  
15,19,26 6195:23  
6201:25 6203:8  
6232:14,21,23  
6233:8,10  
**high-definition**  
6181:4  
**high-profile**  
6178:16  
**higher** 6186:10  
6199:8 6213:18,  
19,20,21,22  
6218:6 6223:23  
**higher-than-**  
**predicted** 6192:3  
**highlighted**  
6211:1  
**highly** 6197:16  
6220:19  
**Hill** 6177:22  
**history** 6239:12  
**Hold** 6226:17  
**Holden** 6229:13  
**holistic** 6207:10  
**hope** 6194:10  
6213:16  
**hoping** 6203:22  
**hospitalization**  
6209:11  
**hospitals** 6219:1  
**host** 6184:3  
6185:23 6186:16  
6187:22 6188:13  
6189:2,20 6191:7  
6196:18 6201:20  
**hour** 6186:6  
6189:13,17,25  
6190:9,14

6191:12  
**hourly** 6186:22  
**hours** 6190:20  
**huge** 6222:21  
**human** 6175:1  
6192:25 6193:4  
6196:26 6197:7,  
8,10,12 6198:1  
6200:1,3,13,22  
6201:6,20  
6202:22 6203:3,  
11,13,15 6205:9  
6207:4,7,14,26  
6208:6,12,24  
6210:13 6215:7,  
25 6218:15  
6219:11 6220:17,  
20 6221:13  
6223:7,12,13,17,  
18 6224:2,15  
**humans** 6198:12,  
26 6215:26  
**hurt** 6221:24  
**hygiene** 6194:23  
6195:18,19

---

**I**

---

**i.e.** 6216:2  
**icon** 6180:11  
**idea** 6194:13  
6201:11  
**identified**  
6198:14  
**identify** 6201:9  
6218:14  
**identity** 6217:21  
**Ignasiak** 6225:7  
6236:24 6238:25  
**ignore** 6222:5,6  
6232:9  
**ill** 6204:7,20  
**illness** 6211:3  
6191:12  
**illnesses** 6204:24  
6208:3  
**images** 6174:2  
**impact** 6196:10,  
25 6197:13  
6200:7,8,15,18  
6206:3 6207:12,  
14,15 6209:9  
6212:14 6217:23  
6220:21 6223:6  
6224:24  
**impacts** 6180:1  
6182:8,22 6183:1  
6200:25 6205:18  
6208:8,24 6211:2  
6215:9 6218:15,  
26 6221:8  
6223:5,8,12  
6224:7  
**impaired**  
6213:21  
**important**  
6188:8 6201:18  
6215:11  
**impossible**  
6234:16  
**improve** 6213:12  
**improving**  
6212:3  
**incidents** 6208:2  
**include** 6212:23  
6215:25 6238:12  
**included** 6178:25  
6197:15 6220:16  
6222:2,4  
**including**  
6174:26 6178:17  
6225:5  
**increase** 6185:1,  
13,14 6186:9  
6187:18 6188:11  
6208:1,2  
**increased**  
6184:17 6217:10,  
23,24

<b>increases</b> 6185:11	<b>intent</b> 6237:13	<b>items</b> 6237:4	6221:16 6224:8 6239:10	6199:14,15,16 6202:26 6203:1 6217:10
<b>independent</b> 6176:10 6179:26 6184:26 6193:23	<b>intention</b> 6237:5	<hr/> <b>J</b> <hr/>	<b>Kitchener</b> 6227:17	<b>levels</b> 6203:2,8
<b>indication</b> 6186:13	<b>interest</b> 6234:20	<b>JAMES</b> 6174:24	<b>knowledge</b> 6208:14,26	<b>liaised</b> 6179:22
<b>indications</b> 6209:12	<b>interesting</b> 6206:16	<b>January</b> 6179:5 6190:26 6238:8	<hr/> <b>L</b> <hr/>	<b>library</b> 6215:23
<b>indicators</b> 6209:13	<b>interfere</b> 6237:26	<b>Jim</b> 6177:15	<b>Lacasse</b> 6229:13, 15	<b>life</b> 6210:13,19 6221:26
<b>indirect</b> 6208:4	<b>international</b> 6178:14 6179:6, 7,16	<b>job</b> 6213:11 6223:25	<b>lack</b> 6183:21 6218:12	<b>lifted</b> 6232:4
<b>INDISCERNIB</b>	<b>internet</b> 6174:15	<b>John</b> 6192:11,12, 18,22	<b>Lake</b> 6188:16 6233:13	<b>limit</b> 6199:7
<b>LE</b> 6176:25 6177:2 6179:18 6181:26 6230:7	<b>interpretation</b> 6207:11,12	<b>join</b> 6228:10	<b>Lambrecht</b> 6229:18,19	<b>limitation</b> 6218:24 6221:5
<b>individual</b> 6190:5 6204:7 6232:17	<b>interrupt</b> 6194:18	<b>joined</b> 6228:6	<b>land</b> 6201:15,16	<b>limitations</b> 6200:20 6218:18 6219:18
<b>industrial</b> 6194:23	<b>interval</b> 6217:15, 20	<b>joining</b> 6225:26	<b>Landowners</b> 6174:25 6175:9 6192:25 6225:24 6230:1 6236:19	<b>limited</b> 6177:21 6220:25 6224:3
<b>industries</b> 6203:7	<b>introduce</b> 6215:18	<b>Joint</b> 6179:7 6229:21	<b>landscape</b> 6198:21 6201:23	<b>limits</b> 6199:6 6203:22 6204:9, 10
<b>industry</b> 6179:23 6195:19 6203:10 6206:4	<b>introduced</b> 6201:5	<b>journal</b> 6220:10	<b>large</b> 6197:20 6208:21 6239:13	<b>linear</b> 6200:2 6224:3,22
<b>inflammation</b> 6211:1	<b>invariably</b> 6204:17	<b>journals</b> 6212:2 6220:10	<b>late</b> 6230:15 6238:8	<b>linearity</b> 6200:20
<b>inform</b> 6223:25	<b>inverse</b> 6184:11	<b>JRP</b> 6184:8	<b>latest</b> 6238:1	<b>lines</b> 6196:11
<b>information</b> 6183:20 6195:22 6203:17 6207:22, 23 6208:7,11	<b>involved</b> 6195:11,20 6196:9 6201:7 6203:18 6211:24 6214:15 6219:21 6220:9	<b>June</b> 6190:23	<b>layers</b> 6221:18,21	<b>list</b> 6201:9 6209:3,8 6218:4
<b>inherent</b> 6200:21	<b>involves</b> 6201:7	<b>justified</b> 6222:4	<b>lead</b> 6206:13	<b>listed</b> 6223:13
<b>input</b> 6180:15,21, 23 6181:5	<b>IR</b> 6184:8	<hr/> <b>K</b> <hr/>	<b>leads</b> 6212:11	<b>listened</b> 6188:4 6230:15
<b>inquiry</b> 6200:24	<b>irritant</b> 6205:2,3	<b>Kapel</b> 6229:13	<b>leave</b> 6222:5 6224:11	<b>listening</b> 6197:3
<b>integrity</b> 6212:4, 6,7,9,10 6216:11 6222:17,18	<b>isolation</b> 6219:19	<b>key</b> 6232:26	<b>leaves</b> 6189:17	<b>literature</b> 6197:14,20 6203:19 6205:21 6209:8 6215:23 6216:18
<b>intend</b> 6236:24	<b>issue</b> 6188:5 6199:13 6209:13 6211:5 6231:2	<b>kidney</b> 6210:8 6213:20	<b>left</b> 6198:6	<b>live</b> 6173:24 6218:25 6219:2 6224:16 6226:9
<b>intended</b> 6204:11	<b>issues</b> 6174:14,18 6194:11 6195:12 6197:21 6210:24 6215:7 6222:23 6224:19 6225:15 6230:17,18	<b>kids</b> 6196:4 6204:21	<b>left-hand</b> 6198:15	<b>liver</b> 6205:8,10
		<b>kilograms</b> 6187:1,3,16,17	<b>legal</b> 6178:21	<b>liver's</b> 6205:11
		<b>kilometres</b> 6189:13,16,25 6190:9,13 6191:12	<b>legislation</b> 6196:13	<b>living</b> 6200:9 6208:23 6210:9, 11 6220:22 6227:11
		<b>Kincardine</b> 6179:26	<b>level</b> 6180:22 6181:5 6195:24	
		<b>kind</b> 6177:6 6198:21 6208:11 6217:8 6218:26		

