

BEFORE THE PUBLIC UTILITIES COMMISSION  
OF THE  
STATE OF CALIFORNIA

ADMINISTRATIVE LAW JUDGES JESSICA T. HECHT and MARCELO  
POIRIER, co-presiding  
COMMISSIONER CLIFFORD RECHTSCHAFFEN, in attendance

Order Instituting Investigation on	)	EVIDENTIARY
the Commission's Own Motion into the	)	HEARING
Operations and Practices of Southern	)	
California Gas Company with Respect	)	
to the Aliso Canyon storage facility	)	
and the release of natural gas, and	)	
Order to Show Cause Why Southern	)	
California Gas Company Should Not Be	)	
Sanctioned for Allowing the	)	Investigation
Uncontrolled Release of Natural Gas	)	19-06-016
from its Aliso Canyon Storage	)	
Facility. (U904G)	)	

REPORTERS' TRANSCRIPT  
Virtual Proceeding  
March 23, 2021  
Pages 804 - 978  
Volume 6

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VIRTUAL HEARING

MARCH 23, 2021 - 10:06 A.M.

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ADMINISTRATIVE LAW JUDGE POIRIER: We will be on the record.

Good morning. This is ALJ Marcelo Poirier. It's March 23rd, 2021. This is day six of the evidentiary hearing in Investigation 19-06-016, the Aliso Canyon Judicatory OII.

Prior to going on the record, we had a discussion on the timing and schedule of the proceeding and the impact of that on service of cross estimates. It appears that as of now that the schedule that has been distributed including right now, the cross of Mr. Krishnamurthy, and the cross of Cal Advocates' witnesses by SoCalGas is consistent with the schedule that was distributed.

As that situation changes or if it does, we've instructed the parties to confer so that we have an accurate understanding of the schedule moving forward. And that parties have a good understanding of when they need to serve those cross-examination exhibits in conformance with the instructions of the assigned ALJs.

1           We left off yesterday with  
2 Mr. Lotterman crossing Dr. Krishnamurthy.

3           Mr. Lotterman are you ready to  
4 continue?

5           MR. LOTTERMAN: I am, your Honor.

6           ALJ POIRIER: Okay. Please go ahead.

7                       RAVI KRISHNAMURTHY,  
8 resumed the stand and testified further as  
9 follows:

10                      CROSS-EXAMINATION RESUMED

11 BY MR. LOTTERMAN:

12           Q    Good morning, Dr. Krishnamurthy,  
13 how are you?

14           A    Pretty good. Thank you.

15           Q    All right. We left off yesterday  
16 discussing whether Blade was able to  
17 determine when the corrosion on the exterior  
18 of that production casing on SS-25 began. Do  
19 you remember that?

20           A    Yes.

21           Q    And I believe you told me that  
22 there was no reliable data, or at least Blade  
23 found no reliable data as to when the  
24 groundwater replaced the drilling fluid in  
25 that annulus; is that right?

26           A    Correct.

27           Q    And I believe you also said that  
28 Blade also was unable to find any reliable

1 data as to when those SS-25 well connections  
2 began to seep and began feeding carbon  
3 dioxygens (sic) to the methanogens; is that  
4 right?

5 A Correct.

6 Q Right. And so when I asked you,  
7 "Does that mean therefore that Blade was  
8 unable to determine when the corrosion  
9 began?"

10 You said that, "That is correct."

11 And that if I were to press you to  
12 give you a date, you would be guessing. Is  
13 that still your testimony?

14 A Yeah. It would be a hypothesis.  
15 It would be nonfactual; that's correct.

16 Q Fair enough. Fair enough. What  
17 you did say though, which I had not focused  
18 on before and I wanted to just pursue this  
19 very briefly is you said that:

20 Under your hypothesis, that  
21 corrosion did not start in  
22 1953 when the original well  
23 was drilled.

24 Correct?

25 A That's correct, yeah.

26 Q And if I understand your answer --  
27 and kind of a light went off in my head at  
28 that point. That's because under your

1 hypothesis, those methanogens were fed by  
2 carbon dioxide, and that could not have  
3 started until SoCalGas converted the well in  
4 1977 to gas injection. Did I get that right?

5 A Yes and no. Let me explain that  
6 because I don't -- they were doing gas lift  
7 operation to produce the oil. So I don't  
8 know what gas was used to gas lift. So I  
9 wouldn't be comfortable reading research how  
10 oil well was operated over pre-gas storage  
11 operations. So you would have to look at  
12 that to confirm it.

13 But there are two items there. And  
14 this was the hypothesis portion of it. Is  
15 until you started storage gas operations, the  
16 loading on the connections wouldn't be at the  
17 level at which you may start seeping. So  
18 you're interpretation is a fair  
19 interpretation.

20 Q Right. And to maybe put a little  
21 more blunt focus on it, I guess what you're  
22 saying is although you didn't rule out the  
23 hypothesis that the corrosion began before  
24 the well was converted in 1977, you believe  
25 it's more likely that the corrosion began  
26 afterward; is that fair?

27 A That's fair.

28 Q All right. Thank you. So I want

1 to -- also I want to next talk about  
2 corrosion rate.

3           And I'm going to ask Mr. Moshfegh  
4 to put up a portion of one of your  
5 supplemental reports, and I'm going to  
6 identify it for the record. It is taken from  
7 Commission Exhibit-1002. And that's  
8 Volume II of Blade's report. And it's a  
9 supplementary report entitled "SS-25 Casing  
10 Failure Analysis." And it's dated May 31,  
11 2019.

12           Do you see that, Dr. Krishnamurthy?

13           A     Yes, I do.

14           Q     All right. Mr. Moshfegh, would you  
15 turn to page 209? And it's section 5.6  
16 entitled "Corrosion Rate. And would you  
17 focus and highlight on that second paragraph,  
18 first three-and-a-half sentences -- lines,  
19 please.

20           Can you read that,

21 Dr. Krishnamurthy?

22           A     I can see it, yeah.

23           Q     All right. So what you say there  
24 -- what Blade says there is:

25                     The exact corrosion rate  
26                     for the seven-inch casing,  
27                     which is the production  
28                     casing that corroded here,

1 cannot be predicted because  
2 of the limited information  
3 about the condition of the  
4 well. Particularly the PH,  
5 alkalinity, temperature,  
6 and composition of the  
7 fluid in context with the  
8 seven-inch casing OD over  
9 the entire life of the  
10 well.

11 And you also say, and I think this  
12 is consistent with what we just talked about.

13 You say:

14 Also the start of the  
15 corrosion attack is not  
16 documented.

17 So I think we've talked about the  
18 second sentence, and I want to focus on the  
19 first.

20 So is it true today, as you wrote in  
21 2019, that the exact corrosion rate that  
22 under your hypothesis attacked SS-25 cannot  
23 be predicted?

24 A That's correct.

25 Q All right. And I understand the PH  
26 and the alkalinity and the temperature,  
27 because I believe we talked about some of  
28 that earlier with drilling fluids et cetera,

1 et cetera.

2 But I was intrigued by the next  
3 sentence. You say:

4 In addition the changes in  
5 season in Aliso Canyon  
6 could also --

7 I assume have affected.

8 -- the factors previously  
9 mentioned.

10 Would you explain to the Commission  
11 how the changes of season could have affected  
12 the conditions which in turn would have  
13 affected the corrosion rate?

14 A Okay. The changes in season here  
15 references the extent of precipitation and  
16 the precipitation that gets to those depths.

17 A lot of those are impacted by the  
18 hydrochemical reactions, the water level as  
19 it seeps through the clay and various  
20 formations to the thousand feet, the pathway  
21 of that. So that is affected by season the  
22 quantity, temperature, voracity. So there's  
23 many factors that drive it. That's really  
24 what we imply there.

25 Q Okay. And is what you're saying  
26 basically: In rainy seasons, that wellbore  
27 and the annulus might have more groundwater.  
28 In the dry season, it might have less. That

1 would vary and that in turn would affect the  
2 corrosion rate?

3 A Yes; that's correct.

4 Q Okay. All right.

5 A Yes. And depending on where you're  
6 measuring or trying to predict, it can be  
7 different. Yes; that's correct.

8 Q And I also believe you say in your  
9 report, and you certainly explain to us in  
10 your deposition, that the corrosion rate  
11 itself in addition to your not being able to  
12 predict it vary -- or could vary over time;  
13 is that true?

14 A Yes.

15 Q All right. I believe you called it  
16 a "time dependent process" in the deposition.  
17 Would you explain what you meant by that  
18 phrase?

19 A Yeah. Again, the microbiological  
20 mechanism that we talked about, it's a  
21 biochemical reaction, okay. And it's a  
22 biochemical reaction dependent in this  
23 particular case as a percent of -- probably a  
24 (indecipherable) for the methanogens.

25 And then on top of that, you have  
26 what is called a "biofilm." And inside the  
27 biofilm there is an environment, there is a  
28 PH, there is an alkalinity. You can not look

1 at the bulk pH and bulk alkalinity for  
2 predictions. And that would change with  
3 time.

4 And on top of that as the corrosion  
5 reaction happens, you form a corrosion  
6 product. And then corrosion product will  
7 change the rate of corrosion. So many  
8 factors such as those will define how we  
9 change over time.

10 Q And when you say "corrosion  
11 product," are you referring to for example  
12 the scales that can form on the side of the  
13 pipe once the corrosion starts?

14 A That's correct. In this particular  
15 case in the local regions because the  
16 corrosion was localized. In the '80s if it  
17 was corroded, it would change with time.  
18 Yes.

19 Q And is it your view -- and I  
20 believe this is correct. But is it your view  
21 that -- and this sounds counterintuitive to  
22 me, but I believe it's true.

23 Is it your view that those scales  
24 can actually form a protective layer on the  
25 pipe and either frankly enhance the corrosion  
26 or protect against it?

27 A It normally will not enhance. Most  
28 of the time the scales will reduce the

1 corrosion rate. That is well known. You  
2 have mass transferred through the scale  
3 depending on the diametric on the scale and  
4 the nature of the scale. All of those define  
5 the rate of corrosion. But, yes, your  
6 interpretation is correct.

7 Q Okay. And when you extracted that  
8 pipe from SS-25 in 2017, you actually saw  
9 kind of variable corrosion rates on the pipe  
10 itself, didn't you?

11 A Correct.

12 Q I mean --

13 A May I clarify? I want to be clear  
14 there. I did not see variable corrosion  
15 rate. I saw variable corrosion depths.  
16 Yeah? That's what I would state.

17 And the reason I clarified that is  
18 it may be 5 percent in one location, 85  
19 percent in another location. Which implies  
20 one location started early, the other  
21 location started later. So the rates may be  
22 the same, but the depths are different.

23 Q Okay. Got it. And as you point  
24 out in your -- in this Section 5.6 in the  
25 bottom paragraph, which we don't need to  
26 highlight. But you actually say that  
27 controlled lab studies were not informative  
28 in this case because lab conditions can vary

1 from field conditions; is that accurate?

2 A Yeah. It's difficult to simulate  
3 the condition, the condition of methanogens  
4 and, you know, the people do the work to  
5 accelerate the behavior.

6 But what happens in nature and the  
7 real world takes a bit more time. Like in  
8 this particular case, it took a long time.  
9 And so, yeah, simulating that in a lab is  
10 very challenging.

11 Q And I would think so. Because  
12 obviously if you have varying climates and  
13 rainfall and the like at the Aliso Canyon  
14 facility, I mean how would you accurately  
15 replicate that in a lab? You couldn't;  
16 right?

17 A Correct.

18 Q All right. Okay. So bottom line  
19 as you say in this 5 -- Section 5.6:

20 Blade was unable to predict  
21 the exact corrosion rate  
22 for SS-25.

23 So if that's the case if you are  
24 unable to determine when the corrosion  
25 started or what its rate was once it started,  
26 does it logically follow that Blade can't say  
27 with any certainty when that corrosion would  
28 have been detectable on SS-25?

1           A    That's correct.

2           Q    Okay. All right. And by the way,  
3 I believe you said this in the deposition. I  
4 couldn't find it in your Blade -- in your  
5 report. Did you also conclude that the rate  
6 was unlikely to be linear with time?

7           A    No. Normally, you know, for  
8 simplistic analysis and planning purposes you  
9 would use a linear estimate. But in reality  
10 corrosion is not linear, it's exponential.  
11 And it will be a function of the scale and  
12 temperature and various factors. So it is  
13 not going to be linear.                   ]

14          Q    All right. Thank you. Okay.  
15 Let's move on. And I'm trying to get through  
16 this as quickly as I can without our stepping  
17 on each other, and I think actually we're  
18 doing a pretty good job this morning.

19                   So one of the other aspects of your  
20 root cause analysis was examining the past  
21 field-wide practices of SoCalGas at the Aliso  
22 Canyon facility; is that true?

23          A    Yes.

24          Q    And in your business, that's called  
25 O&M, or operations and maintenance; right?

26          A    Correct.

27          Q    And so you went into the records  
28 for the various Well Files, et cetera, et

1 cetera, into SoCalGas' internal gas policies  
2 and that type of thing and you examined what  
3 those O&M practices were; is that true?

4 A Yes, we did.

5 Q You identified a number of leaks  
6 that you believe occurred over 40 years, and  
7 I believe our expert has taken issue with  
8 some of that and there's some back-and-forth  
9 about shoe leaks and stage collar leaks and  
10 all that stuff. I'm going to table that for  
11 now because what I want to focus with you on  
12 this morning is what patterns, trends, or  
13 correlations you found when you did that  
14 analysis; okay?

15 A Yeah.

16 Q All right. So there is a volume on  
17 this. It's actually in the same volume we're  
18 looking at, so let's stay with the same  
19 report. I want to turn to -- lost my place  
20 here. Excuse me. You know what? Let's do  
21 this: Let's turn to -- well, let me back up.  
22 I got it.

23 ALJ POIRIER: Off the record.

24 (Off the record.)

25 ALJ POIRIER: We'll be back on the  
26 record.

27 Please continue, Mr. Lotterman.

28 BY MR. LOTTERMAN:

1           Q    Dr. Krishnamurthy, like I said, I'd  
2    like to focus on any patterns, trends, or  
3    correlations you found when you investigated  
4    the O&M practices of SoCalGas. I'd like to  
5    sort of summarize your findings and we can  
6    walk through them and talk about them as much  
7    as you deem necessary.

8                    First of all, you found that casing  
9    failures were not concentrated in one  
10   specific area of facility or well location;  
11   is that correct?

12           A    Yes.

13           Q    So when we saw that expanse of the  
14    foothills of the old mountain and, in fact,  
15    we showed that diagram of where the field was  
16    divided into three sectors, there wasn't one  
17    particular sector that was more corrosive  
18    than the other or it wasn't by terrain or  
19    anything like that, no correlations about  
20    specific area; true?

21           A    True.

22           Q    And, in fact, I think you observed  
23    in the main report that you found adjacent  
24    wells to each other that often showed  
25    differences; true?

26           A    True.

27           Q    Okay. I believe you also concluded  
28    that you found no correlation at Aliso Canyon

1 regarding geology; right?

2 A True.

3 Q What was the hypothesis you were  
4 pursuing there?

5 A Can you ask me the question again,  
6 please, Mr. Lotterman. I apologize, I lost  
7 it.

8 Q Okay. Glad to. I was noting that  
9 your report observes that you found no  
10 correlation between corrosion and geology at  
11 the Aliso Canyon facility. My question is  
12 what hypothesis were you testing there?

13 A Got it. I'm with you. Okay. No.  
14 See, if you look at the SS-25, the failure  
15 happened in a basalt, if I remember right.  
16 There is a formation above. There's a  
17 formation below.

18 So we were wondering if there was  
19 anything in the formation that may be  
20 contributing -- even though the formation is  
21 outside of the surface casings, this is  
22 inside the production casing -- we were  
23 trying to look for anything specific  
24 formation that could be systemic across the  
25 field or across -- you know, depending, on  
26 west, central, or eastern zones. And we were  
27 looking for any contributory factors from  
28 formation such as water.

1           You could be -- you could be water  
2 permeable or water-containing zone that may  
3 be contributing some highly-corrosive liquids  
4 or water. So that was some of the thinking.  
5 And of course we were also looking at  
6 geotechnical or other such parameters. So we  
7 wanted to eliminate that. That was the  
8 intent of that exercise.

9           Q    Okay. And, in fact, you did;  
10 right?

11          A    Yes, we did.

12          Q    Okay.

13          A    Yes, we did.

14          Q    And by the way, I believe you  
15 mentioned a geologist at SoCalGas who  
16 assisted you with the root cause analysis and  
17 you said -- was that Hilary Petrizzo?

18          A    Yes.

19          Q    All right. Thank you. Just wanted  
20 to clarify that. You also didn't find any  
21 correlation between corrosion and converted  
22 or newly-drilled wells; fair?

23          A    That's correct.

24          Q    Right. So to sort of set the stage  
25 there, obviously SoCalGas converted a number  
26 of wells at Aliso Canyon when it took control  
27 of the facilities in the 1970s, and we talked  
28 about that earlier, but they also, during

1 that 38-year time period, drilled new wells;  
2 right?

3 A Yes, that's correct.

4 Q And your analysis of the records  
5 that were available to you indicated that  
6 there were not necessarily more issues with  
7 older wells or newer wells, there was no  
8 correlation you were able -- it was about  
9 50/50 is what I recall from your report; is  
10 that correct?

11 A That's correct.

12 Q Okay. You also -- I think this is  
13 along the same lines, I suspect, since many  
14 of the converted wells are older than the  
15 newer wells -- but you also found no  
16 correlation between corrosion and the age of  
17 a well, did you?

18 A No.

19 Q Did you expect that?

20 A Yeah. I -- it is, again, a bit of  
21 a common tendency to -- to -- I'm looking for  
22 a word, but I want to be careful which  
23 word -- to automatically characterize older  
24 wells are more at risk. In my experience  
25 that is not true for most of the structures.  
26 It is the environment, it is the condition  
27 that it is exposed to, a lot of those  
28 parameters come into play so you have to be

1 cautious about -- or just correlating with  
2 age. I am not surprised honestly.

3 Q All right.

4 A I was not surprised.

5 Q And then just to wrap up a couple  
6 topics, you found no correlation between  
7 corrosion and depth of surface casing shoe;  
8 true?

9 A I don't know. Depth of surface  
10 casing shoe. So the location of -- again,  
11 I'm not sure about that. I can't recall that  
12 particular conclusion, specific conclusion.  
13 We did look for the wells that had wall  
14 thickness inspections. We analyzed them to  
15 see if the corrosion was above the shoe or  
16 below the shoe. And of course the shoe  
17 depths vary depending on which well you're  
18 looking at. Some of them are 500, 580, some  
19 of them are a thousand, 1,500.

20 So the shoe depths varies depending  
21 on where, you know, which well you're talking  
22 about. So I am not -- I don't recall making  
23 that particular conclusion, but I'll have to  
24 look at my report more carefully.

25 Q It's not important for these  
26 purposes. Did you find any correlation  
27 between corrosion and production casing size?

28 A No. There was more in the

1 seven-inch, but that was probably because it  
2 was more prevalent size. So, no, we did not  
3 find a correlation.

4 Q Did you find any correlation  
5 between corrosion and depth of the well?

6 A Depth of the well. I don't believe  
7 so. I don't think so.

8 Q All right. Did you find any  
9 corrosion between -- sorry, did you find any  
10 correlation between corrosion and time  
11 periods?

12 A By time periods you mean life of  
13 the well; right?

14 Q No. Actually I was thinking more  
15 of, you know, kind of this decade versus that  
16 decade versus that decade.

17 A No, no correlation.

18 Q All right. Okay. Did you -- when  
19 you looked at that -- when you undertook that  
20 analysis, did you identify any kind of quiet  
21 periods where there didn't appear to be a  
22 whole lot of leaks occurring for whatever  
23 reason?

24 A I believe there was. There was a  
25 phase where there was a reduction in number  
26 of leaks. There's a period where the number  
27 of leaks were lower or -- again, I want to --  
28 I want to be careful here. I think we

1 define and we are very specific about  
2 defining. I don't think -- I don't know  
3 whether we called it -- when a casing does  
4 not perform its function as defined, we call  
5 it a failure. Okay. So I want to be  
6 careful. And that was the number we were  
7 looking for rather than just leaks. Okay.

8           So, for example, a tight spot -- at  
9 that point the casing is not perform -- is  
10 not performing its role as it was designed  
11 for so we call that a failure. So I want to  
12 kind of clarify that. That's what I mean.  
13 But there were periods -- I believe there  
14 were few periods where the problems were  
15 fewer or less. That is correct, to answer  
16 your question.

17           Q All right. Thank you. Appreciate  
18 that clarification. All right. So let's go  
19 to the back of the report to the grand  
20 finale, shall we say. But before we get  
21 there, I want to set the stage if I could. I  
22 believe you testified yesterday and you  
23 actually set it out on page 22 of the main  
24 report, the scope of your root cause  
25 analysis.

26           And, Mr. Moshfegh, if we could just  
27 sort of highlight that second paragraph under  
28 1.3. That first sentence. There you go.

1 Just the first sentence, please. There you  
2 go.

3 Dr. Krishnamurthy, as I understood  
4 your testimony yesterday and as I read this  
5 portion of your main report, there were  
6 roughly two goals of your root cause  
7 analysis. One is obviously to identify the  
8 root causes of the problems or events. And  
9 then the second -- and this is what I want to  
10 focus our time for this morning -- is  
11 defining methods for responding to and  
12 preventing them.

13 Do you see that?

14 A Yeah.

15 Q Okay. And is it fair to say that  
16 that second piece, the "Defining methods for  
17 responding to and preventing them" is more of  
18 a forward-looking analysis?

19 A Yes. If I may explain that a  
20 little bit. You are -- in order to figure  
21 out in a root cause analysis, in order to  
22 figure what were the root causes, you need to  
23 see what actions or activities that would  
24 mitigate and prevent such incident going  
25 forward. So that is the process we used.  
26 The RCA process we used looks to define the  
27 solutions. And from the solutions you derive  
28 the root causes.



1 Q Got it.

2 A So that -- I want to be clear.

3 Q Got it.

4 And the best example was -- sort of  
5 a really good cause-and-effect was dual  
6 barrier, wasn't it?

7 A Yeah.

8 Q Because if I understand your  
9 analysis correctly, what your root cause  
10 analysis says basically is, had SoCalGas been  
11 injecting or withdrawing through the tubing  
12 only and leaving the production barrier with  
13 no pressure whatsoever, or a minimal amount  
14 of pressure, and had that production casing  
15 corroded to the point of having an anomaly or  
16 parting, the gas still would have been  
17 contained within that tubing, and we wouldn't  
18 have had the leak we had.

19 So that I view as a  
20 cause-and-effect that you think quite  
21 important in this root cause analysis.

22 True?

23 A True. Yes.

24 Q Okay. So you go backward from the  
25 effects, and you draw these diagrams listing  
26 all these potential causes -- and you listed  
27 quite a few of them.

28 But then I think at the end of this

1 report, you then turn around and go back  
2 through those causes, and you try to identify  
3 all potential measures for responding to or  
4 preventing them; is that right?

5 A That is correct.

6 Q And dual barrier is a great  
7 example. Because in 2015, and we'll get to  
8 this in a minute, it wasn't required. It  
9 wasn't a prevailing industry practice.

10 But your view is, notwithstanding  
11 that, underground storage operators like  
12 SoCalGas, should implement dual barriers  
13 going forward to prevent what happened at  
14 Aliso Canyon.

15 True?

16 A That was not my role to say what  
17 operators should do. Our role was to say,  
18 "What are the root Causes?"

19 And dual barrier is definitely --  
20 as you well articulated -- is a root cause  
21 and would have prevented that incident.

22 Q All right --

23 A I wanted to clar- --

24 (Crosstalk.)

25 BY MR. LOTTERMAN:

26 Q Excuse me.

27 That's a very important  
28 clarification. Because I take that to heart.

1 Because what you're saying is, you're not  
2 saying what operators like SoCalGas should  
3 do. You're saying what could be done to  
4 prevent something going forward; correct?

5 A That's correct.

6 Q Okay. Good. Good.

7 And, by the way, this round trip  
8 that I talk about, or your analysis that you  
9 put forward in your main report, it's not  
10 dependent on whether the causes were required  
11 by law or regulation; right?

12 A Absolutely not.

13 Q Not required -- it's not dependent  
14 on whether the causes were required by  
15 industry standard.

16 True?

17 A That's correct. Yeah.

18 Their own -- the objective of the  
19 exercise of the work was to clearly identify  
20 what the root causes are. Whether that is  
21 common practice, whether that's regulation or  
22 not regulation, doesn't enter our analysis.

23 We do articulate in one part of our  
24 report -- I forget where, Mr. Lotterman --  
25 but we do articulate what the prevailing  
26 regulations were and what was the regulation.  
27 I believe we do in a portion of the report.  
28 But that was not the objective of the -- not

1 the objective of our work.

2 Q And, likewise, you don't even  
3 really -- you don't Judge, not really.

4 You don't judge whether such a  
5 cause and effect was foreseeable by any  
6 particular operator; correct?

7 A I'm trying to think. "Foreseeable"  
8 means something else to me.

9 Again, our role was to say, What  
10 were the root causes? What mitigative  
11 practices would have prevented or may have  
12 prevented such an incident? "Foreseeable"  
13 implies -- I don't believe that's our role.

14 I'm trying to think, Mr. Lotterman,  
15 as we are asking the question. That's a good  
16 question. But I don't believe -- our role is  
17 to find out the root causes for the Aliso  
18 Canyon incident, SS-25 incident, and what  
19 were the factors, parameters that contributed  
20 to the failure? And from there, deriving  
21 root causes, if addressed, will prevent such  
22 incident. That's --

23 Q Understood.

24 A I want to be --

25 Q Understood.

26 A Okay.

27 Q And that's consistent with what you  
28 told us right at the beginning of my

1 examination, where when I asked you what a  
2 technical RCA was, you said -- you explained  
3 what it was. And you said, "But let me be  
4 clear. It does not address  
5 management-related issues."

6 True?

7 A That is correct. That was --

8 Q Okay.

9 A Yeah.

10 Q Now, you mentioned the study you  
11 did of the regulations pertaining to  
12 underground storage. And I believe you  
13 looked at both pre-leak and post-leak  
14 reservations (sic); is that right?

15 A Yes, we did.

16 Q All right.

17 And you set out these regulations  
18 at page 197 of the main report, Section 4.6.

19 Do you see that?

20 A Yeah.

21 Q Okay. And if I understand your  
22 analysis, which makes sense, you focused on  
23 California gas storage well integrity  
24 regulations.

25 True?

26 A Correct. I -- I want to -- my  
27 memory is weak. But I don't believe, at that  
28 point, there were other regulations. I don't

1 think PHMSA guidelines or regulations came  
2 out. Or they may have come out, I don't  
3 recall. So...

4 Q Sir, your memory is not weak. But,  
5 as I said before, if you need a lifeline in  
6 the report, I'll -- you take it. But I think  
7 your memory is actually quite good.

8 So, again, subject to check, your  
9 focus -- because it makes sense. I mean, the  
10 Aliso Canyon facility is in California;  
11 right?

12 A Yes.

13 Q Okay. Did you -- did you also look  
14 to find any relevant Federal regulations at  
15 the time?

16 A I believe we did. Again, that's  
17 why my memory -- I want to confirm. I don't  
18 believe the Federal regulations were either  
19 in place or were not complete. I forget --  
20 or they were in that form. The California  
21 DOGGR regulations were in detailed, clear  
22 form. So that's why we only analyzed that.

23 Q Fair enough.

24 I will get to that. I will get to  
25 the Federal regulations in a minute. And I  
26 can probably give you a pretty good citation  
27 for that.

28 And you note in your discussion of

1 the main report that there have been  
2 significant changes in the regulations since  
3 2015; is that right?

4 A Yes.

5 Q Including on the Federal level.  
6 True?

7 A Well, I'm pretty sure. Yes.

8 Q Do you believe your investigation  
9 prompted some of those changes?

10 A I don't know. I wouldn't want to  
11 comment on that. I would ask the folks who  
12 drafted it. No, I wouldn't -- no. I'm  
13 not --

14 Q Okay.

15 A I'm not qualified to comment on  
16 that.

17 Q Okay. Have you worked with a -- or  
18 advised any regulators on how to implement  
19 the solutions you set out in the root cause  
20 analysis?

21 A No, not in detail.

22 Q Okay.

23 A Not the way you're -- not defining  
24 the regulations, no.

25 Q All right.

26 And getting -- all right. Fair  
27 enough.

28 So let's then look at the

1 regulations themselves. And I won't take  
2 much time on this. But, basically -- and I  
3 have this in front of me.

4           You identify -- you actually wrote  
5 a supplementary report. And this is in  
6 Volume 4, which I believe is Commission  
7 Exhibit 1004. And it's entitled "Gas Storage  
8 Well Regulations Review."

9           Now, I'm not going to go through  
10 that report, sir. But I just wanted to --  
11 for the record, to document your earlier  
12 testimony that you had done so. And I wanted  
13 the record to reflect that that effort is  
14 contained in this supplemental report and is  
15 summarized in the main report.

16           Okay?

17           A    Yes.

18           Q    So just so I'm not mistaken, do you  
19 see under Volume 4 a supplemental report  
20 entitled "Gas Storage Well Regulations  
21 Review"?

22           A    Yeah. Yes.

23           Q    And is that the one you were  
24 referring to earlier?

25           A    Yeah. I was referring to the main  
26 report and the supplementary report. Yes.  
27 That's correct.

28           Q    All right.

1           Mr. Moshfegh, let's go to page 234  
2 of the main report, please.

3           And while he's pulling that up, Dr.  
4 Krishnamurthy, let me sort of set the table  
5 on this one as well. So if you look at  
6 Table 42, on page 234 of the main report,  
7 it's identified "Root Causes and Solutions."

8           Do you see that?

9           A    Yes.

10          Q    And the first column are all the  
11 various -- I call them pods -- but all the  
12 various causes that you identified which led  
13 to the effect of both the leak and the  
14 111 days that it lasted; right?

15          A    Mm-hm.

16          Q    You then talk about solutions. And  
17 we're going to talk about those in a minute.

18                You then discuss whether they have  
19 been addressed by SoCalGas. And I assume  
20 that's as of 2019. And then -- this is what  
21 I want to focus on, just briefly.

22                You also have a column called  
23 "Addressed by regulation."

24                Do you see that?

25          A    Yes.

26          Q    And I want to make sure the record  
27 is clear as to what you're endeavoring to  
28 portray here. That last column, for example,

1 you say, "not required."

2 Are you saying that as of 2019,  
3 there was no regulation that required the  
4 solution that you set forth in the second  
5 column?

6 A That's my recollection. Yes.

7 Q Good. That --

8 A And it -- I'm sorry.

9 It would be specific to the DOGGR  
10 regulations. Okay?

11 Q Fair enough. Fair enough.

12 Because DOGGR is the primary  
13 regulator in California as it comes -- visa  
14 vi underground storage facilities; correct?

15 MR. GRUEN: Objection, your Honor.  
16 Asked and answered.

17 ALJ POIRIER: Overruled. Let's  
18 continue.

19 BY MR. LOTTERMAN:

20 Q All right.

21 And then if you look at the next  
22 row, Dr. Krishnamurthy, under "Addressed by  
23 regulation," you say, "Yes." But you say,  
24 "Included in the latest regulations."

25 Do you see that?

26 A Yes. Yes.

27 Q And does that mean that as of 2015,  
28 and we'll go through this in a minute, there

1 was no regulation that pertained to that  
2 particular solution, but there is one today?

3 A Yes.

4 Q Okay. And I'm not going to go  
5 through all these, but I think that covers it  
6 for now. Okay.

7 So let me pull up something a  
8 minute. All right.

9 So let's turn to page 231. And if  
10 I understand this portion of your report,  
11 sir, this is where you lay out the specific  
12 mitigation solutions that Blade believes  
13 would have mitigated or prevented the primary  
14 effect, and that is the uncontrolled release  
15 of hydrocarbons for 111 days from the well in  
16 question.

17 True?

18 A True.

19 Q All right. So I want to walk  
20 through these real quickly. But I'm going to  
21 set up kind of a template. And I think once  
22 you get the sense of what I want to do, we  
23 might be able to knock these of pretty  
24 quickly.

25 So solution one set forth on  
26 page 231 of the main report is called  
27 "Production casing should be cemented to the  
28 surface." And I believe that's basically a

1 solution that's pretty self-explanatory.

2           And that is that you believe that  
3 for a production casing like the one that  
4 ruptured at SS-25, going forward, they should  
5 be cemented to surface; correct?

6           A    Yes. That's applicable to new  
7 wells. That's what we were talking about.

8           Q    That was my next question, sir.  
9 Because is it possible, feasibly or  
10 realistically, to retroactively cement a  
11 current well to surface?

12           A    Anything can be done. But that is  
13 not the intent of that solution. That  
14 solution -- and I believe we are very  
15 specific in some part of the report. It is  
16 intended for new wells that are drilled and  
17 completed.

18           Q    All right.

19           A    Not for existing wells.        ]

20           Q    All right.

21                   (Crosstalk.)

22 BY MR. LOTTERMAN:

23           Q    And so this is a template I'm going  
24 to kind of walk through with each one of  
25 these solutions. Did you find in your  
26 investigation whether SoCalGas had violated  
27 any existing regulations by the fact that  
28 SoCal -- that SS-25 was not cemented to

1 surface?

2 A No.

3 Q Same answer with industry  
4 standards?

5 A That's correct. No industry  
6 standards. yeah; that's correct.

7 Q What about prevailing industry  
8 practices?

9 A Yeah. That's a tougher one. I  
10 don't think so. There are a lot of wells  
11 particularly in the U.S. But the danger in  
12 me trying to compare this is this is -- the  
13 wells have different applications.

14 But you are correct. It is not a  
15 prevailing industry practice.

16 Q All right. And did you see whether  
17 the SS-25 not be cemented to surface, did it  
18 violate any of SoCalGas's internal policies?

19 A No, it did not.

20 Q But you do make a recommendation  
21 here. This is your Solution 1. You do make  
22 a recommendation that if this solution were  
23 to be implemented, it could either mitigate  
24 or prevent a leak like SS-25; correct?

25 A Correct.

26 Q All right. Let's go to Solution 2  
27 and 3. I believe they are, sort of, kind of,  
28 one in the same. And if I read these two

1 solutions correctly, what you're saying is  
2 one of your mitigative measures going forward  
3 that could either mitigate or prevent a leak  
4 like SS-25 is if an operator were to conduct  
5 periodic wall thickness inspections; true?

6 A Yes.

7 Q Okay. And, again, to set the table  
8 here so the Commission understands exactly  
9 what's going on, I believe we established  
10 yesterday that at least at the Aliso Canyon  
11 facility, DOGGR required only annual temp  
12 logs as part of its mechanical integrity  
13 testing; true?

14 A True.

15 Q All right. And we also, I believe,  
16 established that those -- that to do a casing  
17 inspection for wall thickness can only be  
18 done during a workover; correct?

19 A I would say that a bit differently.  
20 A casing inspection such as what you're  
21 highlighted there, Solution 2 and Solution 3  
22 requires a workover where you pull the tubing  
23 under the well.

24 Q Okay. I appreciate that  
25 clarification. So bottom line is: As of  
26 2015, there were no regulatory requirements  
27 for periodic wall thickness inspections to be  
28 done in California; correct?

1           A     That's correct.

2           Q     And there was no industry standard;  
3 correct?

4           A     That's correct.

5           Q     Was it a prevailing practice to do  
6 that?

7           A     I don't believe so.

8           Q     Okay. And did you see any internal  
9 SoCalGas policies that were violated by  
10 SoCalGas not conducting periodic casing  
11 inspections?

12           A     Can I clarify that a little bit  
13 both of them a little bit? My previous  
14 answer and the new question that you're  
15 asking me?

16                     No. 1 there was no internal policy.  
17 Just to clarify, there was no internal policy  
18 of SoCalGas required to do casing wall  
19 thickness inspections.

20                     However, pre-2015 SoCalGas -- in  
21 the 2010 -- post-2010 SoCalGas did do a lot  
22 of casing inspection with different tools.  
23 They used HRVRT or various tools. So I don't  
24 want to say there was no prevailing -- there  
25 was a practice. All SoCalGas and other  
26 operators doing it.

27                     But was there a regular  
28 requirement? No. No internal policy

1 requirement or emissions requirements.

2 Q All right. Thank you. But I take  
3 your solution here to say that  
4 notwithstanding what was done before, that  
5 going forward you believe if this solution  
6 requiring wall thickness inspections were to  
7 be put into place, it could mitigate or  
8 prevent the leak like we saw at SS-25; true?

9 A That's correct. True.

10 Q All right. I want to take a little  
11 detour a minute, and then we'll go back to  
12 these solutions.

13 I saw a lot of -- I remember we  
14 discussed a lot -- I think that I asked some  
15 questions and I think a couple of other  
16 lawyers in Houston asked you questions.

17 We asked you questions about the  
18 accuracy of wall thickness logging tools in  
19 the late 1980s. Do you remember that?

20 A Yes, I remember that. I don't  
21 recall it from the deposition, but I remember  
22 a data request we answered where we did a  
23 more detailed study but, yes.

24 Q And the old technology that  
25 SoCalGas attempted to implement or apply in  
26 the 1988 timeframe was a technology called  
27 "Vertilog," right?

28 A Yes.

1           Q    And its more updated cousin today  
2 is called HRVRT; is that right?

3           A    That's correct.

4           Q    Okay.  And if I understand your  
5 reports correctly, sir, Blade did not perform  
6 a formal review of the reliability of various  
7 casing inspection tools circa late 1980s or  
8 even 1990s; correct?

9           A    Again, we did a review of what was  
10 available in the literature as part of one of  
11 the data request there.  But we are aware  
12 that these technologies are, you know, were  
13 done in the 60s.  And they go through various  
14 generations of tools and they improve in  
15 accuracy and tolerances over time; that's  
16 correct.

17          Q    Right --  
18               (Crosstalk.)

19          Q    Excuse me.

20          A    Sorry.  I apologize.  I spoke over  
21 you.  But they evolve over time.  The  
22 software evolves, the sensor evolves, the  
23 interpretation technology evolves.  So  
24 absolutely there is improvement in these over  
25 time.

26          Q    Right.  I guess what I was getting  
27 at is I didn't see a separate report.  Like I  
28 have about 9 or 10 or 11 of them here.  I

1 didn't see a separate report where Blade  
2 performed a formal review and laid out its  
3 findings on the reliability of casing  
4 inspection tools circa 1988. Is that fair?

5 A That is fair. And there are  
6 reasons for that. I give you context for  
7 that. Because we considered the tools in --  
8 even in the late '80s, early '90s are  
9 reasonably indicative of issues. It may not  
10 be as accurate as a 2018 or 2019 tool.

11 It gave tolerances that were  
12 adequate for our purposes. That's kind of  
13 why we didn't end up trying to interpret how  
14 would that have been different.

15 So it is more to say a wall  
16 thickness tool, it was still high resolution  
17 in the late 80s, early '90s, would give  
18 indications of wall loss.

19 Q Right. So I understand that. But  
20 I'm sort of focusing on the reliability  
21 aspect of it. So let me ask my question a  
22 little differently, and let me make sure I  
23 understand your answer.

24 Did Blade perform a formal review  
25 of the reliability of the casing inspection  
26 tools available before 2000?

27 A We did not do a formal study, no.  
28 We responded to a data request. That's the

1 extent of which we did it.

2 Q And was it your view at least in  
3 Houston a year and a half ago that you didn't  
4 know how reliable that Vertilog technology  
5 was in 1988?

6 A No, we did know. We did believe it  
7 was reliable. It -- we knew it was not as  
8 good as the current tools.

9 But in the late '80s, early '90s,  
10 the tool was still considered adequate for  
11 the purposes of what we were trying to do.  
12 So that is why we didn't pursue that angle or  
13 issue or challenge to our interpretation.

14 Q Would you pull up --  
15 (Crosstalk.)

16 Q Excuse me?

17 A Sorry. I'm attempting to explain  
18 what we did so.

19 MR. LOTTERMAN: Mr. Moshfegh, would you  
20 pull up the deposition of Dr. Krishnamurthy,  
21 Volume I. Which I believe is Exhibit-158.  
22 If we've got SoCalGas-158. And can you turn  
23 to page 330 and highlight lines 19  
24 through 25.

25 ALJ POIRIER: We'll go off the record  
26 until the document is ready.

27 (Off the record.)

28 ALJ POIRIER: We will be back on the

1 record.

2 Please continue, Mr. Lotterman.

3 BY MR. LOTTERMAN:

4 Q So, Dr. Krishnamurthy, this is  
5 Volume I which was November 20, 2019, of your  
6 deposition. And you were asked the following  
7 question:

8 Can Vertilog technology in 1988  
9 detect wall thinning in the outer  
10 diameter of a well casing prior to  
11 a leak?

12 I objected. And would you read your  
13 answer into the record, sir.

14 A Says:

15 I don't know whether it -- how  
16 reliable it is. It did detect  
17 corrosion.

18 That's correct. See reliability,  
19 Mr. Lotterman, is a quantitative number.  
20 Reliability means to me -- someone like me  
21 you say "reliability," and we still don't  
22 know. Reliability means what is my  
23 confidence level? So when I say, "A tool is  
24 reliable." In a quantitative fashion that's  
25 what I implied here. 95 percent confidence  
26 with a 80 percent certainty that it can  
27 detect corrosion within a certain tolerance.

28 Even today I don't know what those

1 tools did in 1988. That is what I implied  
2 there. Now that is what reliability means to  
3 me. Reliability is a quantitative number.  
4 That is what I implied here.

5 Now, can it detect wall loss? Can  
6 it detect wall loss with some tolerance?

7 Now, the next question you ask is  
8 how reliable it is. Even though I don't have  
9 an exact answer, but it can detect wall loss.  
10 It did detect wall loss in the past. So that  
11 is how I would phrase it.

12 Q All right. But be clear, and I  
13 think you may have misread your answer so let  
14 me just put it in the record so we're clear.

15 To the question:

16 Can Vertilog technology in 1988  
17 detect wall thinning in the outer  
18 diameter of a well casing prior to  
19 a leak?

20 Your answer was:

21 I don't know whether it -- how  
22 reliable it is. It did detect  
23 corrosion.

24 Did I read that correctly?

25 A That's correct.

26 Q Okay. And if I understand some of  
27 your other testimony in the deposition, you  
28 definitely believe that the Vertilog

1 technology in 1988 was not as reliable as it  
2 is today; correct?

3 A I would definitely -- yeah,  
4 absolutely. More reliable today.

5 Q Okay. Good, good. In fact what  
6 tool -- when you were performing your RCA,  
7 what casing inspection tool did you choose to  
8 use?