<b>Livingston</b> 6225:24 6229:26	<b>made</b> 6183:25 6189:9 6239:11, 12	<b>meant</b> 6204:5	6232:12	<b>Mitchell</b> 6219:12
<b>Livingstone</b> 6174:25 6175:9 6192:25 6227:14 6236:19	<b>main</b> 6197:18 6209:7 6213:1 6218:10,24	<b>measure</b> 6184:24 6210:2 6217:8	<b>mic</b> 6181:2	<b>mixtures</b> 6205:23 6221:17
<b>LLG</b> 6175:15	<b>make</b> 6174:7 6176:4 6188:6 6191:4 6193:16 6224:21	<b>measurements</b> 6189:9	<b>Michael</b> 6209:6 6212:18	<b>model</b> 6191:3 6199:7,17,18 6207:19
<b>LLG's</b> 6192:17	<b>man</b> 6194:22	<b>measures</b> 6207:24 6208:4	<b>microphone</b> 6174:2 6177:8 6180:11,16,21 6181:3	<b>modelled</b> 6198:13,14,19 6199:4 6200:23 6207:19 6222:6 6223:6,11,23 6224:9
<b>local</b> 6224:12,13	<b>Management</b> 6179:11	<b>medical</b> 6194:24 6211:3	<b>migrant</b> 6234:8	<b>modelling</b> 6201:25 6202:3 6207:8 6220:24
<b>located</b> 6234:2	<b>manager</b> 6178:22	<b>medicine</b> 6194:24 6214:19	<b>migratory</b> 6174:26 6234:9	<b>mon</b> 6190:18
<b>location</b> 6213:12 6233:12	<b>manner</b> 6237:26	<b>meeting</b> 6182:10	<b>millions</b> 6235:12	<b>Monday</b> 6237:20
<b>long</b> 6220:24	<b>March</b> 6177:16	<b>member</b> 6192:10,17	<b>mind</b> 6222:16	<b>money</b> 6211:10, 16,19,21 6212:5
<b>longer</b> 6186:5 6229:1	<b>mass</b> 6184:25 6216:17	<b>members</b> 6183:11 6195:12, 16 6200:9 6236:13	<b>mine</b> 6198:6,7 6200:10 6222:20 6223:24 6234:2, 12	<b>monitored</b> 6203:9
<b>looked</b> 6183:12 6187:20 6209:11, 13,14,16 6215:26 6216:23 6217:25 6218:8	<b>master's</b> 6194:23 6195:3	<b>men</b> 6214:8	<b>mines</b> 6187:13 6189:11 6190:24 6208:22	<b>months</b> 6187:7, 12 6189:13 6190:22 6228:20
<b>loss</b> 6210:21	<b>match</b> 6186:24	<b>mental</b> 6210:24	<b>Mines'</b> 6186:22	<b>morning</b> 6173:23 6174:17 6175:3,4 6183:11 6192:11, 18 6196:17 6210:3 6225:25 6226:1 6230:2 6236:17
<b>lost</b> 6187:8 6195:13 6198:24 6202:8 6206:5 6209:17 6213:4 6216:26 6226:15, 16 6228:3 6232:20,21,22,24 6233:7 6235:16	<b>matches</b> 6187:6, 11	<b>mention</b> 6199:11 6223:16	<b>minimum</b> 6190:19	<b>mortality</b> 6209:14 6210:7, 12,13,21
<b>lot</b> 6208:22 6211:10 6214:20 6215:15	<b>material</b> 6201:16 6202:7	<b>mentioned</b> 6189:23 6206:9 6221:12	<b>mining</b> 6193:5 6197:22 6200:26 6208:17,19,24 6210:10,12 6212:14 6213:4 6214:6,17 6215:10 6216:1, 24 6217:13 6218:16 6222:21, 25,26 6223:9,19, 21 6224:8 6234:3,10,11 6235:8	<b>Motion</b> 6179:12
<b>love</b> 6220:14	<b>mathematical</b> 6207:8	<b>mentioning</b> 6209:25	<b>mischaracterize</b> 6230:25	<b>mountain</b> 6175:10,16 6192:26 6193:5 6197:17 6200:6 6208:15,18
<b>low</b> 6180:16 6187:16 6204:12	<b>mathematically</b> 6198:14,19 6201:25	<b>merit</b> 6222:10,11	<b>minister</b> 6238:16	
<b>lower</b> 6199:7	<b>matter</b> 6238:21	<b>message</b> 6216:18 6222:18	<b>minor</b> 6233:25 6237:3 6239:10	
<b>lung</b> 6209:16,25 6210:6 6213:19, 22	<b>matters</b> 6174:19 6238:18	<b>meta-analysis</b> 6214:18	<b>misguide</b> 6211:20	
	<b>Matthews</b> 6233:22,25 6234:1 6235:14, 25	<b>metaanalysis</b> 6215:1	<b>missed</b> 6182:25	
<hr/> <b>M</b> <hr/>	<b>maximum</b> 6186:24 6187:2, 15 6189:16,24 6190:8	<b>metal</b> 6206:17, 18,19		
<b>Madam</b> 6192:20 6226:21	<b>means</b> 6185:1 6217:9	<b>meteorological</b> 6179:12 6190:18		
		<b>meteorology</b> 6175:16 6183:4		
		<b>method</b> 6186:13		
		<b>methods</b> 6216:12		
		<b>metres</b> 6189:10		

6215:6 <b>Mountains</b> 6208:16 <b>mountaintop</b> 6197:22 6208:19 6213:3,18 6214:17 6215:9 6218:16 6220:21 6222:20 6223:9, 21 <b>mouth</b> 6230:23 <b>move</b> 6190:4 6198:11,20 6201:23 6206:5 6207:4 6210:4 6213:10 6219:10 <b>moved</b> 6194:22 6196:2,5 6228:2 <b>movie</b> 6206:14 <b>MTR</b> 6216:24 6218:16 <b>muffled</b> 6182:1,2 <b>multi-step</b> 6201:6 6202:24 <b>multi-year</b> 6195:10 <b>multiple</b> 6211:2	<b>negative</b> 6220:1 <b>neighbourhood</b> 6234:6 <b>neonates</b> 6210:19 <b>Newcastle's</b> 6194:24 <b>night</b> 6236:16 <b>noise</b> 6219:15 6220:4,14 6221:6 <b>nonpartisan</b> 6176:12 6193:25 <b>northeast</b> 6208:14 <b>note</b> 6189:14 6193:7 <b>notes</b> 6240:6 <b>noting</b> 6191:11 <b>notwithstand</b> 6232:24 <b>notwithstanding</b> 6236:16 <b>November</b> 6190:8,13,25 <b>NRC</b> 6182:16,18 <b>number</b> 6175:7 6177:23 6178:16 6183:19,25 6188:19,20 6199:21 6200:11 6209:16 6210:18 6211:22 6213:1 6217:24 6234:5 6237:12,18 <b>numbers</b> 6187:7, 11 6190:6 6199:4	<b>obesity</b> 6214:2 <b>objective</b> 6176:12 6193:24 6223:26 <b>objectives</b> 6211:25 <b>observations</b> 6191:21 <b>observed</b> 6187:13 <b>observing</b> 6186:22 <b>obstructive</b> 6210:25 <b>Obtaining</b> 6211:16 <b>occasions</b> 6214:2 <b>occupational</b> 6195:4,17,19 6203:6 6214:9 6216:2 <b>occur</b> 6190:25 6207:2 <b>October</b> 6190:23 <b>odds</b> 6191:21 <b>office</b> 6192:15 <b>Official</b> 6240:15 <b>oil</b> 6196:10 <b>on-site</b> 6189:1,18 6190:17 6191:16, 20 <b>one-hour</b> 6191:11 <b>online</b> 6239:9,14 <b>Ono</b> 6188:15 <b>Ontario</b> 6177:22 6179:11,14 6226:9,13 6227:10,17 6228:10,14,15 6230:3 <b>open</b> 6174:9 6180:3 6182:11 6188:3 6210:1	<b>operational</b> 6223:9 <b>operations</b> 6200:26 6208:17, 24 6210:10,12 6212:14 6217:13 6222:25 6223:1, 9,19 6224:8 <b>opinion</b> 6176:11 6191:26 6193:24 6201:2 6223:26 <b>opportunity</b> 6196:14 6236:12, 19 <b>opposite</b> 6185:17 <b>order</b> 6232:8 <b>Organization</b> 6195:8 6207:16 <b>organizations</b> 6179:23 <b>original</b> 6215:2 <b>outcry</b> 6214:16 <b>outlined</b> 6238:6 <b>outstanding</b> 6237:6,11 <b>overlap</b> 6217:20 <b>OVERLAPPIN</b> <b>G</b> 6230:7 <b>oversight</b> 6220:18 <b>overview</b> 6176:22 6194:8 <b>Owens</b> 6188:16 6233:13 <b>oxidative</b> 6206:17	<b>panel</b> 6174:12 6183:8,11 6191:4 6192:11,18 6197:24 6215:12 6223:25 6224:4, 20 6225:2,5,8 6229:14,20,21,26 6236:1,4,13 6237:24 6238:3, 11,14,25,26 6239:6,8 <b>Panel's</b> 6201:1 6237:5 6238:13 <b>panels</b> 6179:17 <b>paper</b> 6180:2 6182:7,13,16 6188:16,18 6210:6,7,18,22 6212:3 6215:1, 11,14 6216:4,8, 10,25 6218:10 6231:4,8 <b>papers</b> 6179:18, 20,21 6209:4 6210:17 6211:9 6212:11 6213:1 6214:22 6215:3 6216:17 6218:7 <b>paradigm</b> 6205:25 6207:2 <b>paragraph</b> 6184:7 6187:24 <b>parallel</b> 6216:5 <b>parameter</b> 6188:8 <b>parameters</b> 6183:5 <b>part</b> 6179:20 6197:8,24 6215:21 6231:23 6232:26 <b>partial</b> 6223:15 <b>participants</b> 6225:5 6238:5,19
<hr/> <b>N</b> <hr/>	<hr/> <b>O</b> <hr/>	<hr/> <b>O</b> <hr/>	<hr/> <b>P</b> <hr/>	
<b>narrow</b> 6200:23 6207:7 6208:9 6222:6 <b>national</b> 6178:14 6182:18 6195:24 <b>nations</b> 6179:22 6195:9 <b>nature</b> 6198:16 <b>nearer</b> 6199:21 <b>necessarily</b> 6204:1 6231:11 <b>needed</b> 6195:21 6196:4 6233:14 6234:26	<b>O'GORMAN</b> 6229:23,24 6230:2,9,14 6233:14,20	<b>oil</b> 6196:10 <b>on-site</b> 6189:1,18 6190:17 6191:16, 20 <b>one-hour</b> 6191:11 <b>online</b> 6239:9,14 <b>Ono</b> 6188:15 <b>Ontario</b> 6177:22 6179:11,14 6226:9,13 6227:10,17 6228:10,14,15 6230:3 <b>open</b> 6174:9 6180:3 6182:11 6188:3 6210:1	<b>operational</b> 6223:9 <b>operations</b> 6200:26 6208:17, 24 6210:10,12 6212:14 6217:13 6222:25 6223:1, 9,19 6224:8 <b>opinion</b> 6176:11 6191:26 6193:24 6201:2 6223:26 <b>opportunity</b> 6196:14 6236:12, 19 <b>opposite</b> 6185:17 <b>order</b> 6232:8 <b>Organization</b> 6195:8 6207:16 <b>organizations</b> 6179:23 <b>original</b> 6215:2 <b>outcry</b> 6214:16 <b>outlined</b> 6238:6 <b>outstanding</b> 6237:6,11 <b>overlap</b> 6217:20 <b>OVERLAPPIN</b> <b>G</b> 6230:7 <b>oversight</b> 6220:18 <b>overview</b> 6176:22 6194:8 <b>Owens</b> 6188:16 6233:13 <b>oxidative</b> 6206:17	<b>panel</b> 6174:12 6183:8,11 6191:4 6192:11,18 6197:24 6215:12 6223:25 6224:4, 20 6225:2,5,8 6229:14,20,21,26 6236:1,4,13 6237:24 6238:3, 11,14,25,26 6239:6,8 <b>Panel's</b> 6201:1 6237:5 6238:13 <b>panels</b> 6179:17 <b>paper</b> 6180:2 6182:7,13,16 6188:16,18 6210:6,7,18,22 6212:3 6215:1, 11,14 6216:4,8, 10,25 6218:10 6231:4,8 <b>papers</b> 6179:18, 20,21 6209:4 6210:17 6211:9 6212:11 6213:1 6214:22 6215:3 6216:17 6218:7 <b>paradigm</b> 6205:25 6207:2 <b>paragraph</b> 6184:7 6187:24 <b>parallel</b> 6216:5 <b>parameter</b> 6188:8 <b>parameters</b> 6183:5 <b>part</b> 6179:20 6197:8,24 6215:21 6231:23 6232:26 <b>partial</b> 6223:15 <b>participants</b> 6225:5 6238:5,19