9 A We used the USIT tool and we also  
10 used I believe the HRVRT. I don't remember.  
11 I don't recall. I have to go back to my  
12 notes. We did use the Vertilog tool for the  
13 11-and-three-quarter inch where it was not in  
14 fluid. So I don't recall. I know we used  
15 USIT. I don't recall whether we used the  
16 magnetic tool for the casing inspection. I  
17 don't remember.

18 Q I'll tell you what, let's do this,  
19 and, your Honors, this might be a good time  
20 for a break.

21 Dr. Krishnamurthy, would you mind  
22 confirming what tool you used? What  
23 Vertilog-sort-of-variation of tool you used  
24 during the root cause analysis? And you can  
25 let us know after we come back from the  
26 break?

27 A Sure.

28 ALJ POIRIER: I think that's a good

1 idea. We will take a 15-minute break until  
2 11:19. Thank you.

3 Off the record.

4 (Off the record.)

5 ALJ POIRIER: We'll be back on the  
6 record.

7 Good morning. We're just returning  
8 from a mid-morning break. We will continue  
9 with the cross-examination of  
10 Dr. Krishnamurthy by Mr. Lotterman.

11 Mr. Lotterman, if you could restate  
12 the question, I think it would be helpful for  
13 the record just at this point.

14 Thank you.

15 MR. LOTTERMAN: Glad to, your Honor.

16 Q I guess the question I was asking  
17 you to research, Dr. Krishnamurthy, during  
18 break was what tool Blade used during the RCA  
19 to inspect wall thickness on casings?

20 A You can hear me now? I'm sorry. I  
21 was on mute.

22 We used a lot of tools,  
23 Mr. Lotterman. We used a Vertilog or a  
24 magnetic tool called the HRVRT tool. We also  
25 used ultrasonic. I'm talking specifically to  
26 wall thickness, okay? Not the other tools.  
27 The other one we've used is ultrasonic.

28 So there are two technologies for

1 wall thickness measurement: Magnetic and  
2 ultrasonic. The Vertilog is a magnetic --  
3 it's a magnetic equivalent from the 1988 to  
4 mid '90s. And it went through various name  
5 changes and different companies.

6 So the magnetic tools are good at  
7 finding small pits. Corrosion that is  
8 really, really small. And it will also find  
9 large. But it won't be very good at  
10 characterizing the large ones very clearly.

11 Whereas the USIT log or the  
12 ultrasonic log will do a very good job  
13 mapping the wall thickness especially for  
14 larger corrosion sites. So for the RCA, we  
15 used both.

16 Q Got it. And for -- I believe this  
17 might come up later on, and I believe those  
18 technologies are called both MFL and USIT,  
19 U-S-I-T; is that correct?

20 A MFL is correct. Its Magnetic Flux  
21 Leakage. But USIT is a propriety tool by  
22 Schlumberger. So the way I would call that  
23 is an ultrasonic tool. USIT is a  
24 Schlumberger ultrasonic tool. I just want to  
25 be clear.

26 Q Understood. Thank you for that  
27 clarification.

28 By the way when you said you used a

1 Vertilog as part of the RCA, are you saying  
2 you used a 1988 vintage of the Vertilog in  
3 your 2017 RCA?

4 A No. Let me clarify. The  
5 nondestructive evaluation principle was  
6 magnetic flux leakage, which is common to  
7 Vertilog and the HRVRT in 2017. That's  
8 really all I meant to say.

9 Q Right, right. So just to be clear  
10 to the extent you have an old vintage 1988  
11 Vertilog sitting on a shelf at Blade, you  
12 didn't fly that out to Los Angeles and use it  
13 as part of your root cause analysis; correct?

14 A No.

15 Q All right. Let's turn to Solution  
16 4, Dr. Krishnamurthy, on page 231 at the  
17 bottom. And, again, I'm going to try to move  
18 through these as quickly as I can.

19 MR. LOTTERMAN: And, Mr. Gruen, I think  
20 you should anticipate that I'll be done by  
21 early afternoon, sir, if that helps for your  
22 planning purposes at all.

23 MR. GRUEN: Understood. Thank you,  
24 Mr. Lotterman. Do you have a bit of  
25 precision on -- a bit more precision on that?

26 MR. LOTTERMAN: My expectation would be  
27 to take this through lunch, look at my  
28 outline during lunch, and probably go for

1 another hour if that.

2 MR. GRUEN: Understood. Thank you,  
3 sir.

4 BY MR. LOTTERMAN:

5 Q All right. Dr. Krishnamurthy, back  
6 to your report. Solution 4 addresses quote:

7 A risk based well integrity  
8 management system should be  
9 implemented.

10 Correct?

11 A Yes.

12 Q And I don't want to get into the  
13 details of risk management plans because  
14 we're going to talk about some of the current  
15 regulations in minute. But basically I get  
16 the sense what you're looking for here is a  
17 risk management plan that assesses risk and  
18 that assesses both the probability of failure  
19 with the consequence of failure. Classic  
20 risk analysis; correct?

21 A Yes.

22 Q All right. And in your description  
23 here on the bottom of page 231, you cite both  
24 the Transmission Integrity Management Program  
25 which, I believe is called "TIMP." And the  
26 Distribution Integrity Management Program,  
27 which I believe is called "DIMP," right?

28 A Yes.

1           Q    And to be clear, those two  
2 programs, TIMP and DIMP, are required by  
3 federal regulation; correct?

4           A    Yes.

5           Q    And as you point in your summary  
6 here and it's elsewhere as well, but let's  
7 stick with the summary because I think it's  
8 in a more cogent form.

9                    You point out that notwithstanding  
10 your requirements under transmission and  
11 distribution assets, there was no comparable  
12 regulation in place for storage; true?

13          A    Yes.

14          Q    All right.  So if I were to ask  
15 you:  Did Blade find that SoCalGas had  
16 somehow violated existing regulations or  
17 standards regarding the implementation of a  
18 risk management plan, what was your answer?

19          A    I apologize, Mr. Lotterman.  Can  
20 you repeat the question?

21          Q    Probably not.  But I will try to  
22 restate it.  If I were to ask you whether  
23 SoCalGas had violated any regulations or  
24 standards by its not having a fully up and  
25 running integrity management system in 2015,  
26 would your answer be no?

27          A    Yes.  They did not violate  
28 anything.  There was no such regulation in

1 place.

2 Q And in fact in your brief  
3 description here, you observe that  
4 notwithstanding the absence of any  
5 requirements or standards, SoCalGas in fact  
6 launched an integrity management system for  
7 storage in 2014; true?

8 A Yeah. Again, I have to be careful  
9 how I say this. There was a general rate  
10 case submission in 2014 for I believe 2016.  
11 And there SoCalGas articulated a SIMP  
12 program. Recognizing that a proactive  
13 integrity management was necessary for  
14 underground storage wells and that other than  
15 a reactive program. And that was what we are  
16 referencing here in this statement that you  
17 have on the screen.

18 Q Okay. And I think that's  
19 consistent with what you wrote elsewhere and  
20 that is that basically SoCalGas filed  
21 testimony in 2014 pertaining to the 2016  
22 general rate case seeking regulatory approval  
23 to implement the program; right?

24 A That's correct.

25 Q Okay. And in fact SoCalGas was  
26 waiting for regulatory approval of that  
27 program when the leak occurred in October of  
28 2016; true?

1           A    I believe so.  I'm not aware of the  
2 details of what happened.  So, yes.  That  
3 sounds about right.

4           Q    All right.  
5                (Crosstalk.)

6           A    Go ahead.

7           Q    Fair enough, sir.  And I appreciate  
8 your clarification there.  Was the program  
9 that SoCalGas launched in 2014 proactive?

10          A    Yes, it was proactive.  And I  
11 believe we have discussed it somewhere in our  
12 report.  I don't remember where.  But, yes.

13          Q    Okay.  And was that program  
14 pioneering in the gas storage industry?

15          A    Yes.  And I -- it predated API  
16 1120(c) and 1121 I believe.  We articulate  
17 that in some place in the report.  I  
18 apologize.  I don't remember where.

19          Q    And that's where I was going next,  
20 Dr. Krishnamurthy, because I think part of  
21 your analysis that you set out in the report  
22 is not only to identify what, if anything,  
23 was in place from a regulatory regime at the  
24 time of the leak.  But you also from time to  
25 time point out what has been done since the  
26 leak; correct?

27          A    Yes.

28          Q    And in this context in your

1 proposed Solution 4 to require underground  
2 storage operators to have risk based well  
3 integrity management systems, that approach  
4 is now a federal regulation through PHMSA;  
5 correct?

6 A I believe so. So I have not --  
7 federal regulations. So I will have to look  
8 at it to confirm that. But if you say so,  
9 Mr. Lotterman, I haven't looked at it lately.  
10 I apologize.

11 Q Is it fair to state, sir, that API  
12 1171 was put into place in 2018 at a minimum?

13 A Yes, that's definitely true. It  
14 was part of our review.

15 Q And obviously the regulation --  
16 we'll see what the regulation says so you  
17 don't need to go there.

18 Okay. Let's go to Solution 5 and  
19 let's plow through this. So Solution 5 is in  
20 the middle of page 232 of your main report,  
21 and it's entitled "Conduct a Casing Corrosion  
22 Study." Do you see that?

23 A Yes.

24 Q Okay. I want to ask you about the  
25 first -- actually the second line in that  
26 narrative. First of all you say:

27 Storage wells with good casing and  
28 tubing design can last for long

1                    periods and operate safely.

2                    I think that's what we talked about  
3 earlier where age may not be or certainty  
4 wasn't a correlation at Aliso Canyon. And in  
5 fact old wells if managed properly can  
6 operate a long time safely; true?

7                    A    Yes, that's true.

8                    Q    And then you state quote:

9                               Casing corrosion is not uncommon  
10                               and its existence does not  
11                               automatically mean that the casing  
12                               is going to fail or is unsafe.

13                               Do you see that?

14                    A    Yes.

15                    Q    And in fact you say that elsewhere  
16 in the report on page 221. But we don't need  
17 it. It's pretty much the same thing.

18                               So I interpret that statement as  
19 saying, "Hey, reader. You need to understand  
20 something. Corrosion cannot be eliminated  
21 from a gas storage field."

22                               Is that correct?

23                    A    I'm thinking. Yeah. Elimination  
24 is different. Mitigation is different to me.  
25 Elimination meaning removing everything that  
26 causes corrosion. That is not practical. So  
27 it may have -- it will occur. So the issue  
28 is how do you mitigate against it and manage

1 it?

2 Q That's right.

3 A Eliminate is not a word that comes  
4 to mind.

5 Q You're right. And not only is it  
6 not practical, it's really not possible, is  
7 it?

8 I mean, you've got 116 wells at  
9 Aliso Canyon over a six square mile area, you  
10 know, being dug a mile and a half deep into  
11 the cap rock of a gas storage facility.  
12 You're going to have corrosion somewhere at  
13 that facility; true?

14 A Yes.

15 Q All right. And I think what the  
16 point you just tried to make is the point of  
17 your Solution No. 5 was you want that  
18 corrosion studied to develop an understanding  
19 of why it occurs and what potential measures  
20 can be taken to mitigate either its effects  
21 or its consequences; true?

22 A That's correct.

23 Q All right. So in light of that --  
24 and I assume you're talking about a formal  
25 study?

26 A Again, formal is separate. A true  
27 study where the vision I would have in this  
28 -- I'm talking about this particular topic.

1 Theoretically many of these may go into a  
2 risk management program. But the intent here  
3 is to understand what may be causing the  
4 corrosion if there is a corrosion factor in  
5 each well. And it required a far more  
6 detailed dive than we did as part of this  
7 work. So that is what we implied by this  
8 particular solution.

9           Once you know what may be causing  
10 it, then you can monitor it and mitigate it  
11 at the right time. You don't have to  
12 mitigate all of them today. Some of them may  
13 take another 30 years. You can plan your  
14 mitigation appropriately. That is where the  
15 value of something like that comes in.

16           Q Understood. And if I understand  
17 your -- kind of the scope of your technical  
18 root cause analysis, that your investigation  
19 didn't delve into whether for example  
20 SoCalGas employees were discussing corrosion  
21 et cetera on an informal basis; true?

22           A That's correct.

23           Q And likewise your investigation  
24 wasn't for example investigating whether  
25 SoCalGas was briefing DOGGR on an annual  
26 basis as to the corrosion it was experiencing  
27 at its operating facilities; true?

28           A Again, the documents we checked, we

1 didn't see a formal report or a study on this  
2 topic. So, yes; that's correct.

3 Q Right. Okay. But as far as  
4 communications between and among employees or  
5 communications between SoCalGas and it's  
6 regulator, DOGGR, you didn't do a deep dive  
7 on that, did you?

8 A We did not check e-mails  
9 communications between SoCal employees,  
10 DOGGR, or within SoCal. No, we did not.

11 Q Okay. And --  
12 (Crosstalk.)

13 A Just to explain just to make sure I  
14 give it context, Mr. Lotterman. So our  
15 entire work, the entire report, was based on  
16 extensive data that we obtained from SoCalGas  
17 and from DOGGR records. The main records  
18 from general rate case.

19 And we had probably three in-person  
20 meetings with SoCalGas teams that is no more  
21 than an hour or two hours long. But we  
22 depended on formal written documents that  
23 detailed anything. That was the basis of our  
24 work as we have put in the report.

25 Q Thank you for that clarification.  
26 Okay. So to kind of wrap up this solution  
27 and then we'll move on. Is it accurate to  
28 say that in investigating this Solution

1 No. 5, Blade did not find any instances where  
2 a casing corrosion study was required by  
3 regulation or industry standard? ]

4 A Yeah. It was not required by  
5 regulations. There's no industry standard  
6 requiring it.

7 Q Okay.

8 A That's correct.

9 Q And do you know if sitting here  
10 today the underground storage industry is  
11 required to conduct casing corrosion studies  
12 as you propose in Solution 5?

13 A I don't recall actively at the  
14 11.17, so that is the only standard that is  
15 there other than the regulations. I don't  
16 remember whether they require that,  
17 Mr. Lotterman.

18 Q Okay.

19 A I'll have to refer to it.

20 Q Okay. The other thing I was going  
21 to ask you is sort of a clarification and  
22 then we'll move on. Do you know elsewhere in  
23 the main report -- and I'm thinking at  
24 page 17 in particular, and this was under the  
25 fact that there was no internal policy on  
26 wall thickness inspections.

27 Do you know what, Mr. Moshfegh?  
28 Why don't we just pull this up a minute.

1 It's page 217. In fact, the 5th or 6th line  
2 from the bottom that begins "The MIT  
3 monitoring system did find casing leaks on  
4 other wells in the fields which were  
5 successfully repaired or remediated."

6 Do you see that, Dr. Krishnamurthy?

7 A Yes.

8 Q Is that an accurate statement from  
9 Blade?

10 A Yes. It's in the report.

11 Absolutely.

12 Q Okay. And is it fair to say that  
13 when SoCalGas saw an issue with one of its  
14 wells; i.e., especially a casing leak, it  
15 took action?

16 A Yes.

17 Q Okay. All right.

18 A By action, I mean mitigated it  
19 right away.

20 Q Right.

21 A Or removed.

22 Q All right. Okay. Let's move to  
23 Solutions 6 and 7 because I believe they're  
24 sort of the same ilk. These address Solution  
25 6. You say, "Conduct a Casing Failure  
26 Analysis." And Solution 7 is called,  
27 "Regulations Should Require a Level 1" and  
28 then in parens you say, "(Per API RP 585)

1 Analysis of All Failures."

2 Do you see that?

3 A Yes.

4 Q It kind of, you know -- it kind of  
5 cut into the chase on this one, because I've  
6 read this a couple times. It's my sense,  
7 sir, that you're saying bottom line  
8 prospectively casing failures need to be more  
9 formally investigated; is that right?

10 A That's correct. 11-1 or a casing  
11 failure analysis is really attempting to  
12 understand and recognizing you do not have  
13 all the data, you don't have -- you may have  
14 a log analysis, you may not, or you may want  
15 to conduct a log analysis, you may want to  
16 run a camera depending on what the problem  
17 is.

18 It organizes the -- it gets a bit  
19 organized and systematic understanding if  
20 there is a pattern to all these failures. If  
21 there is a pattern, then the mitigation is  
22 easy and you can execute a mitigation on  
23 wells that have not exhibited that problem.  
24 So that was the intent of 6 and 7 there.

25 Q And I believe you say in these  
26 narratives -- you don't sort of lay out a  
27 specific type of investigation that's  
28 warranted or that should be pursued, but you

1 say really the type of investigation should  
2 be commensurate with the risk and the  
3 consequences involved; is that right?

4 A Absolutely. Yes. That's correct.

5 Q All right. All right. So, so just  
6 to be clear -- and I think you mentioned this  
7 earlier, but let's put it on the record --  
8 you're not advocating under Solutions 6 and 7  
9 that gas storage facilities, including the  
10 utilities, undertake full-blown RCAs every  
11 time they find a casing failure, are you?

12 A No, we are not. We are very  
13 specific about it. We discussed this in  
14 another portion of the report, I believe.  
15 What we are suggesting is when there is a  
16 casing integrity failure, a compromised  
17 casing integrity, it is important to  
18 understand why. And probably 80, 90 percent  
19 of the time these will require a Level 1 or  
20 some formal process. That's what we're  
21 proposing.

22 Q And when you talk about Level 1,  
23 that's one of the levels that's set out in  
24 API RP 585; right?

25 A Yes, we didn't want to describe a  
26 Level 1 from a Blade perspective. We were  
27 looking for standards that existed and we  
28 found a standard and we felt that that

1 adequately and appropriately described it.

2 (Crosstalk.)

3 THE WITNESS: The regulator or SoCal  
4 may desire mediation of that. This is more  
5 of our suggestion.

6 BY MR. LOTTERMAN:

7 Q And what does API stand for?

8 A American Petroleum Institute  
9 Recommended Practice, RP, Recommended  
10 Practice 585.

11 Q And that is not an industry  
12 standard applicable to storage wells, is it?

13 A No, it is not.

14 Q Okay. And, in fact, I saw  
15 elsewhere in your report -- and I can pull it  
16 up -- not in your, I'm sorry, in one of your  
17 data responses. You said basically -- and I  
18 have that -- I think this is a quote -- "As  
19 of the date of the incident, there were no  
20 documented industry standards related to  
21 investigation of casing failures and gas  
22 storage operations."

23 Is that true?

24 A If you said it, it must be true. I  
25 don't remember the dates, but if we answer it  
26 that way, Mr. Lotterman, that is correct.

27 Q Okay.

28 ALJ POIRIER: This is ALJ Poirier.

1           Mr. Lotterman, do you have a  
2 specific document that references that? I  
3 think that would be helpful.

4           MR. LOTTERMAN: I came to the same  
5 conclusion, your Honor.

6           So, Mr. Moshfegh, if you would pull  
7 up SED Exhibit 215, please.

8           THE WITNESS: I apologize. I can't  
9 remember some of these.

10 BY MR. LOTTERMAN:

11           Q Doctor, it's -- Victoria's got the  
12 right idea, and that is instead of pressing  
13 you to embrace something that you may not  
14 have a clear recollection of, it's best to  
15 pull up the document.

16           Let's go to page 17, Mr. Moshfegh.  
17 Let's get it in the record and we can move  
18 on. This should be on page 17.

19           ALJ POIRIER: And, Mr. Lotterman, if  
20 you could read the Bates number in the bottom  
21 right-hand corner as well, that will be  
22 helpful for the record.

23           MR. LOTTERMAN: Thank you, your Honor.  
24 I will. I want to make sure before I read  
25 the Bates number we've got the right page.

26           Mr. Moshfegh, is that SED  
27 Exhibit 215?

28           ALJ POIRIER: Let's go off the record.

1 (Off the record.)

2 ALJ POIRIER: On the record.

3 Please continue, Mr. Lotterman.

4 BY MR. LOTTERMAN:

5 Q So let us -- let's see. So that  
6 is -- we are looking, Dr. Krishnamurthy, at  
7 SED Exhibit 215. What it is, is it's your  
8 responses to the SED's Data Request 69. The  
9 Bates number of the initial document is 295,  
10 SED\_SUR-REPLY\_00295.

11 Let's go to page 17, Mr. Moshfegh.  
12 If you would pull up the quote in question.  
13 There it is. All right.

14 So, Dr. Krishnamurthy, if you look  
15 at Section 2.2, Question 2, the question on  
16 page 9 states: "As of the date of the  
17 incident, there was no documented industry  
18 standard related to investigation of casing  
19 failures in gas storage operations."

20 Do you see that?

21 A Yes. And I agree with that  
22 conclusion. Yes. Absolutely. I apologize,  
23 I couldn't recall -- I didn't recall API 585  
24 so that's why I was struggling. Okay. I'm  
25 fine now.

26 Q Before we leave this exhibit, in  
27 Section 2.2.1(a) it says, "Does Blade agree  
28 with the statement?"

1                   And what was your answer?

2                   A    Yes, we agree.

3                   Q    All right.  So to wrap up this  
4 piece, basically, there were no existing  
5 regulations or standards that required  
6 SoCalGas to conduct casing failure analyses  
7 as you set out in Solutions 6 and 7; is that  
8 accurate?

9                   A    Yes, that is accurate.

10                  Q    Let's go to Solution 8.  Solution 8  
11 is entitled, "Well Specific Detailed  
12 Well-Control Plan."

13                           Do you see that?

14                  A    Yes.

15                  Q    I'm not going to dwell on this one,  
16 sir, but I'm going to ask you just a couple  
17 questions.  Was Blade able to identify any  
18 regulations or standards in place as of  
19 October 15 that required well-specific  
20 detailed well-control plans?