<b>participate</b> 6174:7 6236:20 6239:9	<b>percent</b> 6186:11 6187:18 6188:10, 11 6190:19 6192:4 6204:21, 22 6217:14 6234:25 6235:1	<b>pollutant</b> 6184:22 6203:4	<b>predict</b> 6223:12	<b>problem</b> 6202:20 6205:26 6206:1 6207:21 6221:20 6232:16
<b>participation</b> 6229:21 6236:3 6239:7	<b>Perfect</b> 6226:3,7	<b>pollutants</b> 6198:5,12,20 6201:23 6203:8 6204:23 6207:1, 21	<b>predicted</b> 6199:15	<b>problems</b> 6200:17 6204:20 6209:2 6210:18 6213:17,23 6214:5 6220:7 6222:13
<b>particle</b> 6201:17, 18	<b>period</b> 6178:18, 24 6186:5,14 6187:16 6190:25, 26 6191:13	<b>pollute</b> 6204:4	<b>prediction</b> 6187:3 6235:2	<b>proceed</b> 6184:20
<b>particles</b> 6185:3	<b>person</b> 6216:6,16	<b>pollution</b> 6195:1, 3,12,26 6196:9 6201:17 6204:25 6205:18 6221:7 6222:22	<b>preference</b> 6199:13	<b>proceeding</b> 6173:25 6176:7 6193:19 6238:4,8
<b>parts</b> 6199:19 6231:18 6232:9	<b>Pfizer</b> 6234:21	<b>population</b> 6208:1,21 6213:26 6219:1 6220:22 6224:16 6234:5,16 6235:3,9,13	<b>preliminary</b> 6174:19	<b>process</b> 6174:10 6197:24 6198:18 6199:10 6200:4 6201:6 6202:24 6207:5,13,17,18 6211:17 6212:6,7 6229:21
<b>party</b> 6223:26	<b>Phd</b> 6194:23 6195:2 6206:21 6219:22 6227:16, 25	<b>portion</b> 6237:3	<b>prepare</b> 6238:12	<b>proceedings</b> 6173:21 6197:4 6239:18 6240:5
<b>pass</b> 6202:1 6207:20 6229:3	<b>phone</b> 6212:21	<b>position</b> 6177:23	<b>prepared</b> 6175:14,25,26 6182:16 6193:3, 11,13 6196:16	<b>process</b> 6174:10 6197:24 6198:18 6199:10 6200:4 6201:6 6202:24 6207:5,13,17,18 6211:17 6212:6,7 6229:21
<b>past</b> 6179:10,11 6189:13 6204:3 6205:25 6206:5 6207:4 6227:16	<b>physics</b> 6232:10	<b>Post-it</b> 6209:21	<b>present</b> 6208:20 6214:8 6236:25	<b>proceedings</b> 6173:21 6197:4 6239:18 6240:5
<b>paths</b> 6198:4	<b>physiologic</b> 6213:22	<b>posted</b> 6238:7	<b>presentation</b> 6196:16,21 6197:19 6223:13	<b>process</b> 6174:10 6197:24 6198:18 6199:10 6200:4 6201:6 6202:24 6207:5,13,17,18 6211:17 6212:6,7 6229:21
<b>patient</b> 6210:17 6214:23	<b>physiology</b> 6208:6	<b>potential</b> 6182:22,25 6183:1 6197:16 6205:1 6207:13 6216:10 6224:7	<b>presented</b> 6180:2 6182:8,13 6188:26	<b>processes</b> 6182:17 6197:26 6203:9 6220:21
<b>patients</b> 6214:24	<b>picture</b> 6223:15 6224:12	<b>pounds</b> 6219:25	<b>presents</b> 6205:9 6223:15	<b>produce</b> 6232:13
<b>pattern</b> 6213:24	<b>pictures</b> 6190:6	<b>power</b> 6185:5,6 6196:11	<b>president</b> 6176:25 6177:14, 20 6179:10,11	<b>prof</b> 6212:18
<b>patterns</b> 6209:11	<b>pit</b> 6182:20	<b>powerful</b> 6203:3 6207:23 6214:19 6216:17	<b>pretty</b> 6201:13	<b>professional</b> 6179:13 6223:26
<b>pay</b> 6222:19	<b>place</b> 6210:4 6212:8	<b>Powerpoint</b> 6196:16	<b>prevalence</b> 6217:9,11	<b>professor</b> 6195:1 6209:10
<b>PCBS</b> 6205:26 6206:9,12	<b>placebo</b> 6234:22, 23	<b>practices</b> 6196:13 6197:22 6198:11	<b>prevalent</b> 6218:2	<b>profile</b> 6182:14
<b>PDF</b> 6175:23 6176:20 6184:5 6185:24 6186:18 6187:23 6189:4 6191:9 6193:9 6194:5	<b>play</b> 6221:7	<b>precautionary</b> 6221:12,14,26	<b>Previously</b> 6174:24	<b>program</b> 6179:2 6228:10
<b>peak</b> 6190:25,26	<b>pleasant</b> 6224:11	<b>preceding</b> 6187:23	<b>primarily</b> 6192:1 6228:13	<b>programs</b> 6195:3
<b>peer-reviewed</b> 6211:16 6212:1	<b>plethora</b> 6223:16		<b>principle</b> 6221:12,14 6222:1	<b>progress</b> 6221:25
<b>people</b> 6190:6 6200:9 6204:19, 20 6205:18 6209:4,15 6215:14 6220:2 6221:24 6234:21, 23,24,26 6235:5, 12	<b>PM</b> 6186:24 6187:4,5		<b>principles</b> 6184:26	<b>project</b> 6175:11, 17 6178:22 6183:15 6193:1,5 6197:20 6199:25 6200:6,24 6223:4,14 6224:24 6228:18
	<b>point</b> 6184:22 6185:11 6207:2 6209:14,25 6226:26 6233:2		<b>prior</b> 6198:17	
	<b>pointing</b> 6221:4		<b>private</b> 6177:19, 20 6179:23	
	<b>points</b> 6198:15 6201:4,9 6223:4			