21                  A    No.

22                  Q    And is it safe to say that,  
23 therefore, Blade did not find that SoCalGas  
24 had violated any existing regulations or  
25 standards as of the incident?

26                  A    Yes, there was no violation.  No,  
27 we did not.

28                  Q    And do you know if your Solution 8

1 has been adopted by either California  
2 regulators or federal regulators as of today?

3 A I don't know. I'm not aware  
4 whether it has or not been. Again, it was --  
5 I want to repeat. This report was meant for  
6 Aliso Canyon. It was meant as solutions for  
7 Aliso. It was never meant -- beyond that, it  
8 was not our vision for this.

9 Q Fair enough. Next solution is the  
10 one we talked about I think when we were  
11 talking about the round trip you took with  
12 the root cause analysis, and that is  
13 Solution 9, "Tubing Packer Completion-Dual  
14 Barrier System."

15 Do you see that?

16 A Yes.

17 Q And, again, we don't need to  
18 re-plow this field, but basically what you're  
19 saying there is that going forward, injection  
20 and withdrawal should be done only through  
21 the tubing, and your root cause analysis  
22 says, "And if that were done in the future,  
23 an incident like SS-25 where the production  
24 casing burst and a leak occurred would likely  
25 not occur"; correct?

26 A Yes.

27 Q Okay. And I believe we also talked  
28 about the fact that as of 2015 just before

1 the leak, it was not an industry practice to  
2 have single barrier -- or excuse me -- to  
3 have dual barrier wells; correct?

4 A Yes, that's correct.

5 Q So to wrap this one up, is it safe  
6 to say that as of 2015, SoCalGas did not  
7 violate any existing regulation or standard  
8 by operating most of its wells at Aliso  
9 Canyon using a single barrier?

10 A There were no standards or  
11 regulations in 2015.

12 Q Thank you. My apologies.

13 Do you know whether SoCalGas  
14 currently operates any of its wells in Aliso  
15 Canyon on single barrier?

16 A I don't believe so because we  
17 reviewed the current practices. I believe we  
18 addressed that somewhere in the report.  
19 That's why I know.

20 Q So as far as you know and as far as  
21 I know, you are correct. As of today, there  
22 is not a single active well at Aliso Canyon  
23 that does not have the dual barrier system  
24 that you identify on page 233 of the main  
25 report; is that right?

26 A That's correct, that's my  
27 understanding.

28 Q Have regulations been put into

1 place in California to require dual barriers  
2 on gas storage wells?

3 A I believe that was part of the  
4 DOGGR regulations. I have to again -- I'm  
5 pretty sure it is part of the DOGGR  
6 regulations. I don't remember. I'd have to  
7 look.

8 Q It's okay. And are you aware,  
9 Dr. Krishnamurthy, whether other operators in  
10 California, including PG&E, are currently  
11 running their wells with single barrier?

12 A No, I am not aware. I am not  
13 familiar what they're operating.

14 Q Let's turn to Solution 10 shown at  
15 page 233 as well right in the middle. It  
16 says, "Implement Cathodic Protection as  
17 Appropriate." I don't want to belabor this  
18 one either, but under that solution, you give  
19 sort of a thumbnail sketch of what that  
20 entails, and I actually believe you have a  
21 more robust discussion in one of your  
22 sub-reports.

23 But I want to just sort of tease  
24 out a couple of thoughts here. One is that  
25 putting cathodic protection on a field where  
26 there are other wells and other operators  
27 makes it complicated, doesn't it?

28 A Yes. It is complex.

1           Q    And, in fact, there's a  
2 possibility, which may not be intuitive --  
3 there's a possibility that by doing so, you  
4 could actually encourage corrosion on other  
5 nearby wells; true?

6           A    Yeah, if it is inappropriately  
7 designed, you know, it has to be -- there are  
8 specialists in this area, and I'm talking in  
9 the area of cathodic protection. It has to  
10 be appropriately designed. It is not  
11 straightforward, but it's done. It's done in  
12 some cases where we have -- where there are  
13 surface casing access to water. That's what  
14 you're looking for.

15           Q    And is it also true that -- to put  
16 it very bluntly as well -- CP will not work  
17 on all wells?

18           A    Again, I want to be very clear.  
19 The CP we are talking about here is only for  
20 the outermost surface casing where there is a  
21 cement issue, which is in the second sentence  
22 there. You have either cement isolation or  
23 there is access to water. So that is the  
24 situation we are talking about. We are not  
25 talking about production casing. We are only  
26 talking about surface casing that is shallow.  
27 By shallow, I mean shallow related to the  
28 total depth of the well.

1           Q    Understood.  Thank you for that  
2 clarification.  To sort of follow up on that  
3 thought, I think you just said it, but let me  
4 make sure we're clear on this as well.  Is it  
5 your view that on a well like SS-25, to the  
6 extent you could put cathodic protection on  
7 the outside surface casing, you could not  
8 technically also put it on the inside  
9 production casing?

10           A    That's correct.

11           Q    All right.  And let's wrap this one  
12 up as well.  Did Blade identify any  
13 regulations or standards in place at time, in  
14 the time of October 2015, that required  
15 SoCalGas to have cathodic protection on any  
16 of its wells, including SS-25?

17           A    As we articulated in the report,  
18 there are no regulations.  There are  
19 standards that discuss, it may discuss CP,  
20 but it is not a requirement.  It is more of  
21 if you apply CP, what do you do, how do you  
22 apply CP.

23           Q    Got it.  All right.  Let's go down  
24 through Solution 11.  I think we have just  
25 two more to go and then maybe we could break  
26 for lunch.

27                    Solution 11, Dr. Krishnamurthy,  
28 says, "Ensure Surface Casings Are Cemented to

1 Surface for New Wells." And maybe to cut  
2 this one short, this is for new wells only;  
3 correct?

4 A That's correct, yeah.

5 Q All right. SS-25 was not a new  
6 well; right?

7 A No, it was not.

8 Q So just cutting to the chase here,  
9 is it fair to say that as of October 2015,  
10 SoCalGas was not violating your recommended  
11 Solution 11 at SS-25?

12 A No.

13 Q "No," it was not correct or, "no,"  
14 there was no violation?

15 A Sorry. It was consistent with  
16 regulation and SoCalGas was cementing surface  
17 casing to surface.

18 Q All right. Thank you. That leaves  
19 one more solution. And I got a bone to pick  
20 with you on this one, but it won't take long.  
21 Basically your final solution is "Well  
22 Surveillance Through Surface Pressure" and in  
23 parens you put, "(Tubing and Annuli)."

24 Do you see that?

25 A Yes.

26 Q And I don't want to get into a  
27 whole lot of detail about this because I  
28 don't think it's important, at least for my

1 purposes, but what you are saying here  
2 basically is there is value in putting or  
3 having realtime pressure measurements on  
4 wells like SS-25 so that you can constantly  
5 monitor both the tubing, the production  
6 casing, and the surface casing pressures and  
7 provide better insights as to whether you  
8 might have a leak, that type of thing.

9           Is that a gross but accurate  
10 summary?

11           A    Yes, that's an accurate summary.

12           Q    Okay. And, in fact, SoCalGas was  
13 in the process of implementing realtime  
14 pressure monitoring systems at its facilities  
15 before the incident; true?

16           A    I don't recall that, Mr. Lotterman.  
17 I don't remember. But I know that such a  
18 system was installed when we were there.

19           Q    Okay.

20           A    So whether it was considering it  
21 prior, we didn't investigate that, but it --  
22 I believe it was being installed or it was  
23 installed during the time we spent at Aliso.

24           Q    Fair enough. Fair enough. And I  
25 believe Ms. Kitson from SoCalGas will be  
26 addressing that later for the Commission so  
27 there's no need for you to go there and I  
28 appreciate that.

1           So bottom line on this one is as of  
2           October 2015 when the incident occurred, were  
3           there any regulations and standards in place  
4           that required well surveillance through  
5           pressure -- through surface pressure realtime  
6           measurements?

7           A     No, there were no regulations that  
8           required it.

9           Q     The bone I have to pick with you on  
10          this one, sir, is I'm not sure what impact,  
11          if any, it would have had on addressing the  
12          SS-25 leak. And here is why I say that:  
13          It's my understanding that on the morning of  
14          October 23, 2015, in Blade's view the leak  
15          occurred. And, in fact, I believe, if my  
16          recollection is correct, within a short  
17          amount of time not only did the casing get a  
18          hole, as you saw in the pictures, but, in  
19          fact, it parted completely.

20                 It's my understanding -- and I  
21          believe this is actually set out in your  
22          chronology on -- I'll find the page for that.  
23          Yeah, there it is. On page 126 of the main  
24          report, that leak was discovered at 3:15 p.m.  
25          and that SoCalGas closed the injection header  
26          valve 15 minutes later.

27                 Do you see that?

28          A     Yeah.

1           Q    Okay.  And then, to make a long  
2 story short, SoCalGas worked all night  
3 bringing in contractors and the like and  
4 attempted to kill the well itself on the  
5 morning of October 24, 2015.

6                    Is that your recollection, sir?

7           A    That's correct, yeah.

8           Q    All right.  So let me ask you kind  
9 of a picky question, but I feel like I should  
10 ask it since we've spent so much time  
11 together.  Why would it matter if that leak  
12 were detected at 3:15 in the afternoon or  
13 7 o'clock that morning?

14           A    Good question.  We discussed this  
15 quite a bit, as you can imagine,  
16 Mr. Lotterman, within Blade as we articulated  
17 the solution.  This is an important point.  
18 The pressure for a production engineer, the  
19 tubing pressure, the casing pressure, and the  
20 surface casing annuli pressures will  
21 immediately tell you in the morning of 23rd  
22 that the valve was potentially flowing or it  
23 was flowing at 90 or 93 million a day.  I  
24 forget the exact numbers, so don't quote me  
25 on that, but the exact number is in the  
26 report.

27                    That number will tell you right  
28 away that this is a very complex well-control

1 issue. It will define your well-control plan  
2 immediately. That is the intent of that. It  
3 is -- it -- that pressure data you can use,  
4 which we discuss in the report, but I don't  
5 recall where, but we do this because where we  
6 discuss the estimate of flow rates, that that  
7 is the value of that pressure. That pressure  
8 data on an ongoing basis where if it's a  
9 little leak, you know it's a little leak and  
10 the reaction can be commensurate with that.

11 If it's 80-, 90-million-a-day leak,  
12 the reaction will be commensurate with that.  
13 That is the value of that pressure  
14 measurement, and that is the reason we put it  
15 in the solution.

16 Q One last question and then, Judge  
17 Poirier, I think this would be a good time to  
18 take lunch.

19 Dr. Krishnamurthy, looking at the  
20 12 mitigation solutions that you set out on  
21 pages 231 through 233 of your main report,  
22 which has been identified as Commission  
23 Exhibit 1000, are you aware that SoCalGas has  
24 implemented or is in the process of  
25 implementing each one of them?

26 A I believe we discussed -- as part  
27 of the same program, I believe SoCalGas had  
28 already implemented quite a few of them. I

1 have not followed up, Mr. Lotterman, to see  
2 if all of them have been implemented, but I  
3 absolutely believe that they would have,  
4 yeah.

5 Q I guess what I was asking -- my  
6 apologies, Judge. I'm going to do one  
7 follow-up question if you don't mind.

8 I guess what I was asking,  
9 Dr. Krishnamurthy, have you read, for  
10 example, Ms. Kitson's testimony that was  
11 submitted in this case?

12 A I don't -- I receive -- if we read  
13 it in context of the DR, I don't recall. I  
14 can read it tonight or this evening, but --

15 Q No. No, sir. I wasn't suggesting  
16 you do so, and Ms. Kitson will testify on her  
17 own. I just didn't know if you knew of what  
18 the current status of the measures that  
19 SoCalGas are. If you don't, we'll break for  
20 lunch and we'll talk to you afterward.

21 A I don't recall right away. Thank  
22 you, Mr. Lotterman. I will look at it.

23 MR. LOTTERMAN: Your Honor, this might  
24 be a good time to break for lunch.

25 ALJ POIRIER: Okay. Let's go off  
26 record.

27 (Off the record.) ]

28 ALJ POIRIER: Back on the record.

1                   While off the record, we were  
2 discussing some timing for the afternoon,  
3 cross-examination, and witness orders and so  
4 we have a better idea of that moving forward.

5                   We're going to take a lunch break  
6 now until 1:15. And we'll be off the record.

7                   (Whereupon, at the hour of 12:06  
8 p.m. a recess was taken until 1:18  
9 p.m.)

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AFTERNOON SESSION - 1:18 P.M.

\* \* \* \* \*

ALJ HECHT: We'll be back on the record. We were off the record for a lunch break.

So we are beginning the afternoon session on March 23rd of the hearings in I.19-06-016. We are going to pick up where we left off with cross-examination of Witness Krishnamurthy by Mr. Lotterman.

So, please go ahead.

MR. LOTTERMAN: Thank you, your Honor.

RAVI KRISHNAMURTHY,  
resumed the stand and testified further as follows:

CROSS-EXAMINATION RESUMED

BY MR. LOTTERMAN:

Q Good afternoon, Dr. Krishnamurthy.

A Good afternoon.

Q All right. I have a couple of clarifications, and then I want to turn to the final topic of my examination.

Mr. Moshfegh, would you pull up that portion of the main report at page 215, right in the middle of the first long paragraph, before Figure 152?

And I'm going to ask you to

1 highlight the following language. It says --  
2 I think it was the fourth line down:  
3           While a cathodic protection  
4           system would have provided  
5           casing protection to the  
6           11-and-3/4-inch casing, it  
7           would not have provided  
8           (sic) the 7-inch casing  
9           inside the 11-and-3/4-inch  
10           casing.  
11           Do you see that, Dr. Krishnamurthy?  
12           A    Yes.  
13           Q    And to, sort of, shift from casing  
14 sizes to casing names, are you saying there  
15 that while it's possible that a cathodic  
16 protection system would have protected the  
17 surface casing of SS-25 from corrosion, it  
18 would not have been able to protect the  
19 production casing from the same?  
20           A    That's correct.  
21           Q    All right. Okay.  
22                    The second thing I was going to  
23 mention to you -- and don't worry, I'm going  
24 to go back to your mitigation solutions.  
25                    But I want to note that I didn't  
26 see a solution for annular flow safety  
27 systems -- which I call subsurface safety  
28 valves, but you prefer to call annular flow

1 safety systems.

2 And, I guess, my question to you  
3 is, why was that not included as a potential  
4 mitigation solution in your root cause  
5 analysis?

6 A Yeah. We studied -- and I don't  
7 have the -- I believe we have a supplemental  
8 report or some discussion of that system. We  
9 did look at it. It was -- as we went through  
10 the well files, it was -- it was installed in  
11 1978, '79. And then there was some issues,  
12 it was removed.

13 That technology in the oil patch  
14 has never been successfully applied. There  
15 is some indication that there is some  
16 technologies, but we didn't find any --

17 (Audio interruption.)

18 (Court reporter clarification.)

19 ALJ HECHT: We'll be back on the  
20 record. We went off the record, once again,  
21 due to technical problems with our telephone  
22 line. I appreciate everybody's patience. I  
23 believe Mr. Krishnamurthy was in the middle  
24 of his response.

25 And I will say, Mr. Krishnamurthy,  
26 do you want Mr. Lotterman to repeat his  
27 question? Or can you pick up about where you  
28 left off?

1           THE WITNESS: I can pick up. I can  
2 pick up roughly where I left off.

3           ALJ HECHT: Great. Thank you very  
4 much. And you can err on the side of  
5 restating anything that you think might have  
6 been missed, based on the update the court  
7 reporter gave us before we went back on the  
8 record.

9           THE WITNESS: Thank you.

10           So the annular surface systems -- or  
11 subsurface safety valve is another -- annular  
12 safety valves were installed in '79. And I  
13 believe there were some issues with it, and  
14 it was removed in '80. We researched it  
15 quite a bit. We attempted to understand what  
16 it's supposed to look like. And we are quite  
17 familiar with subsurface valves that are  
18 commonly used in the oil patch, especially in  
19 offshore wells and some land wells, depending  
20 on what application they are on. And that  
21 technology is highly evolved and used  
22 commonly.

23           However, the annular safety system  
24 that was being considered for Aliso was not  
25 viable, necessarily, in '80. And we didn't  
26 see its viability in the period we were  
27 looking at. And so we didn't see it as a  
28 solution or as a root cause of the problem.

1 Because that technology was not where it  
2 needed to be to be an effective solution,  
3 perhaps, even -- at least in 2019 when we  
4 wrote the report. That is why we didn't have  
5 it as part of our root causes. It didn't fit  
6 the explanations -- it didn't fit the  
7 solutions we were looking for.

8 BY MR. LOTTERMAN:

9 Q And is it safe to say, Dr.  
10 Krishnamurthy, that in light of the  
11 infeasibility or impracticability of those  
12 type of safety systems in gas storage wells,  
13 that there were no regulations in place that  
14 required SoCalGas to have them in place?

15 A I don't believe DOGGR had any  
16 regulations. That is correct.

17 Q All right. Thank you. All right.

18 Let's -- oh, by the way, when you  
19 say, "annular flow systems," are you talking  
20 about a valve that would be able to somehow  
21 block the flow of gas between the tubing and  
22 the production casing?

23 A Yes, that is --

24 Q Okay. And is that --

25 (Crosstalk.)

26 BY MR. LOTTERMAN:

27 Q Excuse me.

28 And is that the challenge visa vi

1 oil production wells, where they are  
2 typically flowing up one pipe sort of in one  
3 direction; but in a gas storage well, they  
4 could be flowing up the tubing, they could be  
5 flowing up the annular flow, they could be  
6 flowing up both, and, by the way, you could  
7 be injecting gas six months later?

8 A That is correct. It is a  
9 challenging, challenging operation, as you  
10 well described, Mr. Lotterman. You described  
11 it very, very well. It is through the tubing  
12 or through the casing. And you have to  
13 isolate both. You have to be effective  
14 during injection, and then when you're doing  
15 the withdrawal. So there are quite a few  
16 challenges. So, yes, we studied it quite a  
17 bit. And we didn't identify it as a solution  
18 here.

19 Q Okay. One final area, sir. And I  
20 want to talk about the well kill.

21 And when I say, "well kill," that's  
22 sort of the industry way of saying stopping  
23 the flow of gas from the reservoir up into  
24 the well head or the atmosphere.

25 True?

26 A That is correct.

27 Q All right. So, let's set the stage  
28 a minute. And then I've got a handful of

1 questions for you.

2           You set out on pages 125 and -- I'm  
3 sorry -- 126 and 127 of your main report, the  
4 chronology of key events during the SS-25  
5 incident.

6           Would you mind turning to that page  
7 a minute?

8           A    Yes.  I'm there.

9           Q    Okay.  And, in fact, in your main  
10 report and then some of your sub-reports, you  
11 review the various attempts to kill the leak  
12 at SS-25, which started, according to  
13 chronology, on October 23, 2015.

14                    True?

15           A    Yes.

16           Q    And you note in your chronology  
17 that the first attempt -- first attempt --  
18 first kill attempt was made on October 24,  
19 2015.

20                    Do you see that?

21           A    Yes.

22           Q    And then they were six additional  
23 attempts.  And the last one was made on the  
24 next page on December 22, 2015.

25                    Do you see that?

26           A    Yes, I do.

27           Q    All right.

28                    And I believe it's your

1 understanding that the first attempt on  
2 October 24 was conducted by SoCalGas.

3 True?

4 A Correct. Kill attempt number one.  
5 Yeah.

6 Q Right.

7 And then kill attempts 2 through 7  
8 were conducted by various representatives of  
9 Boots and Coots; right?

10 A That is correct.

11 Q All right.

12 Had you heard of Boots and Coots  
13 before you took on this project?

14 A Yes.

15 Q Okay. Were they pretty well known  
16 across the world for their expertise in  
17 killing wells?

18 A Yes, they are.

19 Q And have you -- and are you aware  
20 that they indeed have killed wells across the  
21 world?

22 A Yes.

23 Q Okay. Have you ever been involved  
24 with them when they are killing a well?

25 A No. Not me, personally, no.

26 Q Okay. What I would next like to do  
27 is, Mr. Moshfegh, to turn to main report page  
28 227 and highlight or elaborate on Figure 164.

1 And, again, this is Commission Exhibit 1000.

2 Are you with me, Doctor?

3 A Yes, I am with you.

4 Q All right.

5 So it's my understanding, sir, that  
6 this configuration, or this figure, depicts  
7 basically what SoCalGas and what Boots and  
8 Coots did, generally, to try to kill the leak  
9 at SS-25.

10 Is that your understanding?

11 A That is correct.

12 Q All right.

13 And then if we just sort of walk  
14 through this very quickly, if you start at  
15 the top of the figure where it says, "Kill  
16 fluid," that's where, basically, they would  
17 attach a pump truck to the appropriate well  
18 head and, basically, try to pump, kind of  
19 force feed, kill fluid down that tubing;  
20 right?

21 A Yes.

22 Q Okay. And depending on the plan  
23 and modeling and whatever, you pick a certain  
24 weight of the fluid, and pick a certain pump  
25 rate, and then you go out there and hope for  
26 the best; right?

27 A Correct.

28 Q And then if you follow that

1 diagram, the kill fluid goes all the way down  
2 that tubing. And then when it gets to the  
3 bottom, what you see are two arrows which go  
4 out of the tubing and into the annulus  
5 between the tubing and the production casing;  
6 is that right?

7 A Yes.

8 Q And if I understand how this well  
9 was configured, that was able to occur  
10 because that tubing actually had perforations  
11 in it --

12 A Yes.

13 Q And so -- I believe there's  
14 actually a phrase for that, something about  
15 communication between the two pipes or  
16 whatever. But the idea is that given a  
17 certain configuration, gas could flow from  
18 the tubing into the production casing or vice  
19 versa; correct?

20 A Yes.

21 Q All right.

22 And then if I understand your  
23 Figure 164, that kill fluid then, once it  
24 goes down the tubing to the end and hits that  
25 obstruction and goes out either way through  
26 the tubing perforations, it's then in the  
27 annulus between the tubing and production  
28 casing, then it's got a couple options.

1           One, it can continue to go down and  
2 actually go into the storage reservoir;  
3 right? -- which is depicted at the very  
4 bottom of the figure?

5           A    Yes.

6           Q    And the other option, which I think  
7 we're well aware of it at this point, is it  
8 goes up the annulus between the production  
9 casing, the tubing, and, as we found out  
10 later given your extraction of the production  
11 casing, it went out of a parted casing at  
12 about 892 feet into the formation; right?

13          A    That is correct.

14          Q    All right.

15                And if there had been no parted  
16 7-inch casing where you show in this diagram,  
17 the kill fluid would have gone down the  
18 tubing and up the production casing and would  
19 have basically, sort of, stopped at the top,  
20 because it would have nowhere else to go;  
21 right?

22          A    I think I followed the question.

23                So what you're saying is, if the  
24 casing was not parted, it would just be on  
25 top of the reservoir. That is correct.

26          Q    Yes. Yes.

27                And the idea is, at some point in  
28 this time, if you put enough kill fluid into

1 that wellbore, the weight of that fluid is  
2 greater than the weight of the pressure  
3 pushing the gas up into the well, and you  
4 effectively stop the leak and you kill the  
5 well operation; is that right?

6 A That is correct.

7 Q Okay. And, in fact, you know, when  
8 you do a workover, isn't that exactly what  
9 you do? -- you sort of kill the well? --  
10 obviously, it doesn't have any holes or  
11 casing partings. But you kill the well, that  
12 allows you to pull the tubing, go in and do  
13 your workover, and do whatever you want to  
14 do.

15 So, I mean, but for those case --  
16 that parted casing, this diagram would show  
17 sort of a successful, routine well kill;  
18 right?

19 A Yes and no. The situation is a bit  
20 different when you're talking about just  
21 pulling the tubing and killing the well for a  
22 workover. Because you do not have gas  
23 flowing at a very high rate, like in this  
24 case. Okay? So the situation is different.  
25 It's not the same.

26 The kill -- the fact that you  
27 overwhelm the reservoir with a kill fluid is  
28 similar. The act of overwhelming the well is

1 similar. But what is important in a case  
2 like this, not just density, is also pump  
3 rate. So those are the two things that will  
4 overwhelm the reservoir in a case like where  
5 you have parted casing or gas flowing at a  
6 very high flow rate from the top.

7 Q Fair enough.

8 So I guess what you're saying is  
9 the principles are same for a routine or  
10 standard well kill where you're just going to  
11 do a workover, and what happened here. But  
12 the calculations as far as the pump rates and  
13 the density of the fluid, that's all a very  
14 different operation when you're trying kill  
15 an uncontrolled well; right?

16 A That's correct.

17 Q Okay. And so -- that's helpful.  
18 Because I want to talk about a couple of  
19 things here.

20 First of all, when you first  
21 arrived at the SS-25 well pad, in  
22 February 2016, you didn't the know the depth  
23 of that -- where that casing parted, did you?

24 A When we arrived, we didn't know.  
25 But when we looked at the temperature log, we  
26 had some estimates of various depths. That  
27 is correct.

28 Q Fair enough. Fair enough.

1           And you also didn't know, really,  
2 what specifically failed on the well --  
3 although, I think you said at one point your  
4 suspicions were -- was the production casing;  
5 right?

6           A     That is correct.

7           Q     And you certainly didn't know  
8 whether the issue was a joint, a pinhole, a  
9 big hole, or a parted casing, like, as  
10 depicted in Figure 164; right?

11          A     Yes. We didn't know; but, yeah.  
12 I'm -- I will wait for your next question.  
13 But you had some data telling you it was bad;  
14 it was pretty big kill rate. But, yeah, we  
15 didn't know it was a big pinhole or a failure  
16 or a parted casing. That is correct.

17          Q     Understood. And I appreciate that  
18 clarification. So you didn't know those  
19 things.

20                   And is it fair to assume that when  
21 SoCalGas attempted its first well kill on  
22 October 24, 2015, it didn't know that either?

23          A     That is correct.

24          Q     And, in fact, those are critical  
25 elements, or they could be very critical  
26 elements, when designing and planning a well  
27 kill.

28                   True?

1           A     Can you repeat -- what is the  
2 critical element, please? I didn't hear the  
3 first part of the question.

4           Q     Depth of the leak, what specific  
5 leak failed, size of the breach, those types  
6 of factors.

7           A     Yes. Often in a well kill, you  
8 don't know those exactly. What you're  
9 looking for is what rate is the -- possibly,  
10 the well is slowing at. And that's really,  
11 your only indication at that point --

12          Q     Right.

13          A     -- that is correct.

14                     Until you run the temperature log  
15 or some other parameters.

16          Q     Right.

17                     And I'm not saying you can't model  
18 for contingencies. All I'm saying is, if you  
19 have that information, like the depth of the  
20 leak, the size of the breach, and all that  
21 kind of stuff, that makes your modeling a  
22 little easier, doesn't it?

23          A     Yeah. But the -- again, I need to  
24 articulate this.

25                     We did do the modeling with  
26 information that would have been available at  
27 that point. And we also did the modeling  
28 with a lot more information that we had -- we

1 were privy to after the RCA or after we  
2 pulled the casing.

3           But with the pressure measurements  
4 on the surface, which is the tubing pressure  
5 measurement and the flowing -- casing  
6 measurement of the shutting casing pressure  
7 measurements, you could estimate the rate of  
8 the leak, and that would have given an  
9 estimate of the flow rate. We talk about  
10 that in the report --

11           Q    Right --

12           A    So I --

13           Q    Okay. And what I want to stop  
14 and just talk about very quickly before we  
15 actually talk about the specific well kills  
16 themselves is that your report acknowledges,  
17 I believe, in the one or two spots that as a  
18 general matter, SoCalGas was able to stop  
19 well leaks at Aliso Canyon; correct?

20           A    Correct. Two other underground --  
21 I forget the number. And SS-34, I believe,  
22 was successfully done in the past.

23           Q    Right. I've got Frew 3, and then I  
24 think Fernando Fee 34-A.

25                   Does that roughly comport with your  
26 recollection?

27           A    That is correct. Yes.

28           Q    And both of those wells are at

1 Aliso Canyon; right?

2 A Yes.

3 Q And both of those wells were  
4 successfully killed by pumping fluid down to  
5 tubing of the well, as you see in Figure 164;  
6 right?

7 A Yes.

8 Q And both of those wells were killed  
9 almost immediately, at least within a day or  
10 so of finding the leak; right?

11 A That's correct. That's what I  
12 remember, yes.

13 Q And that's what SoCalGas tried to  
14 do on October 24 for SS-25, didn't it?

15 A That's correct.

16 Q But your analysis, if I'm not  
17 mistaken, showed that there was significant  
18 differences between Frew 3 and Fernando Fee  
19 34-A and SS-25; right?

20 A Yes.

21 Q And so, unfortunately, in this  
22 circumstance -- and maybe add this to the  
23 list -- past experiences that SoCalGas had in  
24 almost immediately killing two large leaks at  
25 the Aliso Canyon facility were not helpful at  
26 SS-25, were they?

27 A That is correct. We discuss that  
28 in the report, I believe.

1 Q Good. All right.

2 And to make a long story short  
3 here, if you turn to page 148 of the main  
4 report, if you're looking at what SoCalGas  
5 did, you conclude right underneath Table 19  
6 -- and that's actually kill attempt number 1,  
7 alternative. And I'm not going to get into  
8 all that, 'cuz I have -- I really have no  
9 idea which -- what you mean.

10 But if you look at the sentence  
11 below the table, it says:

12 This kill attempt was a  
13 reasonable response,  
14 because the extent of the  
15 failure at SS-25 was  
16 unknown.

17 A That's correct.

18 Q True?

19 A Yes.

20 Q Okay.

21 And, in fact, I think you told me  
22 at the deposition, you called it a good first  
23 pass; right?

24 A That's correct.

25 Q Okay. So let me stop you there a  
26 minute.

27 Sitting here today, looking at what  
28 SoCalGas did in attempt number 1 -- and, by

1 the way, looking at the attempts Boots and  
2 Coots did, do you believe that well was  
3 capable of being killed from a top kill?

4 A Yeah. Our conclusion is yes, which  
5 was discussed in the report.

6 Q Right. All right.

7 Now, let's skip ahead. All right.

8 So let's talk about Boots and  
9 Coots's six attempts. Okay? And, again, I'm  
10 not going to get into mud rates and rate --  
11 pump rates and all that stuff.

12 But you say in your report -- first  
13 of all, you assume in your report that Boots  
14 and Coots did no modeling on its first six  
15 attempts. So remember, kill attempt number  
16 one was SoCalGas. Boots and Coots were 2  
17 through 7.

18 So you say for kill attempts 2  
19 through 6, there was no modeling done by  
20 Boots and Coots; is that right?

21 A Let me carefully phrase this. We  
22 requested data around modeling multiple  
23 times, because we were looking for models  
24 that were done. And that -- we had probably  
25 about 3 to 5 requests on this topic. And we  
26 also had this discussion in person to get  
27 some data, any data, to show that modeling  
28 was done. We didn't find any.

1           And based on that, is the only way  
2 we can prove. Yeah. We requested quite a  
3 few times on this topic, explicitly and  
4 implicitly. And we didn't get any  
5 information. So that is why we concluded.

6           Q    And so your critique of -- one of  
7 your critiques of Boots and Coots kill  
8 attempts 2 through 7 -- or 2 through 6, I  
9 guess, since I believe you acknowledged that  
10 kill 7 did have some modeling done. So let  
11 me rephrase the question.

12                   So your critique of Boots and  
13 Coots's kill attempts 2 through 6 assumed,  
14 rightfully or wrongly, that no modeling was  
15 done in preparation of those attempts.

16                   True?

17           A    I wouldn't say rightly or wrongly,  
18 Mr. Lotterman. Because there was extensive  
19 discussions, extensive data requests, there  
20 were requests to talk to Boots and Coots. We  
21 never managed that. So, we were very clear  
22 about this. There was not data that  
23 indicated transient modeling was ever done to  
24 design these kill attempts.

25                   And when we looked at the kill  
26 attempts -- I don't want to say -- basically,  
27 the same mud rate was used 2 through 6, with  
28 some variations to it. And -- whereas, when

1 the modeling was done after 6, there was a  
2 clear change in weight and pump rate. I  
3 don't have the details in front me. I can go  
4 to my tables. So take that into account,  
5 plus the fact that we had no data, that is  
6 why we made the conclusion.

7 Q Fair enough. But I don't want to  
8 get there yet. I want to focus on the one  
9 assumption in your analysis. And let me  
10 phrase it this way.

11 As far as you were concerned, as  
12 far as you knew, Boots and Coots did no  
13 modeling in preparing and implementing kills  
14 2 through 6; correct?

15 A That's correct. Based on the data  
16 we had and based on the conversations we had,  
17 yeah.

18 Q And do you now believe -- or do you  
19 now know that that assumption is incorrect?

20 A No. I don't know anything to -- to  
21 change my mind. I haven't been given -- we  
22 have not looked at it with any additional  
23 information. We haven't seen any additional  
24 information.

25 Q Okay. All right.

26 So let's turn to the seventh kill  
27 attempt. That one, I believe, you just said  
28 did have some transient modeling; right?

1           A     Well, yeah.  Because that was  
2 shared with us.  There was a lot of data  
3 shared with us --

4           Q     Right.  Right.  Right.

5                     And, again, I don't want to get  
6 into the mud weights and all that stuff.

7                     But at the end of the day, were you  
8 satisfied that Boots and Coots did model that  
9 kill and then went out there and tried to  
10 implement its plan?

11           MR. GRUEN:  Your Honor, if I may, just  
12 before that answer.  And this may be an  
13 objection for vagueness for the record.

14                     Is this a question specific to well  
15 kill attempt number 7, at this point?

16           MR. LOTTERMAN:  Yes.  And I will  
17 clarify, your Honor, for the record.  And  
18 let's find the page here a minute.  I'm  
19 trying to find the chron right.

20                     If you go back to the chronology,  
21 Mr. Gruen, and you go to page 127, this would  
22 be the well kill showing up on December 22,  
23 2015, called kill attempt number 7 failed.

24           MR. GRUEN:  And for clarity, for the  
25 record, the questions are relating to that  
26 specific kill attempt; correct?

27           MR. LOTTERMAN:  They are.  They are.

28           MR. GRUEN:  Thank you.  Understood.

1 ALJ HECHT: Thank you for clarifying.

2 BY MR. LOTTERMAN:

3 Q So, Dr. Krishnamurthy, in light of  
4 that clarification, I want to focus on Boots  
5 and Coots's last kill attempt.

6 Okay?

7 A Yeah.

8 Q And if I understand your analysis,  
9 you acknowledge that modeling was done. And,  
10 obviously, you're aware that Boots and Coots  
11 and SoCalGas implemented the plan. But you  
12 believe, and your modeling shows, that if  
13 Boots and Coots had continued pumping and not  
14 stopping when it did, it would have been able  
15 to bring that well under control; correct?

16 A That is correct.

17 Now, the reason they couldn't keep  
18 it under control, I believe, we al- -- we  
19 discuss that somewhere. There were practical  
20 challenges for them to continue pumping.  
21 That is why they couldn't pump. So it was  
22 well understood that by well kill number 7,  
23 the conditions had deteriorated, there were  
24 challenges all -- like we talk about there.  
25 You have it on the screen -- the gas flow out  
26 of a two-range outlet, the crater enlarged,  
27 so -- so it was a challenge. So it was  
28 understandable why 7 didn't hap -- didn't

1 work.

2 Q Right. And I want to actually talk  
3 about that. But maybe we should -- and this  
4 is my last line of questions, sir. So I'll  
5 ask you to be patient. But maybe we should  
6 pull up a picture here.

7 Mr. Moshfegh, why don't we go with  
8 Figure 17 on main page 33. There you go. If  
9 you could just enlarge that a bit?

10 So, Dr. Krishnamurthy, is that the  
11 crater you're talking about?

12 A Yeah. Yeah. That is a picture,  
13 probably, we took April 1, 2016.

14 Q Right.

15 And, by the way, are those the two  
16 brother wells right on the same pad, the  
17 SS-25A and -25B?

18 A Yes. That is correct.

19 Q And do you see that bridge that  
20 goes across the crater?

21 Was that put in by SoCalGas to  
22 allow, basically, access to that well head  
23 that you see in the middle of the bridge  
24 there, where the bridge seems to not have any  
25 footing?

26 A Yes.

27 Q All right.

28 And if I understand how that last

1 well kill on December 22, 2016, -- '15,  
2 excuse me -- transpired, you pull up the pump  
3 truck, you attach the pump truck to that well  
4 head -- which you can't really see that well;  
5 but it's just that kind of piece of equipment  
6 that you can see sticking up in between that  
7 -- sort of like a cage with no bars.

8 Do you see that?

9 A Yes.

10 Q Yeah. Yeah. Okay. So you --  
11 there you go. There you go.

12 So you attach the pump truck,  
13 you've got your plan, and then when it's time  
14 to go, you start force-feeding that kill  
15 fluid down that tubing with the hope that at  
16 some point you can overcome the reservoir  
17 pressure and stop the flow of gas to  
18 atmosphere; right?

19 A That is correct.

20 Q All right.

21 And it's my understanding, sir,  
22 that there are two paramount concerns when  
23 killing a well. One is, maintain safety.  
24 And what I mean by that is, you avoid  
25 injuries, you avoid deaths.

26 Do you agree?

27 A Yes.

28 Q And, as far as you know, have

1 people been injured and died attempting to  
2 kill wells like that around the world? ]

3 A Yes.

4 Q Okay. Second paramount concern is:  
5 Don't make the leak worse or don't make the  
6 situation worse. And what I mean by that is  
7 if somehow you overpressure the wellbore  
8 during a kill attempt, you can for example  
9 fracture the rock and lose fluid to  
10 formation, can't you?

11 A Yes.

12 Q Why is that a bad thing?

13 A Since you don't successfully kill,  
14 you'll have more gas coming at you. So that  
15 could be one problem if you fracture the  
16 rock.

17 Q Okay.

18 A You could have an underground --  
19 well, there are a lot of scenarios, yes.

20 Q Okay. The other aspect of don't  
21 make the situation worse is you don't want to  
22 do further damage to the wellbore; right?

23 A That's correct.

24 Q Because you got -- now you got a  
25 leak at 892 feet. You don't want one at  
26 2,000 feet; right?

27 A Sure. You don't want to have  
28 additional leaks; that is correct.

1           Q    Right.  You don't want to go to one  
2 failure mode to two; right?

3           A    Correct.

4           Q    And if you do, you might make a top  
5 kill like we depicted earlier more  
6 complicated or even impossible; true?

7           A    If you did that, yes.  Correct.

8           Q    Right.  Right.  So when on  
9 December 22, 2015, when SoCalGas and Boots &  
10 Coots stood on that well pad and hooked up  
11 that pump truck to that wellhead and began  
12 their planned modeled well kill, they had  
13 those two paramount concerns in mind didn't  
14 they?

15          A    Yes.

16          Q    Okay.  And I assume you learned  
17 later on that during that kill the wellbore,  
18 that piece of equipment that's sort of shown  
19 there between that cage with no bars, started  
20 flopping around like a loose fire hose.  Is  
21 that your understanding?

22          A    Yeah, it was vibrating.  That was  
23 the reason for stopping of the kill attempts;  
24 that's correct.

25          Q    Yes.

26                   (Crosstalk.)

27          MR. GRUEN:  I am sorry, your Honor.  I  
28 couldn't hear the witness finish his answer

1 to the question.

2 ALJ HECHT: Yes. Please avoid  
3 crosstalk. Let's hear from the witness, and  
4 then we'll keep going.

5 THE WITNESS: I am sorry. I'm trying  
6 to speak slowly, Mr. Lotterman. So  
7 occasionally I pause. I apologize for that.

8 But, yes, we were -- we had read  
9 detailed reports from the order from SoCal.  
10 And I believe there was some reports from  
11 Boots & Coots where it was very clear when --  
12 this type of pumping on seven, the density  
13 was good. But this time the location had  
14 become so challenging that the wellhead was  
15 vibrating and the pump lines -- the pumping  
16 lines were moving.

17 And now the imagery that,  
18 Mr. Lotterman, you depicted I don't have that  
19 imagery in my mind. But we understood it was  
20 vibrating and it was moving. So definitely  
21 at that point you want to stop.

22 Q Got it. Because you told me in the  
23 deposition that those were indications --  
24 there were indications that things were  
25 shaking, moving, vibrating, so it was  
26 dangerous to continue; true?

27 A That's correct. Kill No. 7, we  
28 write that in the report and absolutely.

1           Q    Right.  So that was a pretty  
2 serious situation involving possible harm to  
3 persons and/or more damage to the well; true?

4           A    Yes.  The wellhead was moving.  So  
5 that is not a good idea.

6           Q    Right.  And so at that point in  
7 time at that pad and at that moment, SoCalGas  
8 needed to make a realtime decision using its  
9 best judgement involving many moving parts  
10 with very serious consequences; true?

11          A    Yes.  And the decision was solid.  
12 Yeah.

13          Q    Good.  And only SoCalGas was in a  
14 position to make that decision; isn't that  
15 right?

16          A    That's correct.

17          Q    And so from what I hear you saying  
18 to me now, you -- meaning Blade -- you are  
19 not contesting the decision by SoCalGas to  
20 suspend the top kill on December 22, 2015, as  
21 they did; correct?

22          A    That's correct.

23          Q    And are you contesting the decision  
24 at that point to stop top kills altogether  
25 and to focus on the relief well?

26          A    No, we are not.

27          Q    Okay.  And in fact that relief well  
28 was in the process of being drilled when this

1 kill attempt was being performed; correct?

2 A Yes.

3 Q And that relief well drilled  
4 1.5 miles into the formation and successfully  
5 intercepted that SS-25 wellbore at its base,  
6 or roughly at its base. And it hit that  
7 wellbore at a spot about the size of a coffee  
8 can. Is that your understanding?

9 A Absolutely.

10 Q And then at that point, SoCalGas  
11 pumped kill fluids not down the well but  
12 through the relief well into the bottom of  
13 the SS-25 wellbore. And that in turn flowed  
14 the well-kill fluid up the wellbore and  
15 killed it; true?

16 A Up and down, yes.

17 Q Right. Was that a pretty  
18 remarkable feat in your view?

19 A Yes. Relief wells are done --  
20 again, I'm an oil patch guy. It's a very  
21 unique achievement and unique application of  
22 technology in the oil and gas industry. And  
23 it's amazing every time we do it.

24 Q And was it amazing here?

25 A Yeah. It was successful here.  
26 Yeah.

27 MR. LOTTERMAN: No further questions,  
28 your Honor.

1 ALJ HECHT: All right. Thank you very  
2 much.

3 So I think at this point, we have  
4 some additional clarifying cross from Safety  
5 and Enforcement Division. And I don't know  
6 if there will be any redirect from  
7 Ms. Frazier for Blade.