6229:5,6 6234:2 6238:13 <b>projects</b> 6195:10 6207:13 6228:16 <b>properly</b> 6232:23 <b>proponent</b> 6186:11,23 6187:19,20 6191:2 <b>proponent's</b> 6183:18 6187:3 6188:3 6189:9 6191:1 <b>proportional</b> 6185:5,9 <b>propose</b> 6237:24 <b>proposed</b> 6192:4 6208:18 <b>protect</b> 6224:15 <b>protection</b> 6221:18,21 <b>protective</b> 6204:1 <b>provide</b> 6176:22 6183:8 6194:7 <b>provided</b> 6176:17 <b>providing</b> 6179:8 <b>province</b> 6179:13 6240:8 <b>public</b> 6173:26 6174:9 6211:1 6214:16 <b>publication</b> 6216:22 <b>publicly</b> 6174:4 <b>publish</b> 6211:25, 26 <b>published</b> 6179:24 6197:14 6203:16 6207:9 6209:1,12 6214:22,23,25	6215:3,7 6222:17 6223:7,21 <b>publishing</b> 6212:1,10 6220:11 <b>pull</b> 6184:3 6185:23 6188:14 6236:15 <b>pulmonary</b> 6210:25 <b>pure</b> 6206:18 <b>purposes</b> 6194:6 6232:19 <b>put</b> 6185:13 6213:1 6221:18 6228:18 6230:22 6231:17 6236:10 <hr/> <b>Q</b> <b>Q'</b> 6184:23 <b>qualified</b> 6216:6 <b>quality</b> 6175:10, 15 6177:21 6178:12,13,21 6179:6 6183:14, 18,22 6185:15 6186:25 6197:9 6204:1 6210:13, 19 6228:9 6230:24 <b>quantity</b> 6184:25 <b>quarry</b> 6182:20 <b>question</b> 6175:5, 7 6227:7,23,24 6229:25 6230:14 6231:24 6233:25 <b>questions</b> 6225:4,8,15 6226:8 6229:7, 13,16,19,23,26 6233:21,23 6235:24,26 <b>quoted</b> 6187:13	<b>quotient</b> 6199:11 <b>quotients</b> 6199:12,24 <hr/> <b>R</b> <hr/> <b>rain</b> 6179:2,3 <b>raise</b> 6196:4 6238:19 <b>range</b> 6187:15 6191:12 6204:23 <b>Rasouli</b> 6237:12 <b>rate</b> 6184:23,24 6185:3 6210:8 6234:25 <b>rates</b> 6201:22 6209:14 6210:21 6213:19,20,21 <b>ratio</b> 6217:9 6218:2 <b>re-ask</b> 6227:7 <b>re-direct</b> 6236:5, 6 <b>reach</b> 6220:24 <b>reached</b> 6212:17 <b>read</b> 6184:10,15 <b>ready</b> 6225:22 <b>real</b> 6206:1 6211:5 6224:2 <b>real-world</b> 6200:24 6223:17, 18 <b>Realtek</b> 6181:4 <b>reason</b> 6233:10 <b>reasonable</b> 6188:7 6199:20 <b>reasons</b> 6203:10 6222:12 6223:11 <b>receive</b> 6237:5,14 <b>received</b> 6201:20 6238:4,10 <b>recent</b> 6214:7	<b>recently</b> 6183:3 6215:7 <b>receptor</b> 6198:11,22 <b>recognize</b> 6186:9 6224:5 <b>recognized</b> 6218:17 <b>recommendatio ns</b> 6238:15 <b>record</b> 6175:20 6193:8 6237:9, 15,22 6238:1,3,7 <b>recorded</b> 6191:13,15,20 <b>recordings</b> 6173:25 6174:3 <b>recreational</b> 6198:23 <b>red-flagged</b> 6199:9 <b>reevaluation</b> 6199:17 <b>reference</b> 6183:25 6184:18 6191:10 6231:8 <b>referenced</b> 6184:11 <b>referred</b> 6186:1 <b>referring</b> 6189:26 6190:7 <b>refinement</b> 6199:17 <b>refineries</b> 6196:11 <b>reflect</b> 6214:9 <b>refuted</b> 6222:3 <b>regard</b> 6175:11 <b>region</b> 6198:24 6200:10 <b>Registry</b> 6175:22 6176:19 6184:4 6185:24 6189:3 6191:8 6193:8	6194:5 <b>Regulator</b> 6229:26 <b>regulatory</b> 6199:6 6231:12, 25 6232:5,19 6233:11 <b>reinforces</b> 6188:18 <b>relate</b> 6203:15 <b>related</b> 6182:8 6230:17 6237:7, 12,19 <b>relation</b> 6212:12 <b>relationship</b> 6184:12 6188:9 <b>relationships</b> 6182:14 <b>relative</b> 6219:7 <b>relevant</b> 6178:25 6197:16 6201:2 6215:25 6220:19 <b>relies</b> 6200:22 6207:8 <b>rely</b> 6174:16 6203:13 6207:18 6208:9 6235:10 <b>remainder</b> 6174:17 <b>remarkably</b> 6236:17 <b>remember</b> 6231:14,16 <b>remind</b> 6224:14 <b>reminder</b> 6173:24 6194:13 <b>removal</b> 6199:19 6208:19 6213:4, 18 6215:9 6218:16 6220:21 6222:21 6223:9, 21 <b>remove</b> 6221:21
--	---	--	---	--