8 MR. GRUEN: Thank you, your Honor. I  
9 see Blade is raising their hand. If I may,  
10 will your Honors indulge us for a short break  
11 just to consult and be sure that we have  
12 everything in order in light of  
13 Mr. Lotterman's most recent line of  
14 questions?

15 ALJ HECHT: Let's hear from  
16 Ms. Frazier, and then it is likely that we  
17 will take at least a short break.

18 MS. FRAZIER: Mary Frazier on behalf of  
19 Blade. Your Honor, I was just going to  
20 mention we do have a few clarifying points.  
21 I think it will be less than 30 minutes. But  
22 I just wanted to make you guys aware of that.

23 ALJ HECHT: Okay. You're breaking up a  
24 little bit for me. I do not know if the  
25 court reporters are also having the same  
26 issue or if it's on my end.

27 I think what we're going to do is we  
28 will take a 10-minute break until 2:10, and

1 then we will come back and pick up with SED  
2 and then with Blade for redirect. Okay.

3 MS. BONE: Your Honor, Traci Bone from  
4 Cal Advocates.

5 ALJ HECHT: Yes.

6 MS. BONE: Before we signed off for  
7 lunch, Cal Advocates also requested that we  
8 have 15 minutes to do some cross-examination  
9 of Blade, and we understood that ALJ Poirier  
10 would allow that.

11 ALJ HECHT: Yes.

12 MS. BONE: We would go after SED.

13 ALJ HECHT: Yes. Thank you for  
14 reminding me of that. That is what we will  
15 be doing. At this point, we will take that  
16 break until 1:10.

17 We'll be off the record.

18 (Off the record.)

19 ALJ HECHT: We'll be on the record.

20 We just took a short afternoon  
21 break. And now we are going to pick back up  
22 with more cross-examination of Witness  
23 Krishnamurthy. We will be starting with the  
24 Safety and Enforcement Division and then the  
25 Public Advocates Office and then redirect by  
26 Blade's Ms. Frazier.

27 Mr. Gruen, are you ready to proceed?

28 MR. GRUEN: Yes, your Honor. We are.

1 ALJ HECHT: Thank you.

2 CROSS-EXAMINATION

3 BY MR. GRUEN:

4 Q Good afternoon, Dr. Krishnamurthy.

5 A Good afternoon.

6 Q So, Dr. Krishnamurthy, if I may  
7 just through the -- understandably  
8 Mr. Lotterman and Ms. Frazier indicated they  
9 had not practiced before the Commission  
10 before. And as a matter of practice, if I  
11 may just ask you a few basic foundational  
12 questions about the Blade Report.

13 So if I may, where there are facts  
14 in both the Blade report and the four  
15 supporting attachments, both Commission's  
16 Exhibits 1000, 1001, 1002, 1003, and 1004,  
17 where there are facts identified in the Blade  
18 -- the Blade report and those supporting  
19 attachments, are those facts true and correct  
20 to the best of your knowledge and  
21 understanding?

22 A Yes, they are.

23 Q Thank you. And in those reports  
24 where there are opinions, conclusions, or  
25 interpretations expressed, are those  
26 expressed to the best of yours and your  
27 colleagues at Blade's professional judgement  
28 and expertise?

1           A    Yes, they are.

2           Q    Thank you very much.  Okay.  So  
3 with that basic out of the way, if I can turn  
4 you if you recall to when Mr. Lotterman had  
5 referred to, if you will, rolling credits  
6 looking at the acknowledgements page in the  
7 main report.  And he was asking you about  
8 SoCalGas's efforts related to that.  Do you  
9 recall being asked about that?

10          A    Yes, I do.

11          Q    Okay.  Thank you.  And would it be  
12 accurate to say that without SoCalGas, you  
13 could not have done the root cause analysis?

14          A    Yes, we could not have.

15          Q    Okay.  So without SoCalGas  
16 providing you with the information it did,  
17 that was a necessary component for the root  
18 cause analysis; is that correct?

19          A    Yes.

20          Q    And that would include information  
21 from its well file for well SS-25; is that  
22 also correct?

23          A    That's correct.

24          Q    And would it be accurate to say  
25 that SoCalGas controlled the information it  
26 provided to you regarding well SS-25?

27          A    I don't know about control.  But,  
28 yeah.  They were giving us information;

1 that's correct. We procured information on  
2 that from SoCalGas. And also we would look  
3 at DOGGR websites being publicly available.  
4 But the crucial information would come from  
5 SoCalGas.

6 Q Understood. And that -- what you  
7 just described well SS-25, was that also  
8 accurate for SS-25A, the sources of  
9 information from SoCalGas with cross checking  
10 from DOGGR?

11 A Yes. 25A, 25B, yes.

12 Q Yes. Thank you, Dr. Krishnamurthy.  
13 Do you recall Mr. Lotterman also asking you  
14 if you found the well file for SS-25 to be  
15 complete for your analysis?

16 A Yes, I do remember. Yes, I  
17 remember him asking, yes.

18 Q And if I recall correctly, you  
19 answered something to the effect of:

20 As far as we could see, we had all  
21 the information we needed.

22 Does that comport with your  
23 recollection?

24 A Yeah. You know, I couldn't comment  
25 on things missing because we didn't see any  
26 gaps in information. And if there's some  
27 additional information -- not that we don't  
28 know about it. But information for what it

1 appeared complete to us.

2 Q Okay. Thank you. And that  
3 addresses -- just for the record, if SoCalGas  
4 had provided you with incomplete well file  
5 information, you would have no way of  
6 knowing?

7 A Yes and no. Occasionally depending  
8 if there's a question on 25 and 25-A, we go  
9 through every information all the data bits.  
10 So if there are obvious gaps, let's say I  
11 look at daily reports and then five days are  
12 missing in the daily reports. We would know  
13 and we would ask and we would tell them.

14 So very similar to the modeling  
15 information we just talked about. We know  
16 that was not there. So we asked.

17 So to me, yes. If there are some  
18 really massive additional information that we  
19 didn't have, yeah we wouldn't know. But if  
20 things don't fit we know. Because we're  
21 analyzing the information. And we look for  
22 data trends and stuff like that. So as far  
23 as we could see, it appeared complete.  
24 That's all I could say.

25 Q Thank you, Dr. Krishnamurthy. And  
26 you were jumping into the next question.  
27 Your answer related to it. But just for the  
28 record if I could. What if SoCalGas provided

1 you with certain inaccurate information from  
2 the well file well SS-25? In that instance  
3 would you be able tell certain of the  
4 information from the SoCalGas SS well 25 well  
5 file was inaccurate?

6 MR. LOTTERMAN: Your Honor, I will  
7 object to this for calling for speculation.

8 MR. GRUEN: Well, your Honor, I'm not  
9 -- sorry.

10 ALJ HECHT: Go ahead, Mr. Gruen.

11 MR. GRUEN: Your Honor, I'm asking for  
12 his stated knowledge. I'm not asking him to  
13 guess.

14 ALJ HECHT: He can answer to the best  
15 of his abilities.

16 Go ahead, Mr. Gruen.

17 MR. GRUEN: Thank you.

18 Q Just to restate, would you be able  
19 to tell if certain of the information from  
20 the SS-25 well file was in accurate?

21 A Okay. Sticking to SS-25,  
22 Mr. Gruen. So for example we had a lot of  
23 the temperature surveys, we had a lot of  
24 special surveys. So with a lot of that  
25 information, we can assess that really no  
26 workover happened in SS-25.

27 So I don't know the answer to the  
28 question because inaccuracy can be small, can

1 be large, and it's very difficult for me to  
2 even state of the intelligence on that.  
3 Yeah, the data tells us a lot. When you  
4 analyze the data, the data tells you a story.  
5 If the story doesn't fit or there are gaps,  
6 we normally can figure that out and we didn't  
7 see any.

8           But that doesn't mean -- I don't  
9 know how to answer that question. I don't  
10 know if I answered your question, but.

11           Q Did you have an opportunity to  
12 quality check all of the information on the  
13 SS-25 well file for accuracy?

14           A Oh, yeah. Because if we see a temp  
15 -- so I'll give you an example. If the  
16 temperature log indicated some issues, and so  
17 what you look in the data is that trend will  
18 continue or the trend will appear. So you're  
19 looking for other things.

20           So we do do quality checks  
21 absolutely. We have to. We use that  
22 information to model and analyze. So the  
23 information that's provided, we do quality  
24 checks.

25           Q Okay. Thank you. And the quality  
26 checks -- I think you had begun to answer  
27 that certain pieces of data, maybe the  
28 smaller pieces of data, might have been

1 inaccurate without you knowing. Could the  
2 quality checks have pulled for the smaller  
3 pieces of data or inaccurate data whether  
4 those were in fact inaccurate?

5 A Let me phrase it another way,  
6 Mr. Gruen. So if the data impacts any of my  
7 conclusions, we would throw it out. If there  
8 is something -- I made a conclusion that wall  
9 thickness inspection is necessary or required  
10 and wall thickness was done or some such  
11 thing, then I would drill down. So I don't  
12 know if I'm answering the question.

13 But any data that would impact my  
14 conclusion, I -- we would throw it out  
15 whether it's small or big. I don't know  
16 whether I'm answering the question.

17 So I -- we did do QC on all the  
18 data pretty much. So we analyzed -- normally  
19 in a normal course of operations, you will  
20 have some information not match exactly and  
21 we pick those up.

22 Q Okay.

23 A But I can't say every little issue  
24 we picked up, no. I wouldn't be able to say  
25 that.

26 Q Okay. Thank you,  
27 Dr. Krishnamurthy. Moving on do you recall  
28 being asked by Mr. Lotterman whether you

1 found a quiet period? I believe that was the  
2 term he used and forgive me if I misstated  
3 it. But whether you found a quiet period  
4 where there were no leaks in the Aliso Canyon  
5 field for whatever reason?

6 A Yeah, again, I am going by my  
7 memory, which is sometimes dangerous. There  
8 was a period if I remember right if you read  
9 the casing -- Aliso Canyon casing integrity  
10 section. The period of time where the number  
11 of incidents dropped, the number of casing  
12 integrity incidents dropped, and I believe  
13 that's what Mr. Lotterman was referencing,  
14 and that's what I -- that's how I answered.

15 Q And in response to that, I believe  
16 part of your response was also that there was  
17 a period where a number of leaks were lower.  
18 And you added that when a casing does not  
19 perform its function as defined, Blade called  
20 it a failure. And you included the term  
21 "tight spot" in what you considered a  
22 failure. Do you recall that?

23 A Yes. Yes, I recall it.

24 Q Thank you. And we reviewed the  
25 Blade report as best we could, SED did, and  
26 could not find a tight spot identified in the  
27 Blade report specifically with regards to  
28 well SS-25.

1           Do you recall whether the Blade  
2 report identified any tight spots on the  
3 SS-25 well casing?

4           A    No.  We did not find a tight spot  
5 in SS-25; that's correct.

6           Q    Okay.  Thank you.  And if Blade had  
7 identified -- so hypothetically if Blade had  
8 in fact identified a tight spot on well  
9 SS-25, would you have considered that to be a  
10 casing failure then?

11          A    Yes.  In our report on the  
12 historical casing failures section, we  
13 defined what compromises the functionality of  
14 casing.  And tight spot is one of them.

15          Q    Okay.  Thank you.

16          A    It is an important factor if there  
17 was an event like that.

18          Q    Thank you, Dr. Krishnamurthy.  So  
19 another hypothetical if I can.  If there was  
20 an indication of a leak above or below the  
21 packer in SS-25 that you described to  
22 Mr. Lotterman in some detail yesterday I  
23 believe, would that impact the findings and  
24 conclusions of your root cause analysis?

25          A    Above the packer, you know, let's  
26 review -- it's a hypothetical question.  We  
27 didn't find one of course.  However it may.  
28 At most probably it may not, Mr. Gruen,

1 because it so deep in the well, you know,  
2 8,500 feet. And -- (inaudible). So it's  
3 much shallower. So it may not have a  
4 material impact on it. We would have  
5 attempted to figure out why it did. It would  
6 be important because it happened in SS-25.  
7 But it may not have directly impacted the  
8 failure analysis. May or may not. So  
9 probably not.

10 Q Okay. And why given your answer  
11 "probably not," why not?

12 A Because, again, you have a packer  
13 issue. The packer implies maybe a tubing  
14 issue, okay. So if it is a tubing issue,  
15 that's really not relevant for a casing  
16 failure. Tubing may be a separate problem.  
17 We would have flagged it if there was an  
18 issue with that.

19 But it won't have a material impact  
20 on the interpretation of the failure at 892  
21 and root causes.

22 The root cause to be identified if  
23 you -- the definition of a root cause: If it  
24 needs to address events similar to SS-25 and  
25 any other casing integrity instance. It  
26 should. The root cause analysis all sorts of  
27 incidents. Not just the -- type of failure  
28 to address the packer in any of these so.

1           Q    Thank you, Dr. Krishnamurthy.  And  
2 just to clarify, I believe you were talking  
3 about tubing leaks there if I understand  
4 correctly.

5                     Let me change the hypothetical  
6 slightly.  What if there was an indication of  
7 a casing leak above or below the packer in  
8 SS-25?  Would that impact the findings and  
9 conclusions of your root cause analysis?

10           A    It would be very important because  
11 we ran logs not all the way to the packer or  
12 below the packer -- above the packer in the  
13 casing if I remember right.  So we didn't  
14 find any indications or any trends that  
15 showed us the seven --

16           Q    Okay.  
17                     (Crosstalk.)

18           A    However, if there was a leak at the  
19 packer, yeah.  It may impact.  It may impact.

20           Q    Okay.  Thank you.  And do you  
21 recall -- just turning to another point.  Do  
22 you recall being asked whether there was any  
23 other way to check for why or how SS-25  
24 failed other than through the process of  
25 pulling the tubing?

26           A    Yes.

27           Q    And you said "no" in that case; is  
28 that right?

1           A     Yes.  Because the SS-25 -- just to  
2 explain that answer.  SS-25 ruptured and  
3 parted, yeah?  So that is a big failure.  You  
4 can't run logs in that case.  You can run  
5 tubing logs like we ran, but you won't know  
6 enough about it.  You will know it's parted,  
7 but that is really all you will know at that  
8 point.

9           Q     Thank you.  And under what  
10 conditions would SoCalGas, if any, under what  
11 conditions would SoCalGas be able to check  
12 for how or why a well failed without pulling  
13 the tubing?

14           A     Again, without pulling tubing,  
15 that's a different question.  Without pulling  
16 the tubing the way the weight has been  
17 monitored with temperature logs and noise  
18 logs, you know there's a hole, there's a  
19 leak.  That's really what you would know.

20                     Now, based on that information you  
21 can then look and say, "Okay.  Is there an  
22 environment internal to the casing that could  
23 cause corrosion?

24                     And if you like the gaps, you  
25 conclude like we concluded the gaps cannot  
26 cause the corrosion.

27                     So by process of elimination, you  
28 could assess then, "Hey, this has to be

1 happening from the outside. If it's not  
2 happening from inside, it has to be happening  
3 from the outside."

4 So that is one way of doing it.  
5 But it would be a hypothesis. You would come  
6 up with two or three possible reasons and you  
7 would attempt to mitigate all of them  
8 assuming you cannot pull the tubing, you  
9 can't do any of these other things.

10 Q Thank you. Okay. Turning to  
11 another point another line, do you recall  
12 being asked in Mr. Lotterman's  
13 cross-examination about SoCalGas's  
14 communications with DOGGR to inform the Blade  
15 report?

16 A Can you repeat, Mr. Gruen? I  
17 apologize. I didn't follow.

18 SoCalGas communication with DOGGR.

19 Q Yes. Just generally if I recall  
20 Mr. Lotterman did ask just this morning about  
21 if you had reviewed specifically the  
22 communications that SoCalGas had with DOGGR  
23 in order to inform your -- the Blade main  
24 report. Do you recall him asking about that?

25 A Yes, yes, yes.

26 Q And if I understood your answer  
27 correctly, you said you did not check  
28 communications between SoCalGas employees and

1 DOGGR. But the entire report is based on  
2 extensive data that was obtained from  
3 SoCalGas and DOGGR records. And I believe  
4 you also included general rate cases. Did I  
5 understand that answer correctly?

6 A That's correct.

7 Q Okay. So with that understanding,  
8 if we could pull up the Blade main report?

9 A Can I explain -- expand a little  
10 bit, Mr. Gruen, on that answer?

11 Q Yes.

12 A And clarify?

13 If DOGGR -- if DOGGR -- if DOGGR  
14 included those communications as part of the  
15 documentation for their well on the website,  
16 we would have it. Or if SoCalGas had it as  
17 part of the well file, we would have it. I  
18 want to be very clear.

19 Q Understood. Thank you  
20 Dr. Krishnamurthy. And if I may with that if  
21 we could turn and using the screen share pull  
22 up the main report, the Blade main report.

23 And just for -- while we're doing  
24 that, I use the term "Blade main report." I  
25 believe that was the same term Mr. Lotterman  
26 used. You'll understand that I'm referring  
27 to Blade's root cause analysis; is that  
28 correct? Of the Aliso Canyon -- the release

1 from Aliso Canyon well SS-25? ]

2 A Yes.

3 Q Thank you. So turning to page 245  
4 here, I believe. You see that this is  
5 page 245 of Blade's main report?

6 A Yes.

7 Q And if you look at references 54,  
8 for example, do you see that? There's a  
9 reference to DOGGR's "History of Oil or Gas  
10 Well," from September 8, 1988.

11 Do you see that?

12 A Yes, I do.

13 Q And also reference 65 toward the  
14 bottom of the screen as we see that that's  
15 the "P-50A Well History File from SoCalGas."

16 Do you see that as well?

17 A Yes, I do.

18 Q And that one references -- the date  
19 in that one is 2016, I believe.

20 Do you agree?

21 A Yes.

22 Q And the date for the top one, I  
23 failed to mention, looks like 1988.

24 Does that look right to you as  
25 well?

26 A Yes.

27 Q So would you agree that these are  
28 examples of history records?

1 A Yes.

2 Q Okay.

3 A Or Well Files, or it could be from  
4 the Well File.

5 Q History records or Well Files.

6 Understood. And do you recall how in the --  
7 let's stick with history records for a  
8 second. How did you acquire those documents  
9 if you would?

10 A So looking at 54, that would be  
11 from DOGGR. Okay. It says, "Division of  
12 Oil, Gas, and Geothermal Resources." That's  
13 where we would have got that data set. Now,  
14 the bottom data set we obtained from Southern  
15 Cali -- from SoCalGas, so that's the source  
16 document.

17 Q I see. And this illustrative, is  
18 it not, that these history files, the sources  
19 of those documents were either from DOGGR or  
20 from SoCalGas; is that right?

21 A That's correct.

22 Q Okay. Turning to Well SS-25, the  
23 Well File there that you reviewed, did that  
24 contain a folder titled "Well History"?

25 A That is very specific, Mr. Gruen.  
26 I'll need to check. I don't recall.

27 Q I don't know if it will be  
28 necessary for this line of cross. I could

1 maybe ask it more generally and see if this  
2 refreshes your recollection just to keep  
3 things moving forward.

4 Do you recall if Well SS-25 had  
5 well history information akin to what we're  
6 reviewing on this page?

7 A I'll have to check. My guess is  
8 yes. Okay. Now, it may not be titled that.  
9 I see -- I'm looking at the references now.  
10 We got an SS-25 Well File so that had 2,000  
11 pages in it. I'm reading from a reference  
12 here, Mr. Gruen. And also we got from DOGGR  
13 an SS-25 chronology summary, so an SS-25  
14 event every which way to get data.

15 And there was also towards early  
16 2019 we got a lot more electronic data on 25,  
17 25A, 25B, which in many cases we had already  
18 been provided. But as an abundance of  
19 caution, there was some additional  
20 information provided by SoCalGas and so we  
21 did get a lot of data. But, yeah, looking at  
22 "History of Oil and Gas Well," did we have a  
23 file titled exactly that for SS-25? I cannot  
24 answer. But we did get a Well File on SS-25.

25 Q Understood. I'm tracking you.  
26 Thank you, Dr. Krishnamurthy. And do you  
27 recall -- just with regards to the history  
28 documents that we've been talking about, do

1 you recall seeing history documents on Well  
2 SS-25 between 1997 and 2015?

3 A I don't recall. That doesn't mean  
4 it's not there so I want to be careful. I  
5 need to check. I can get back to you.

6 Q Understood. If it was there, would  
7 it show up in the Blade report in these  
8 references here?

9 A It may or may not. Can you go to  
10 Reference Number 8.

11 Q Sure.

12 A I'm looking at Reference Number 8.  
13 It may show up in 8, so it may be a subset of  
14 that. Okay. So I want to -- so you can see  
15 the facility. That is one. And then you go  
16 back at 6, it tells you the chronology  
17 summary. So there was a lot of data and  
18 information on SS-25 so I want to be careful  
19 to say. It may be contained in that so I  
20 don't want to say it is or it isn't.

21 Q I see. Okay. Would there be any  
22 other references that we could check to see  
23 if that information is available -- was  
24 provided to Blade?

25 A Those would be the two references.  
26 I'll have to look carefully and talk to my  
27 team because, as you can imagine, everybody  
28 who has worked on it has gone through the 25

1 data set for sure.

2 Q Yes. Understood.

3 Your Honor, if I may, if we could  
4 ask for an answer. If Blade could consult  
5 and get back to us with an answer to that  
6 question, we'd appreciate it for the record.

7 ALJ HECHT: Are there any objections to  
8 that request?

9 MR. LOTTERMAN: I guess my only  
10 concern, your Honor, is this going to be a  
11 written submission or are we going to drag  
12 poor Dr. Krishnamurthy back into this  
13 proceeding? What did Mr. Gruen have in mind?

14 MR. GRUEN: Your Honor, I certainly  
15 have no intent of having Dr. Krishnamurthy  
16 testifying any further than he needs to. It  
17 was -- in asking this question --

18 Q Maybe I should clarify,  
19 Dr. Krishnamurthy. How burdensome for you is  
20 this question?

21 A Let me rephrase your question,  
22 Mr. Gruen, and see if it makes sense and then  
23 I'll answer the question.

24 ALJ HECHT: I'm going to ask to pause  
25 for a moment. I believe that Ms. Frazier  
26 would like to say something and I'd like to  
27 give her that opportunity before we continue.

28 MS. FRAZIER: Thank you, Your Honor.

1 Mary Frazier on behalf of Blade. If I -- I  
2 guess what I would suggest is maybe we take a  
3 break so that I can visit with  
4 Mr. Krishnamurthy to figure out what this  
5 entails and then we can report back on  
6 whether it's something we're able to do or  
7 not.

8 ALJ HECHT: I think that's a better  
9 idea.

10 Mr. Gruen, is it possible to  
11 continue with other questions and take a  
12 break later after that to find this out or  
13 would it make more sense to take a break now?

14 MR. GRUEN: Your Honor, we can do  
15 whatever your druthers are. We can move on  
16 or, if you would prefer, we can take a break  
17 now. Either way.

18 ALJ HECHT: All right. I'm having  
19 computer bandwidth problems so we will take a  
20 break. We will take a break for 10 minutes  
21 coming back at 2:48. Thank you.

22 MR. LOTTERMAN: Your Honor, I'm sorry,  
23 before we do --

24 THE REPORTER: Are we off the record?

25 ALJ HECHT: No. We are not yet off the  
26 record, and I apologize. I was about to say  
27 that.

28 THE REPORTER: Thank you, Judge.

1 ALJ HECHT: Mr. Lotterman, you were  
2 saying.

3 MR. LOTTERMAN: Yeah, I wanted to get  
4 this on the record. Could I understand  
5 exactly what Mr. Gruen's ask is.

6 ALJ HECHT: That's a good idea.  
7 Why don't you repeat that.

8 MR. GRUEN: The question is any history  
9 documents, either the DOGGR History of Oil  
10 and Gas Wells or SoCalGas Daily Well  
11 Activities in the SS-25 Well File for the  
12 period from 1997 to October 2015.

13 MR. LOTTERMAN: And so are you asking  
14 Mr. Krishnamurthy to confirm they exist or to  
15 produce them or what?

16 MR. GRUEN: The question is whether or  
17 not Blade had access to that information  
18 while during the preparation of the Blade  
19 root cause analysis and supporting  
20 attachments.

21 ALJ HECHT: To be clear, you're not  
22 asking that they actually produce those  
23 documents because --

24 MR. GRUEN: That is --

25 ALJ HECHT: -- the --

26 MR. GRUEN: That is correct, your  
27 Honor. We're not asking Blade to do a data  
28 gathering exercise at this point.

1 ALJ HECHT: Okay.

2 MR. GRUEN: My apologies if we left a  
3 different impression.

4 ALJ HECHT: Thank you.

5 With that understanding, I'm  
6 hopeful, Ms. Frazier, that you can check with  
7 your witness and when we get back, we can  
8 address this.

9 That being the case, it is now 2:40.  
10 We'll take a 10-minute break until 2:50. We  
11 will return then. Thank you, everyone, and  
12 thank you Dr. Krishnamurthy.

13 THE WITNESS: Thank you.

14 ALJ HECHT: Appreciate your time.

15 THE WITNESS: Thank you.

16 (Off the record.)

17 (Recess taken.)

18 ALJ HECHT: We'll be back on the  
19 record.

20 While we were off the record, we got  
21 some clarification on the ability to answer  
22 that last question.

23 Mr. Gruen, I believe that you will  
24 ask the question again and we'll go from  
25 there.

26 MR. GRUEN: Yes, your Honor, certainly.

27 Q Dr. Krishnamurthy, before the  
28 break, do you recall I had asked you just for

1 the record do you recall seeing any history  
2 documents, either the DOGGR "History of Oil  
3 and Gas Wells" or "SoCalGas Daily Well  
4 Activities" in the SS-25 Well File for the  
5 period 1997 to October 2015.

6 I understand you have a preliminary  
7 answer to that question and that you are  
8 going to check to be sure that the answer is  
9 accurate by tomorrow.

10 A Yes.

11 Q Very good.

12 A Yeah. Thank you, Mr. Gruen. Yeah,  
13 we believe we have a lot of -- we have data  
14 post-1997 to 2015. We have -- we believe we  
15 have logs, we have various things regarding  
16 data from SS-25. Like Mary mentioned, we  
17 will confirm by tomorrow, but we believe we  
18 have data post-1997.

19 Q Okay. And if you could, just for  
20 clarification, if you could clarify whether  
21 you got that data from DOGGR or from  
22 SoCalGas.

23 A Yeah. We should -- we'll try to  
24 confirm that.

25 Q Okay.

26 A But we do have substantial data.  
27 We also have the weekly pressure measurements  
28 and other information that we've used so I'll

1 confirm that.

2 Q Okay. Thank you.

3 MS. PATEL: Your Honor, this is Avisha  
4 Patel for SoCalGas. May I interject an  
5 objection for this line of questioning?

6 ALJ HECHT: Before we do that, I am  
7 going to say I'm still having technical  
8 difficulties so I am going to hand the lead  
9 back to Judge Poirier for the rest of the  
10 afternoon, so he will be the one responding  
11 to your question and I apologize for that.  
12 It's a video problem. My audio is fine.

13 ALJ POIRIER: Ms. Patel, please go  
14 ahead.

15 MS. PATEL: Sure. The basis for my  
16 objection is that in December of 2019 SED  
17 data requested all the documents that Blade  
18 reviewed in the course of its investigation  
19 from Blade, and Ms. Frazier provided a copy  
20 of that to SED, again, December of 2019 and  
21 we actually got a copy of that hard drive as  
22 well. So Mr. Gruen is actually in possession  
23 of this information that he's asking the  
24 witness to go research tonight.

25 ALJ POIRIER: Mr. Gruen.

26 MR. GRUEN: Your Honor, it's my  
27 understanding from our witness that we  
28 haven't been able to get certain of this

1 information from SoCalGas, so we have  
2 concerns that it hasn't been provided to  
3 Blade. But if we're mistaken, we'll  
4 certainly defer to Blade to provide that  
5 answer. But we think it's helpful for the  
6 record just to be sure that Blade was given  
7 the information. In light of Blade saying  
8 they can provide this by tomorrow, we don't  
9 think it's a particularly onerous task. We  
10 think it's quite doable. This is a quick  
11 check of a drive it seems.

12 ALJ POIRIER: Ms. Frazier.

13 MS. FRAZIER: I just wanted to point  
14 out one thing. We weren't anticipating  
15 producing anything. We were just going to  
16 confirm whether the information exists.

17 ALJ POIRIER: Okay. I'm going to  
18 overrule the objection. I think if it's just  
19 the confirmation, let's go ahead and do that.  
20 I'd like to move on with the hearing today.

21 So, Mr. Gruen, please continue.

22 MR. GRUEN: Thank you, your Honor. And  
23 just to confirm, our understanding matches  
24 that of Ms. Frazier's, that this is only for  
25 a request for confirmation.

26 Q With that, moving on, this is the  
27 next line of questioning. That's all I had  
28 on that one.

1                   Dr. Krishnamurthy, do you recall  
2 being asked questions yesterday from  
3 Mr. Lotterman about SS-25 having both tubing  
4 and casing? Sorry, Dr. Krishnamurthy, I  
5 think you may be on mute.

6                   A     Yes. I apologize. I was on mute.  
7 Yes.

8                   Q     Not at all. And the purpose of the  
9 tubing? Do you recall being asked about that  
10 as well?

11                  A     Yes, I believe, yeah.

12                  Q     And if I -- okay. Pardon me. Now  
13 I'm talking over you. I'll do my best not  
14 to. You responded, if I understood  
15 correctly, that tubing was initially for oil  
16 production.

17                             Do you recall that?

18                  A     Yes.

19                  Q     Was the original construction of  
20 SS-25 as an oil well intended to include  
21 service for extraction and injection of  
22 high-pressure gas through the annulus between  
23 the tubing and the casing?

24                  A     The original design of the well was  
25 an oil well as you mentioned and  
26 Mr. Lotterman mentioned. It was converted  
27 into a gas well in the late 1970s, I believe,  
28 mid to late 1970s. So, yeah, the initial

1 intent of the well was probably an oil well,  
2 that's correct.

3 Q Okay. And just to be sure I have a  
4 clear understanding to my question, the  
5 original construction of SS-25 as an oil  
6 well, was that intended to include service  
7 for extraction and injection of high-pressure  
8 gas through the annulus between the tubing  
9 and casing?

10 A That design would not have  
11 envisioned that. That design would have  
12 envisioned -- what you do normally in an oil  
13 well or a gas well is -- in conventional oil  
14 or gas well, I'm not talking about storage --  
15 you produce through the tubing and you design  
16 the production casing to handle that entire  
17 pressure, so that's really would have been  
18 intent of the design.

19 Q Thank you.

20 A As an oil well.

21 Q Yes. Understood. Thank you.

22 Dr. Krishnamurthy, do you recall  
23 being asked if you heard Ms. Felts testifying  
24 earlier prior to you testifying?

25 A Yes.

26 Q And you said that you had listened;  
27 is that correct?

28 A Very little. It was a half hour or

1 so. I just couldn't peel off some other  
2 things I was doing so I did not attend as  
3 much.

4 Q Okay. Did you happen to hear  
5 SoCalGas asking Ms. Felts if she had seen  
6 information that Blade did not have for  
7 purposes of producing the Blade main report  
8 and the supporting reports?

9 A No, I did not hear that question.

10 Q Okay. Following the Blade report,  
11 the issuance of it in May 2019, you're aware  
12 that the Commission ordered -- opened an  
13 Order Instituting Investigation and an Order  
14 to Show Cause; is that correct?

15 A Yeah.

16 Q Okay. And that's the incident  
17 proceeding where you're testifying.

18 You understand that?

19 A Yes.

20 Q And were you aware that during the  
21 course of this proceeding, SED --

22 (Reporter call dropped.)

23 ALJ POIRIER: We'll be back on the  
24 record.

25 Why don't you restate, Mr. Gruen.  
26 Mr. Gruen, you're on mute.

27 MR. GRUEN: I'm sorry. Can you hear  
28 me?

1 ALJ POIRIER: Yes.

2 BY MR. GRUEN:

3 Q Dr. Krishnamurthy, during the  
4 course of the Order Instituting Investigation  
5 and Order to Show Cause, were you aware that  
6 the Safety and Enforcement Division asked  
7 Southern California Gas Company data  
8 requests?

9 A I'm not aware, but I'm sure that  
10 happened.

11 Q Okay. So that's after Blade issued  
12 its root cause analysis; is that right?

13 A Correct. Correct.

14 Q And since you're not aware, you did  
15 not review any of the data responses that  
16 SoCalGas provided in response to SED's data  
17 requests of SoCalGas during the course of  
18 this proceeding.

19 Is that also true?

20 A That's correct. That's true.

21 Q Thank you. Mr. Krishnamurthy, if I  
22 could turn to another line of questioning --  
23 I'm sorry, Dr. Krishnamurthy. I should be  
24 more careful and accord you the respect that  
25 you're due. Do you recall that you had  
26 originally told SoCalGas -- and I believe it  
27 might have been the Commission as well --  
28 that Blade intended to produce its root cause

1 analysis; that is, the main report and  
2 supporting attachments, in March of 2019?

3 A I don't remember saying that, but  
4 it's possible. I don't remember saying the  
5 March deadline, Mr. Gruen, but it's possible.

6 Q Okay. Maybe if I just state it  
7 more generally. Do you recall that Blade had  
8 let SoCalGas and SED know that Blade was  
9 intending to publish its main report and  
10 supporting attachments prior to May of 2019?

11 A Yes. We had a couple of deadlines  
12 and March was one of them. We were thinking  
13 of finalizing it in March.

14 Q Okay. Thank you. And so I'm  
15 noticing the discrepancy in dates there  
16 between Blade's intent to finalize in March  
17 and Blade actually finalizing in May. So if  
18 I may, why wasn't Blade able to finalize the  
19 main report and supporting attachments that  
20 it produced until two months after it had  
21 initially projected?

22 A Yeah, our target was, if I remember  
23 right -- and, again, I'm going back deep into  
24 my memory bank. Sometimes it's  
25 challenging -- it was around middle of March,  
26 if I remember right, Mr. Gruen, middle of  
27 March. And then we got some additional data,  
28 electronic data. For me, the most important

1 part of this project was to make sure we are  
2 not missing any data because the data there  
3 is crucial to our conclusion, in addition to  
4 all the physical evidence. And so we were  
5 given data, I believe in February, February  
6 of -- or January. I forget. Don't hold me  
7 to the dates -- in electronic form to con --  
8 I believe that that (inaudible) from SoCal  
9 was just to make sure we are not missing  
10 anything.

11 And so we went through that data to  
12 make sure, and really that data had been  
13 provided in other forms and we had already  
14 had it so it didn't make any change to our  
15 conclusion but we wanted to check everything.  
16 It gave us a bit more time to tighten up a  
17 few things and so that's why it went to me.

18 So I don't want to say it was only  
19 the data. Data was part of it. And also we  
20 wanted to tighten and couple of things, but I  
21 did want -- we did want to confirm that we  
22 had anything materially new in the data set  
23 that could change our conclusions or modify  
24 or inform it differently.

25 Q Understood. Thank you. And did  
26 that new data -- do you recall whether that  
27 came in before or --

28 (Reporter call dropped.) ]

1 ALJ POIRIER: We'll be back on the  
2 record.

3 Mr. Gruen, please go ahead and  
4 proceed.

5 BY MR. GRUEN:

6 Q Dr. Krishnamurthy, before the  
7 break, we experienced some technical  
8 difficulties there. But before the break, we  
9 were discussing the discrepancy between when  
10 Blade announced, initially, it would finalize  
11 its main report and when Blade actually  
12 produced the main report.

13 And if I understood right, the  
14 approximate dates, the initial statement was  
15 March of 2019 when Blade would finalize. And  
16 Blade actually ended up publishing in May of  
17 2019.

18 Is that accurate?

19 A Yes. That's accurate.

20 Q And I had understood your answer to  
21 be that Blade -- you -- -- that Blade had  
22 received some additional data from SoCalGas  
23 prior to the finalization March date of the  
24 Blade data report. And that was part of the  
25 reason for change in dates.

26 Did I characterize that accurately?

27 A That is correct. I want to be  
28 careful. That is part of the reason. Of

1 course, it also gave us a chance to work it  
2 and make sure everything was right.

3 So we had to review the data just  
4 to check and make sure everything was there,  
5 and it was not an issue. It didn't change.  
6 But we had to check a few things, make sure  
7 some new information was not there that we  
8 may miss.

9 Q Okay. And did SoCalGas provide the  
10 new data that you were just referencing  
11 before or after Blade mentioned that it was  
12 intending to finalize the main report in  
13 March? Do you recall?

14 A I don't recall, Mr. Gruen. I don't  
15 recall that at all.

16 Q That's okay.

17 A That is quite a challenge. No, I  
18 don't recall.

19 Q I agree with Mr. Lotterman. I'm,  
20 frankly, in awe of your memory. So I  
21 certainly appreciate your answers.

22 If I can, the data that Blade  
23 received that you were just referencing,  
24 would -- were these data provided in response  
25 to data requests that Blade had issued?

26 Do you recall?

27 A I don't recall. But I can go back  
28 and check. It would be in request (sic) to

1 some of our data requests. But, like I  
2 mentioned, we checked everything. And I  
3 believe it was -- I want to -- I want to say  
4 it was 25-A there was some data, 25-B there  
5 was some data. But this data we had already  
6 received before, I believe. And so it didn't  
7 really have an impact. But we had to check  
8 everything.

9 Q Okay. Let me just -- let me ask  
10 you, if I could, I believe that Mr. Lotterman  
11 had asked you about your knowledge of Boots  
12 and Coots as a well-kill contractor.

13 Do you recall being asked that?

14 A Yes.

15 Q And I believe your answer -- and  
16 correct me if I'm misstating this.

17 I believe your answer to that was  
18 you were familiar with them?

19 A Yes.

20 Q Okay. And that you had wanted to  
21 talk to Boots and Coots and ask them  
22 questions.

23 Did I understand that correct?

24 A Yeah.

25 Again, I don't want to phrase it  
26 "ask them questions." It was more -- our  
27 goal was, there was -- as I had mentioned to  
28 Mr. Lotterman earlier, we didn't see any

1 modeling, data, results, anything. And we  
2 were a bit curious.

3 And, whereas, kill number 7, there  
4 was a lot of good information. We understood  
5 what was done. The other kills, 2 through 6  
6 we couldn't see it. And that was the intent  
7 of the question.

8 That was the clarification we  
9 wanted to have. That was the reason for  
10 wanting to meet with them and understand what  
11 was the thinking behind each of the kills so  
12 that we can reflect that in our analysis.

13 Q Thank you --

14 A That was the intent of our request.

15 Q Thank you, Dr. Krishnamurthy.

16 And in -- was Blade granted access  
17 to asking questions of Boots and Coots, or to  
18 communicating with them about what you just  
19 described?

20 A No, we couldn't. We didn't have  
21 the ability to do that yet.

22 Q Okay. So that's an example of  
23 information that you wanted to get but  
24 weren't able to get during the course of root  
25 cause analysis; is that right?

26 A Yes. Yes.

27 So the assumption we made -- so  
28 consequently, as we articulated in our

1 report, we assumed modeling was not done.  
2 And other factors guided us in that  
3 conclusion. So that is why we were  
4 comfortable to write the report at that  
5 point.

6 If I were -- if we were not  
7 comfortable writing the report, we would have  
8 attempted to do some other stuff. But we had  
9 enough information to write our report. So  
10 we decided to go without that information.

11 Q Understood.

12 Your Honor, at this time, that's  
13 all I have on redirect.

14 ALJ POIRIER: Thank you, Mister --

15 MR. GRUEN: And if I could just thank  
16 Dr. Krishnamurthy and Blade for all their  
17 hard work and their contributions to the  
18 proceeding.

19 Thank you very much.

20 ALJ POIRIER: Thank you, Mr. Gruen.

21 I believe Ms. Bone indicated that  
22 she had a short amount of clarification  
23 cross.

24 Ms. Bone, are you ready to proceed?

25 MS. BONE: I am. Thank you, your  
26 Honor.

27 ALJ POIRIER: Please go ahead.

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CROSS-EXAMINATION

BY MS. BONE:

Q Dr. Krishnamurthy, good afternoon.

A Good afternoon.

Q My name is Traci Bone. And I'm representing Cal Advocates in this proceeding.

And I wanted to be clear that I'm not an engineer. So please bear with me and correct me where you need to.

Can you do that for me?

A Yes, I will.

Q Okay. Thank you.

On cross-exam with Mr. Lotterman, you seem to agree that SS-25 was pressure tested at over-the-average pressure in the well field, at an operating pressure over that of the general field.

Do you recall that discussion with Mr. Lotterman?

A Yes, I recall. May I clarify that statement a little bit, just so that --

Q Please.

A Is that okay?

Yeah. What I -- what we wrote in the report, and what I meant to say to make sure I say it correctly, is that the well was tested above the pressure it was supposed to

1 operate at as a gas storage well, giving  
2 yourself a safety factor. That is what I  
3 meant. Okay? I want to clarify.

4 Q All right. Thank you for that  
5 clarification.

6 Do you know when that pressure test  
7 was performed?

8 A I believe it was '73 or '77.  
9 That's the timeline that sticks in mind.  
10 But, yes, that would be the time.

11 Q Did the utility perform any other  
12 pressure test after that time on SS-25?

13 A No.

14 Q Is there anything that you know of  
15 that prevented SoCalGas from pressure testing  
16 the well after that time?

17 A You would have to pull the tubing  
18 to do the pressure test. That's the only way  
19 I can think of. There are other ways to do  
20 with the tubing, but it's more complicated,  
21 so -- so that would be one issue. And then  
22 we would kill the well.

23 Those are some things to do, which  
24 I believe Mr. Lotterman asked me questions on  
25 that. So those are things you would do. You  
26 would pull the tubing, kill the well, and  
27 then do the pressure test.

28 Q So how often do you believe that a

1 pressure test should be done to ensure the  
2 mechanical integrity of a well?

3 A Yeah. I'm not a fan of the  
4 pressure test. So I'm talking as a technical  
5 opinion, Ms. Bone. Because the way I would  
6 -- which we articulate in our root cause of  
7 solutions, we don't recommend a pressure  
8 test. What we would recommend is a wall  
9 thickness inspection instead and periodic  
10 timeframe. And there's a reason for that.

11 What a pressure test does for you  
12 is, if you have a corrosion that is deep  
13 enough to fail, it will cause it to fail.  
14 And that is what we would call a trailing  
15 indicator. By that time, the casing has  
16 failed. So you would want to do wall  
17 thickness so that you prevent -- it prevents  
18 a pressure test or underoperation. That is  
19 what you want to do.