<p><b>repeat</b> 6179:19 6187:10 6192:14 6227:22,24 6228:5</p> <p><b>replies</b> 6183:19</p> <p><b>reply</b> 6185:16 6236:25</p> <p><b>report</b> 6175:14, 22,24 6176:4,6,9, 18 6183:19 6185:24 6186:26 6193:3,8,11,16, 18,19 6194:5 6200:12,20 6209:6 6213:2 6226:13 6228:18, 23 6237:6 6238:2,12</p> <p><b>reported</b> 6191:19 6197:21 6200:25 6216:1 6217:22</p> <p><b>reporter</b> 6176:26 6177:4,11 6178:1 6179:19 6180:4 6182:24 6185:6 6187:9 6192:20 6194:18 6195:14 6198:25 6199:1 6202:9,12 6206:6,11 6209:18 6213:5 6217:1 6226:18, 19,21,22 6230:8, 10 6240:15</p> <p><b>reporters</b> 6236:14 6238:26</p> <p><b>reporting</b> 6209:1 6215:6 6223:8</p> <p><b>reports</b> 6197:9 6233:18</p> <p><b>representation</b> 6190:18</p> <p><b>representative</b> 6190:21 6232:13</p>	<p><b>representativene</b> <b>ss</b> 6189:18</p> <p><b>reproduce</b> 6186:23 6212:23</p> <p><b>reproduced</b> 6215:12</p> <p><b>requested</b> 6237:19</p> <p><b>requests</b> 6183:20</p> <p><b>required</b> 6237:23</p> <p><b>requires</b> 6190:19 6235:5</p> <p><b>research</b> 6177:25 6178:10 6179:16 6182:18 6195:25 6211:10,11,12, 16,22 6212:5,8,9, 10,22 6215:2 6228:7</p> <p><b>resident</b> 6224:13</p> <p><b>residents</b> 6209:13</p> <p><b>residual</b> 6204:13</p> <p><b>respect</b> 6180:1 6183:17</p> <p><b>respiratory</b> 6195:9 6196:8 6204:20 6205:2,3 6206:24 6210:7, 24 6218:5</p> <p><b>responded</b> 6237:16</p> <p><b>response</b> 6221:3 6237:14</p> <p><b>responses</b> 6237:6</p> <p><b>result</b> 6185:2,13 6192:2 6220:1,4</p> <p><b>results</b> 6200:1 6213:24 6216:7, 9,24</p> <p><b>resume</b> 6225:17</p> <p><b>retained</b> 6175:9 6192:24 6228:18,</p>	<p>22</p> <p><b>retire</b> 6178:15 6227:12</p> <p><b>retrospective</b> 6218:25</p> <p><b>review</b> 6175:9 6192:25 6193:4 6215:8 6229:21 6238:11</p> <p><b>reviewed</b> 6197:12 6205:20 6216:5 6218:7</p> <p><b>reviewers</b> 6211:14 6216:7, 15 6222:13</p> <p><b>reviewing</b> 6212:2 6215:2 6216:8,17 6220:11</p> <p><b>reviews</b> 6196:10</p> <p><b>revised</b> 6195:21 6205:20</p> <p><b>revision</b> 6195:22</p> <p><b>Richmond</b> 6177:22</p> <p><b>right-hand</b> 6180:20 6190:2</p> <p><b>risk</b> 6175:1 6192:26 6193:4 6195:2,6,23,26 6196:9 6197:1,12 6198:1 6199:8,10 6200:1,3,5,13,20, 22 6201:6 6202:22 6204:13 6207:4,7 6208:12 6219:11 6220:17 6221:14 6223:14 6224:2</p> <p><b>risks</b> 6197:7,16 6199:25</p> <p><b>Roger</b> 6214:14</p> <p><b>roll</b> 6239:10</p> <p><b>rolled</b> 6206:2</p> <p><b>room</b> 6174:1</p>	<p><b>row</b> 6186:26</p> <p><b>Rudolph</b> 6231:7, 10</p> <p><b>Rudolph's</b> 6188:4 6230:22</p> <p><b>run</b> 6228:9</p> <p><b>running</b> 6196:6</p> <p><b>RWDI</b> 6178:18</p> <hr/> <p style="text-align: center;"><b>S</b></p> <hr/> <p><b>safe</b> 6199:5,6,7 6202:26 6203:1,2 6204:10</p> <p><b>safety</b> 6195:19 6203:9</p> <p><b>sands</b> 6196:11</p> <p><b>Saturdays</b> 6239:3</p> <p><b>scenario</b> 6188:8</p> <p><b>scenes</b> 6236:15</p> <p><b>schedule</b> 6238:6</p> <p><b>scheduled</b> 6174:6</p> <p><b>schematic</b> 6198:2</p> <p><b>school</b> 6194:25</p> <p><b>science</b> 6178:23</p> <p><b>scientific</b> 6179:17,20,21 6211:20</p> <p><b>scientifically</b> 6179:18</p> <p><b>scientists</b> 6215:19,20,21</p> <p><b>scope</b> 6200:23 6207:8 6208:9 6222:6 6224:4</p> <p><b>scoped</b> 6220:25</p> <p><b>score</b> 6216:14</p> <p><b>screen</b> 6185:16 6190:10 6192:19 6198:15</p>	<p><b>screening</b> 6221:19,23</p> <p><b>seams</b> 6208:17</p> <p><b>searches</b> 6215:23</p> <p><b>season</b> 6190:20, 24</p> <p><b>sec</b> 6226:17</p> <p><b>secretary</b> 6179:1</p> <p><b>section</b> 6178:12</p> <p><b>sections</b> 6197:13</p> <p><b>sector</b> 6177:19,20 6179:24</p> <p><b>seek</b> 6211:24</p> <p><b>SEIA</b> 6238:17</p> <p><b>selection</b> 6213:26</p> <p><b>seminal</b> 6212:25</p> <p><b>SENES</b> 6177:21 6178:17</p> <p><b>senior</b> 6177:20 6178:19</p> <p><b>sensitive</b> 6204:23 6206:26</p> <p><b>sensitivity</b> 6204:25</p> <p><b>sensitized</b> 6206:23</p> <p><b>sentence</b> 6184:9</p> <p><b>sentiments</b> 6238:24</p> <p><b>served</b> 6179:16</p> <p><b>service</b> 6174:15 6178:11</p> <p><b>services</b> 6177:15, 25 6178:14,20</p> <p><b>session</b> 6174:13</p> <p><b>set</b> 6196:3</p> <p><b>setting</b> 6203:6,7</p> <p><b>settings</b> 6180:13, 18 6225:12,19</p> <p><b>settled</b> 6196:3</p> <p><b>severe</b> 6214:5</p> <p><b>share</b> 6201:1</p>
---	---	---	---	--

6238:21	<b>single</b> 6187:16 6210:16	<b>slowly</b> 6178:4 6182:5 6192:7	6190:9 6231:5,22 6232:3,5,12,21	6194:5 6198:6 6209:5 6213:8
<b>shared</b> 6212:22	<b>sir</b> 6175:8 6176:9 6184:18 6185:22 6186:15,20	<b>small</b> 6188:10 6235:9	<b>speeds</b> 6183:13, 17 6185:4	<b>starts</b> 6176:19
<b>sharing</b> 6216:7	6188:12 6190:10 6191:25 6193:3, 22 6221:9	<b>smoking</b> 6213:26	6186:10 6188:21 6189:16,25	<b>state</b> 6178:22 6180:8 6210:10
<b>sheet</b> 6216:14	6225:20 6230:13, 19 6231:16	<b>smoothly</b> 6236:17	6191:5,11,15,20, 26 6232:23	<b>states</b> 6184:10 6206:17 6208:15 6209:10 6212:18 6223:1,10
<b>shifts</b> 6205:25 6207:2	6232:2 6236:6, 13,26	<b>Society</b> 6179:12 6195:10,18	6233:8,10	<b>stating</b> 6191:15
<b>short</b> 6197:19	<b>site</b> 6190:19,21, 24 6191:1,5 6229:5,6	<b>soil</b> 6198:8,10	<b>spend</b> 6199:26 6211:21	<b>station</b> 6186:22 6189:15,24
<b>shorter</b> 6186:14	<b>sites</b> 6198:11,22	<b>solely</b> 6200:22 6207:8	<b>spent</b> 6211:9 6219:25 6227:19, 25	<b>stations</b> 6189:1 6191:13
<b>shorthand</b> 6240:5,6	<b>sitting</b> 6210:3	<b>solid</b> 6220:15	<b>spoke</b> 6237:13	<b>statistics</b> 6178:24,25 6209:9
<b>shortly</b> 6237:21 6238:9	<b>situation</b> 6232:20	<b>soluble</b> 6206:15, 18	<b>spread</b> 6217:17 6235:2	<b>stats</b> 6217:16,19
<b>show</b> 6198:4 6210:16 6216:21 6217:7,11,23 6219:26 6232:22 6233:3,6 6235:19	<b>situations</b> 6201:26 6232:23	<b>somebody's</b> 6204:25	<b>square</b> 6185:11	<b>stayed</b> 6194:26
<b>showing</b> 6219:21 6222:23 6224:12	<b>six-week-long</b> 6236:11	<b>son</b> 6224:13	<b>squared</b> 6185:10	<b>staying</b> 6205:19
<b>shown</b> 6185:16 6186:25	<b>size</b> 6201:18	<b>sophisticated</b> 6207:11	<b>stable</b> 6174:16	<b>steel</b> 6206:23,25
<b>shows</b> 6187:5,14 6189:16,24	<b>skewed</b> 6235:4	<b>sort</b> 6180:20 6195:22 6197:4 6199:2 6205:25 6234:18	<b>staff</b> 6225:11,18 6236:13 6238:26	<b>stepped</b> 6192:15
<b>sic</b> 6202:13 6205:14 6215:12 6217:11 6221:3, 26	<b>skill</b> 6240:7	<b>sound</b> 6177:11	<b>stainless</b> 6206:23,25	<b>steps</b> 6201:7
<b>side</b> 6180:20 6181:2 6190:3 6198:15 6217:13	<b>skimmed</b> 6197:9	<b>source</b> 6180:3 6182:11 6231:20	<b>stake</b> 6224:1	<b>story</b> 6206:14
<b>sidetrack</b> 6234:18	<b>slide</b> 6181:8,12 6197:2,25,26 6199:22 6200:16 6201:3,9 6207:6 6208:10,25 6210:15,23 6212:15 6214:10 6215:17 6216:20 6217:4 6218:13 6219:10 6221:10 6223:2 6224:10	<b>sources</b> 6235:10	<b>stand</b> 6225:17 6236:7	<b>straightforward</b> 6202:22
<b>signal</b> 6210:1,2	<b>slider</b> 6180:22 6181:8	<b>speak</b> 6178:4 6192:7 6194:12, 16 6227:3	<b>standard</b> 6188:22 6189:10, 11 6200:2 6204:6 6222:7	<b>strange</b> 6203:23
<b>significant</b> 6200:7,8,18 6217:21 6234:2,4	<b>slightly</b> 6230:13	<b>SPEAKERS</b> 6230:7	<b>standards</b> 6195:21 6203:26 6204:4 6205:19 6220:26	<b>strategy</b> 6179:3
<b>similar</b> 6200:26 6203:21 6208:16 6223:8	<b>slow</b> 6178:3 6194:16	<b>speaking</b> 6181:15 6182:5 6196:14 6230:23	<b>start</b> 6174:11,12 6175:6 6180:17 6196:21 6203:21 6217:6 6225:25 6233:2	<b>streaming</b> 6227:2
<b>simple</b> 6232:7	<b>slower</b> 6194:12, 15	<b>species</b> 6174:26	<b>started</b> 6217:3 6232:26 6233:1	<b>streams</b> 6173:24
<b>simplistic</b> 6232:18		<b>Specifically</b> 6196:26	<b>starting</b> 6174:22 6175:22 6193:9	<b>strength</b> 6210:2
<b>simply</b> 6185:13 6194:7		<b>speed</b> 6180:1 6182:8,14 6184:17,23,26 6185:1,5,10,12, 13 6186:7,8		<b>stress</b> 6235:18

24,25 6216:1 6218:15,17,18,25 6219:16,19,22 6220:9,12,16,19 6221:2,4 6222:2, 10,14,16 6223:7, 18 6232:6	<b>surrogate</b> 6203:24	<b>task</b> 6224:20	<b>today</b> 6194:6 6235:24 6236:3	<b>typical</b> 6190:18
<b>study</b> 6178:23 6210:15 6211:25, 26 6216:11 6218:14,20,21,24 6219:7,18,20 6220:2,5 6222:12 6235:6	<b>surrounding</b> 6200:9	<b>taught</b> 6195:1,3	<b>tooth</b> 6210:21	<hr/> <b>U</b> <hr/>
<b>submission</b> 6205:15 6227:15	<b>surroundings</b> 6174:3	<b>teaching</b> 6195:25	<b>topics</b> 6197:6	<b>U'</b> 6184:23
<b>submissions</b> 6236:3	<b>suspect</b> 6224:24	<b>tease</b> 6235:7	<b>Toronto</b> 6178:23	<b>UK</b> 6195:18,19 6196:5
<b>submitted</b> 6237:21	<b>sworn</b> 6174:24 6175:5 6192:21	<b>technical</b> 6179:1 6194:11	<b>total</b> 6186:12 6190:23	<b>uncertainties</b> 6200:21
<b>submitting</b> 6233:18	<b>symptoms</b> 6210:24	<b>technology</b> 6194:12	<b>totalling</b> 6188:4	<b>unclick</b> 6181:19
<b>substitute</b> 6185:8	<b>syndrome</b> 6211:5,7	<b>telling</b> 6182:7	<b>touching</b> 6206:25	<b>under-predicts</b> 6188:21
<b>success</b> 6234:25	<b>syndromes</b> 6211:2,3	<b>ten</b> 6204:17 6218:22 6229:1	<b>toxic</b> 6206:18,19, 20 6208:2	<b>underestimate</b> 6186:5 6188:23
<b>suggest</b> 6213:24 6225:10	<b>synergism</b> 6205:1,7,13	<b>tenth</b> 6189:3	<b>toxicity</b> 6203:14	<b>underestimates</b> 6233:7
<b>suggesting</b> 6232:4 6233:8	<b>Systematic</b> 6215:8	<b>term</b> 6231:20	<b>tract</b> 6206:24	<b>underlie</b> 6199:18
<b>suggests</b> 6184:16 6185:16 6187:20 6191:23	<b>systems</b> 6174:15 6202:3	<b>terms</b> 6201:17,18 6212:13 6239:13	<b>transboundary</b> 6179:9	<b>underlying</b> 6214:2
<b>summarizes</b> 6210:17	<hr/> <b>T</b> <hr/>	<b>terribly</b> 6206:18	<b>transcribed</b> 6240:6	<b>underneath</b> 6190:5
<b>summary</b> 6183:9 6191:26 6212:26 6213:3,8 6218:14 6223:3	<b>table</b> 6186:18,25, 26 6189:5	<b>tested</b> 6234:21	<b>transcript</b> 6230:20 6240:1,4	<b>understand</b> 6221:7 6234:4 6237:16
<b>supervised</b> 6195:2	<b>tabled</b> 6200:14	<b>testimony</b> 6196:17 6219:12	<b>transformed</b> 6198:10	<b>understanding</b> 6183:22 6205:17, 21,22,26 6207:4 6208:8 6217:19 6237:10,20
<b>support</b> 6194:15 6207:17	<b>takes</b> 6206:4 6207:2	<b>thing</b> 6219:21	<b>transmission</b> 6198:4	<b>undertaken</b> 6183:3
<b>supports</b> 6207:15,16	<b>taking</b> 6192:6	<b>things</b> 6174:16 6214:19 6221:19 6231:9	<b>transparent</b> 6174:9	<b>undertakings</b> 6237:7,8,11,18, 19,24
<b>supposed</b> 6180:8	<b>talk</b> 6181:25 6194:15 6203:1 6204:10 6212:20, 21 6215:15 6217:3 6221:11 6231:4 6234:19	<b>thought</b> 6212:21 6215:11	<b>transported</b> 6201:19	<b>unequivocal</b> 6219:6 6220:4
	<b>talked</b> 6199:24 6201:24 6219:12	<b>threshold</b> 6186:7	<b>treatment</b> 6214:21,22	<b>unit</b> 6217:8
	<b>talking</b> 6195:23 6199:26 6224:14	<b>time</b> 6174:6 6180:5 6196:8 6199:26 6206:1 6222:10,26 6228:13,22,25 6232:19 6233:15 6237:9 6238:19	<b>trial</b> 6183:7	<b>United</b> 6195:9 6208:14 6223:10
	<b>talks</b> 6184:8	<b>times</b> 6218:6,22 6236:23	<b>triangle</b> 6217:11, 26	<b>units</b> 6205:5
	<b>tap</b> 6206:25	<b>tissues</b> 6208:6	<b>true</b> 6235:3	<b>universities</b> 6179:23
	<b>targeted</b> 6179:3	<b>title</b> 6196:24	<b>Tumour</b> 6210:26	<b>university</b> 6194:24 6195:25
		<b>titled</b> 6175:15 6193:4 6215:8	<b>turn</b> 6176:21 6180:16,25 6181:8,23 6192:10	
		<b>Tiverton</b> 6226:13 6227:9	<b>turned</b> 6174:2 6183:7 6206:14	
			<b>turning</b> 6206:24	

6227:16  
**unmerited**  
 6211:19  
**unusual** 6236:23  
 6239:1  
**UQ** 6185:8  
**USCDC** 6207:17  
**USEPA** 6185:20  
 6188:18

---

**V**

---

**vaccinated**  
 6234:24  
**vaccine** 6234:23  
**vaccines** 6234:20  
**valid** 6222:16  
**valley** 6234:4,6  
**valuable** 6212:25  
**values** 6207:9  
 6217:17  
**variability**  
 6217:16  
**variables**  
 6213:25 6214:4  
**variety** 6195:11  
**vary** 6231:5,21  
**verification**  
 6180:2 6182:11  
**version** 6232:5  
**versus** 6187:3  
 6210:10  
**vertical** 6218:2  
**viability** 6216:9  
**vice** 6177:20  
**video** 6173:24,25  
 6174:4 6227:2  
**view** 6212:22  
 6213:3,9 6220:15  
 6224:22 6230:22  
**violations**  
 6210:22

**virtual** 6174:1  
 6236:15  
**vitae** 6176:17  
 6194:4  
**voice** 6177:7  
**volume** 6180:15,  
 22,23 6181:5,10,  
 17 6202:7  
**Vulnerability**  
 6204:26

---

**W**

---

**walking** 6224:13  
**wander** 6220:6  
**wanted** 6196:4  
 6212:23 6224:11,  
 21 6238:24  
**Waste** 6179:10  
**watching**  
 6234:20  
**water** 6198:8,9  
 6201:15,16  
 6210:22  
**Waterloo**  
 6227:17  
**weaknesses**  
 6216:11 6218:10,  
 11  
**weather** 6178:14,  
 21 6202:2  
**weather-related**  
 6178:20 6183:5  
**Weaver** 6188:15  
**website** 6173:26  
**week** 6230:15  
 6238:1,2  
**weekly** 6179:24  
**weeks** 6197:5  
**weight** 6210:18  
**weird** 6203:20  
**welders** 6206:21,  
 22 6219:23

**welding** 6206:24  
 6219:24  
**west** 6234:3  
**wet** 6206:25  
**white** 6218:2  
**whittled** 6215:24  
**wildlife** 6174:26  
 6175:1  
**willingness**  
 6239:8  
**wind** 6178:25  
 6180:1 6182:8,  
 13,23 6183:1,12,  
 17 6184:17,23,26  
 6185:1,4,5,9,12,  
 13 6186:8  
 6188:21,24  
 6189:12,16,24  
 6191:5,11,15,19,  
 26 6231:5,22  
 6232:3,4,12,21,  
 23 6233:8,10  
**windblown**  
 6185:3 6231:3,4,  
 20  
**windiest** 6188:20  
**winds** 6175:12  
 6180:1 6186:7  
 6190:25 6191:5,  
 23 6201:25  
 6233:9  
**windy** 6182:21  
 6202:1  
**witnesses**  
 6194:11 6236:7,  
 10  
**wondering**  
 6180:10,12  
 6181:7  
**wonky** 6178:4  
 6209:23 6233:1  
**word** 6204:26  
**words** 6230:22  
 6238:21

**work** 6186:21  
 6195:8,24  
 6203:12 6212:16,  
 17 6215:21  
 6218:23 6222:7  
 6226:9,13  
 6227:9,13  
 6228:26 6230:24  
 6232:18,21  
 6233:11,19  
 6234:5  
**worked** 6206:21  
 6227:16 6228:1,  
 7,13,16  
**Workers** 6203:6  
**workforce**  
 6216:3 6234:9  
**working** 6177:17  
 6178:13 6194:26  
 6208:23 6217:15  
 6227:19,26  
 6236:14  
**workplace**  
 6195:5,6  
**works** 6186:4  
 6232:19  
**world** 6195:8  
 6207:16 6220:6  
 6222:20 6224:6  
 6228:16 6239:9  
**worry** 6202:16  
**worsening**  
 6214:7  
**worst** 6187:7,10,  
 12,19,21  
**worst-case**  
 6188:7  
**writing** 6212:8  
 6237:25  
**written** 6183:9  
 6212:26 6233:18  
 6236:2 6238:4  
**wrong** 6204:26  
 6231:1

**wrote** 6211:13

---

**Y**

---

**year** 6186:5,12  
 6191:24  
**yearlong**  
 6232:15  
**years** 6177:19,23  
 6179:15,25  
 6195:1 6196:2,6  
 6203:26 6214:7,  
 15 6219:25  
 6227:19,26  
 6228:2,8 6229:1  
**yellow** 6211:1  
**yesterday**  
 6174:12 6199:12  
**yesterday's**  
 6174:13  
**young** 6174:24  
 6175:3,4,24,26  
 6176:12,17,26  
 6177:2,3,7,14,15  
 6178:2,6 6180:6,  
 9,14,17,23,26  
 6181:3,9,11,14,  
 15,18,21,24,26  
 6182:4,26 6183:6  
 6184:2,7,19  
 6185:7,26  
 6186:2,21  
 6187:11,26  
 6188:2,16  
 6189:6,7,19,22  
 6191:10,17  
 6192:6 6194:22  
 6201:24 6202:13  
 6225:3,17,26  
 6226:4,5,8,9,25,  
 26 6227:3,4,6,22,  
 24 6228:4,17  
 6229:8,25  
 6230:3,5,12,19  
 6232:25 6233:5,  
 15,24 6235:23

6236:2

**Young's** 6175:22

6192:8 6225:12

**Youtube** 6173:26

6174:4

---

**Z**

---

**Zoom** 6180:11

6184:3 6185:23

6186:16 6187:22

6188:13 6189:2,

20 6191:7

6196:18