20 That is why a pressure test is not  
21 an ideal way. It is a more complicated way.  
22 It's not a simple way in a wellbore. And  
23 like a pipeline, which is the result when  
24 external pressure is constant, when you look  
25 at a downhole casing, there is an external  
26 pressure to the casing, which we call pore  
27 pressure. And that changes with depth, so...

28 Q Okay. So, it sounds to me like you

1 would prefer ultrasonic imaging tools or  
2 magnetic flux leakage tools to be used;  
3 correct?

4 A Yeah. Those are better options and  
5 more practical and easier options. Yeah.  
6 That would be the better option.

7 Q So when you say, "easier," they are  
8 easier to implement than a pressure test?

9 A No. It is easier from a mitigation  
10 point of view. So you -- you don't go to the  
11 point of which a pressure test and you have a  
12 hole. You want to do it before that. So  
13 that is why a wall-thickness inspection is  
14 better.

15 Q So do you believe that a USIT or an  
16 MSL tool could have detected the corrosion in  
17 SS -- in SS-25's casing before 2015?

18 MR. LOTTERMAN: Objection, your Honor.  
19 I'm going to object on several grounds,  
20 vagueness is one.

21 What time period is she talking  
22 about? The day before? Or let's say 1982?

23 I guess that's my main objection. I  
24 would like a timeframe.

25 ALJ POIRIER: Ms. Bone, can you  
26 restate, please?

27 BY MS. BONE:

28 Q Sure.

1           Do you believe that a USIT or an  
2 MSL tool could have detected the corrosion in  
3 SS-25 in 2015?

4           A    Yes.  In 2015, it could have.

5           Q    And could it have detected  
6 corrosion in 2010?

7           MR. LOTTERMAN:  At this point, your  
8 Honor, I will object on speculation grounds  
9 as well.

10          MS. BONE:  Your Honor, I would remind  
11 everyone that yesterday Mr. Krishnamurthy  
12 testified that the corrosion was very, very  
13 slow.  And so it seems like he may have a  
14 sense of how long, how far back the corrosion  
15 would have been existent in the pipe.

16          ALJ POIRIER:  Objection overruled.

17          Mr. Krishnamurthy, please answer to  
18 the extent you can.

19          THE WITNESS:  Yeah.  It would be -- I  
20 don't want to use the word "speculative."  I  
21 would be making an educated estimate of some  
22 of this.  So we want to be careful.

23          The data we looked at in literature  
24 for metallogens and bacterial corrosion  
25 showed a low corrosion rate.  And depending  
26 on how you measured it in this well, it could  
27 be a bit higher, could be a bit lower, so  
28 that is why I called it -- it's a hypothesis

1 or a speculation. But I would say in 2010,  
2 you would have seen it. That would be my  
3 guess.

4 BY MS. BONE:

5 Q What about in 2005?

6 A I would have to do -- I would have  
7 to do some thinking to come up with those.  
8 So wha- -- the way an engineer or a scientist  
9 would do that is, you would bring a lower  
10 bound and upper bound and say, "How back  
11 could I go?" And I would have to do that  
12 kind of an analysis to go beyond, say, 2010  
13 or 2005 to understand what is an upper bound  
14 of cor- -- so if you can understand my  
15 question, is the corrosion rate at 17 mils  
16 per a year -- mills is 1,000th of an inch --  
17 then I would say, "Hey, probably 2010 is the  
18 limit." But if the corrosion rate is 15 mils  
19 per a year, then 2,000 is the limit, you know  
20 what I mean?

21 I haven't done what I would call an  
22 upper bound, lower bound corrosion rate to  
23 truly establish what those boundaries are.  
24 So I would -- it would be close speculation  
25 at this point, if I go beyond that 2010. But  
26 -- by "beyond," I mean before 2010.

27 Q So do you have an opinion as to how  
28 often an MSL or a USIT inspection should be

1 performed?

2 A Yeah.

3 Again, like we discussed earlier,  
4 you don't want to remove the tubing every  
5 year or two years. It's too -- it is not a  
6 -- it is not something necessary. So you  
7 have to understand the corrosion rate  
8 phenomenon.

9 So what I would do in a case like  
10 this is, I would say every 10 years, every  
11 15 years to be conservative. 10 or 15 years  
12 is more than adequate, if not longer. Depend  
13 -- see, the problem with that answer is, it  
14 depends on the corrosion mechanism. That  
15 goes back to the root causes or solutions we  
16 identified.

17 You want to understand the  
18 mechanism of the corrosion, which will then  
19 inform you on what rate this corrosion is  
20 growing. If it's microbiological, it's one  
21 way. If it's CO<sub>2</sub>, it's another way. And  
22 once you understand that, then you can come  
23 up with the frequency. But the frequency has  
24 to be defined by or -- informed by the  
25 mechanism in place.

26 Q Thank you, Mr. Krishnamurthy.

27 Could you -- we've heard some  
28 discussion about pressure tests and also

1 pressure surveys.

2           Can you tell us what the difference  
3 is between a pressure test and a pressure  
4 survey?

5           A    Absolutely.  I -- and I want to  
6 clarify something that I answered earlier  
7 when Mr. Lotterman asked me.

8           So the pressure test is what was  
9 done in 1973.  I just found the date on the  
10 report, so that's why I'm a little bit more  
11 confident.  In 1973 when the conversion  
12 happened, a pressure test was done.

13           So you're actually putting a  
14 retrievable bridge plug at the bottom,  
15 separating the reservoir from the well.  And  
16 so that pressure test actually pressures the  
17 casing.  And you go -- they go back up and  
18 they pressure different portions of the  
19 casing like they did in '73.  And, like I  
20 mentioned earlier in your Q and A, that  
21 pressure test was above the safety factor --  
22 or above the pressure anticipated in the  
23 wellbore.

24           Whereas, a pressure survey is,  
25 you're open to the reservoir at that point,  
26 your reservoir is still there, and you're  
27 running a transducer mapping the pressure  
28 inside the tubing.  Okay?  That is a pressure

1 survey done.

2 Now, I misspoke when Mr. Lotterman  
3 asked me this question. This is one of the  
4 clarifications I was going to make is, you  
5 would have -- since you're running it through  
6 the tubing, a small casing leak would not be  
7 picked by the pressure survey. The pressure  
8 survey quite often is done to establish the  
9 reservoir pressure, understand what the  
10 reservoir pressure is over time, which is an  
11 important data point to have.

12 So when you're running it through  
13 the tubing, you're going to see that now the  
14 casing had a massive rupture or leak which,  
15 of course, other things would have found it.  
16 You would see the bottom hole pressure shift.  
17 But in the leak situation, or under other  
18 failure situation, a pressure survey will not  
19 help. The temperature and the noise is far  
20 better tools that were used.

21 Q Far better tools to do what?

22 A To monitor leaks or identify leaks.

23 Q Would a pressure survey be expected  
24 to reveal the corrosion from the SS-25  
25 production casing?

26 A Not the way I understand the  
27 pressure survey that is done, yes. No, I  
28 don't believe so.

1 Q Okay. And do you believe that a  
2 noise log or a temperature survey would be  
3 expected to reveal the corrosion in the SS-25  
4 production casing?

5 A No. Those are what we call  
6 trailing indicators. So you need to have a  
7 leak already in place. And then the  
8 temperature will tell you right away. So it  
9 would be a very good indicator to that. But  
10 prior to that, it won't. And that is why in  
11 SS-25 there was never any indication of leak  
12 ever in the history. We didn't find any.

13 Q Thank you, Dr. Krishnamurthy.  
14 Mr. Lotterman also asked you about  
15 what kind of tests might be available to  
16 measure the wall thickness of a surface  
17 casing.

18 Do you remember that?

19 A Yes.

20 Q And as I understood it -- and,  
21 again I'm not an engineer -- it's saying that  
22 you agreed with him that if you wanted to  
23 measure the wall thickness of a surface  
24 casing, you would have to remove the  
25 production casing to measure the wall  
26 thickness.

27 Do I have that right?

28 A That is correct. Again, let me

1 clarify and explain further. Yeah? Because  
2 that's an important -- so the way we did it  
3 in SS-25 as part of our RCA, we wanted to  
4 have had a good handle on where was the  
5 corrosion, how much. So we did a direct  
6 measurement.

7 Now, since I don't know the  
8 timeline on this, close 2016 or 2015 or --  
9 there are tools today, they are not accurate  
10 by any means, they -- what they do is they  
11 run through your tubing, and they identify  
12 leaks in multiple casing --

13 ALJ POIRIER: I'm sorry --

14 THE WITNESS: They are not -- the  
15 reliability --

16 ALJ POIRIER: I'm sorry, Mr.  
17 Krishnamurthy. We have some background  
18 noise.

19 (Off the record.)

20 ALJ POIRIER: Let's go back on the  
21 record. Please continue. I apologize for  
22 interrupting you, Mr. Krishnamurthy.

23 THE WITNESS: That is okay.

24 So that is correct. To do a good  
25 measurement of well thickness loss, you have  
26 to pull the casing to render evaluation. But  
27 as part of SS-25, our RCA, we identified  
28 technology that per- -- I don't know when it

1 came to market. It was new to me when I --  
2 when we looked at it in 2016. I -- and this  
3 technology has been floating around. It's  
4 still -- reliability is an issue.

5 But what they do is, they give you a  
6 qualitative estimate of wall loss in  
7 different strengths. They are not as  
8 accurate as some of the tools we ran. But,  
9 currently, there are some technologies that  
10 do -- the reliability or repeatability, all  
11 that should be reviewed in detail. We did it  
12 for an RCA where -- that was -- we wanted to  
13 get an indication. But when I'm attempting  
14 to do this on a field-wide basis, I would  
15 work it a lot harder before I come to that  
16 conclusion. That is an option.

17 Q Okay. Thank you for those  
18 clarifications. My question is a little more  
19 simplistic than all of that.

20 And it's just that I got the  
21 impression that it was a very significant  
22 undertaking to remove production casing; is  
23 that correct?

24 A That is correct. It is a  
25 significant undertaking.

26 Q Okay. And -- but, there's a  
27 difference between a surface casing and a  
28 production casing; is that correct?

1           A    Yes, it is.

2           Q    Okay.  And so in your report, you  
3 found that SoCalGas's failure to perform a --  
4 a wall thickness inspection for the  
5 production casing was the issue, not whether  
6 they had measured the wall thickness of the  
7 surface casing; is that correct?

8           A    That is correct.

9           Q    And that, in fact, SoCalGas's  
10 failure to perform a wall thickness  
11 inspection for the production casing was a  
12 root cause of the incident; is that correct?

13          A    Yes.  That was one of the root  
14 causes.  That is correct.

15          Q    So SoCalGas did perform wall  
16 thickness inspections between 1988 and 1990  
17 for the seven wells that were Vertilogged; is  
18 that correct?

19          A    That is correct.

20          Q    Do you know why they didn't perform  
21 Vertilog on the other 13 wells that their  
22 engineer recommended?

23          A    We didn't find any record of the  
24 rationale for it in the documentation.  I  
25 believe, at some point, we requested it --  
26 and, again, I'm testing my memory here -- and  
27 SoCalGas gave us the rationale for it.  I --  
28 I don't recollect what that rationale was.

1 But we didn't find any records from 1988,  
2 1991, '94 stating this is why it was stopped.  
3 And we articulated that in the report.

4 Q Thank you.

5 Dr. Krishnamurthy, I just have one  
6 other short line of questioning and then  
7 we'll be done, if we can continue.

8 I believe that yesterday you  
9 testified that the water found around the  
10 surface casing for SS-25 was from rain and  
11 that that was the only source of water; is  
12 that correct?

13 A That is correct. Yes.

14 Q So is it strange or surprising to  
15 you to find rainwater around the surface  
16 casing?

17 A I don't want to call it strange.  
18 But when you look to the shallow geology in  
19 Aliso, about 200, 300 feet shallower, I mean  
20 0 to 200, 300 feet, the rock is weathered and  
21 it has a lot of permeability. So it makes  
22 sense that you would have precipitation at  
23 145 -- 80 to 145, which is where some of the  
24 largest external corrosion was on the surface  
25 casing. And the challenges of cementing the  
26 surface casing all add up.

27 So it -- going in, I would not have  
28 expected that. But, again, I didn't know

1 enough about Aliso at that point. But the  
2 shallow geology clearly indicates the rock is  
3 weathered and highly permeable where it's --  
4 the shallow result. So it kind of makes --  
5 it adds up.

6 Q So do you think that the rainwater  
7 was present there for a long time?

8 And by "a long time," I mean, you  
9 know, 10 or 20 years?

10 A I don't know. I wouldn't -- see  
11 the challenge there is, what you're dealing  
12 with this water is two things. There are two  
13 mechanisms possible with water. I'm talking  
14 shallow now. Okay? I'm not talking deep in  
15 the seven-inch.

16 When you go down around the  
17 seven-inch, around the shoe, which is what we  
18 believe initially happened, what you're  
19 dealing with is, the water will deoxygenate  
20 at different -- so water has some oxygen in  
21 its rainwater. The oxygen comes from the air  
22 at 20 percent -- whatever the oxygen number  
23 is, it will dissolve in the rainwater.

24 So your first source of corrosion  
25 is the oxygen in the water. Once that oxygen  
26 is depleted, then other mechanisms step  
27 forward. But that oxygen corrosion, with a  
28 finite amount of oxygen and finite amount of

1 water, there will be little bit of wall loss  
2 due to it. And then the mechanism may shift  
3 the microbiology and other things.

4 So my expectation is, this would  
5 take a long time. How long? You know, those  
6 are the things where I would be speculating.

7 Q Mr. -- Dr. Krishnamurthy, the water  
8 that was found around the surface casing for  
9 SS-25, is that something that would have been  
10 visible during an inspection of the well?

11 A No, I don't think so. No, it  
12 wouldn't be visible.

13 Q And that concludes my  
14 cross-examination. Thank you very much.  
15 It's been a pleasure meeting you.

16 A Thank you.

17 ALJ POIRIER: Thank you, Ms. Bone.

18 I think now we'll turn now to Ms.  
19 Frazier.

20 Are you ready to proceed?

21 MS. FRAZIER: If we could take a short  
22 break, I think that would be helpful.

23 Mr. Krishnamurthy, do you need that?

24 THE WITNESS: Yeah. Can we talk for  
25 2 minutes, 5 minutes?

26 ALJ POIRIER: Let's take a 5-minute  
27 break until 3:40. And then we'll be back on  
28 the record.

1           So, off the record.

2           (Off the record.)           ]

3           ALJ POIRIER: Back on the record.

4           We took a short break, and now we're  
5 back on. Ms. Frazier is going to do redirect  
6 for Dr. Krishnamurthy.

7           Please proceed.

8                         REDIRECT EXAMINATION

9 BY MS. FRAZIER:

10           Q    Dr. Krishnamurthy, my name is Mary  
11 Frazier. Obviously I'm the attorney for  
12 Blade and for yourself here at this  
13 proceeding today. You understand that;  
14 correct?

15           A    Yes.

16           Q    It has been a relatively long two  
17 days, and I understand you would like to make  
18 some clarifications to your testimony; is  
19 that correct?

20           A    Yes.

21           Q    Okay. So I'm going to bounce  
22 around a little bit. But to the extent that  
23 you need to provide further details on the  
24 scope of the question, please feel free to do  
25 so.

26                         The first line of questioning  
27 relates to the first day when you were asked  
28 about a stage collar leak in casing

1 integrity. Is there anything that you would  
2 like to clarify as it relates to the stage  
3 collar leak on the SS-25-A?

4 A Yes, I do. A casing stage collar  
5 is part of the production casing, which  
6 provides pressure containment. So a leak in  
7 the stage collar does affect casing  
8 integrity. I misspoke that day. I was  
9 focused on problems with the casing itself.  
10 But when you put a stage collar in a casing,  
11 it becomes part of the casing strength.

12 So I wanted clarify that.  
13 Mr. Lotterman asked me that question. I  
14 wanted to make sure I clarified that.

15 Q There was also a discussion on well  
16 mains. Do you know how the well mains in  
17 Aliso were selected?

18 A See I don't know how they were  
19 selected in Aliso. But that day I was  
20 focused on standard Sesnon which was another  
21 formation. When -- when you -- especially  
22 when you look at land base wells, they're  
23 based on leaseholder names. So my assumption  
24 is that Aliso was something similar.

25 There's somebody more qualified to  
26 answer that. But I wanted to make sure I  
27 clarify that.

28 Q Okay. The next area that I want to

1 visit with you about is surface casing. Can  
2 you please provide some additional detail on  
3 the purposes of surface casing?

4 A Yeah. I wanted to clarify this.  
5 Again, this is a detail I believe I may have  
6 neglected a couple of points when I addressed  
7 this. I want to clarify and enhance my  
8 answer.

9 Of course the primary one of the  
10 functions of the surface casing is isolate  
11 and protect the fresh and groundwater.

12 The other two are also important  
13 roles. It is to provide structural support  
14 during well construction. That means during  
15 drilling the next section of the well.

16 And also once you have the surface  
17 casing, that is when you put the BOP on and  
18 you can drill containment for drilling.

19 So it has multiple objectives in  
20 addition to what I mentioned. So I just  
21 wanted to make sure I clarify that.

22 Q And who is it if you know that  
23 proposes the surface casing depth?

24 A Surface casing depth, normally it  
25 would be coming from the -- that depends.  
26 Normally the person who is drilling the well  
27 will propose the depth for the regulatory  
28 (indecipherable) to make sure it covers the

1 water zone. That is our understanding.

2 Q Right. Mr. Lotterman asked you  
3 some questions about Blade's involvement in  
4 revising regulations. Was Blade involved in  
5 the revision of storage gas well regulations  
6 for California or any other state?

7 A No. I want to clarify that. Our  
8 -- since May 2019, we generate the report.  
9 We have not been involved with DOGGR or PHMSA  
10 or any other regulators in terms of  
11 contributing to any regulations. Nobody had  
12 asked us and we have not volunteered.

13 UNIDENTIFIED SPEAKER: Be careful.

14 (Crosstalk.)

15 BY MS. FRAZIER:

16 Q You confirm reliability several  
17 times during your deposition -- or your trial  
18 testimony. So the record is clear, can you  
19 please describe what you mean by the term  
20 "reliability"?

21 A Yeah. This is a very important  
22 term for us. I hate to use the word "nerds,"  
23 but engineers and scientists. Reliability is  
24 a statistical term. You cannot say something  
25 is reliable, not reliable. You can say  
26 something is less reliable, more reliable.  
27 But it has to be quantified.

28 For example an inspection tool such

1 as USIT or HRVRT, you would run it 20 times  
2 in a well whether it's 1998 or 2016. And you  
3 would say it runs just as the -- I have  
4 95 percent confidence it will sight the  
5 corrosion within plus or minus 10 or  
6 20 percent. That is the reliability.

7           So when you say -- so just looking  
8 at growth of technology and computers and  
9 everything else, 1998 would have been less  
10 reliable than 2016.

11           So we have to frame that it is not  
12 reliable, it is reliable. That's not the way  
13 we look at it even today. And the downhole  
14 tools have -- do not have well documented  
15 reliability not even today.

16           Q All right. Just two more short  
17 topics. You provided some testimony  
18 regarding API recommend practice 585 and how  
19 it applies to gas storage wells failure  
20 investigation. Do you need to clarify  
21 anything as it relates to that testimony?

22           A Yeah. Again, we recognized 585 is  
23 not for gas storage. We were looking for  
24 analogous pipelines that we could reference  
25 other than just put up a Blade approach to  
26 this.

27           We followed API 585, which was very  
28 good. And the API 585 they are explicit that

1 other components that are pressure containing  
2 such as could be gas storage, could be other  
3 wells, other components, could draw and apply  
4 their approach. So we researched it. So I  
5 wanted to give context to our reference.

6 Q All right. And then finally before  
7 we took our last break before I started  
8 asking you questions, Mr. Lotterman believed  
9 that you had an incorrect date for the dates  
10 the pressure tests were performed.

11 Could you please look to page 197  
12 of the main report, which I believe is  
13 Exhibit-1000, and confirm the dates that the  
14 pressure test was done on the SS-25 A?

15 A Yeah. The -- just to clarify, the  
16 pulses of conversions started in May 1973.  
17 And pressure tests were done during that  
18 time. That is the pressure I was  
19 referencing.

20 But as Mr. Lotterman said, there  
21 were additional pressure tests done in '76,  
22 '79, in addition to 1973. And that is on  
23 page 197. That is correct. I wanted to make  
24 sure I clarified my dates from before.

25 MS. FRAZIER: All right.  
26 Dr. Krishnamurthy, that's all the questions I  
27 have. Thank you for your time.

28 THE WITNESS: Thank you.

1 ALJ POIRIER: Thank you.

2 Mr. Lotterman, do you have any  
3 additional recross on what was covered by  
4 Ms. Frazier?

5 MR. LOTTERMAN: I do not, your Honor.  
6 I have one question to ask Dr. Krishnamurthy  
7 off the record but nothing else.

8 Thank you.

9 ALJ POIRIER: Mr. Gruen, do you have  
10 any additional cross based on what  
11 Ms. Frazier raised?

12 MR. GRUEN: Nothing further from SED,  
13 your Honor.

14 ALJ POIRIER: Ms. Bone, do you have  
15 anything?

16 MS. BONE: Yes, your Honor, actually I  
17 do. Give me a second to come put myself back  
18 on.

19 RECCROSS-EXAMINATION

20 BY MS. BONE:

21 Q So, Dr. Krishnamurthy, as I  
22 understand it then, there was a pressure test  
23 performed in 1976 and then another one in  
24 1979?

25 A Yes; that's correct.

26 Q What do you understand that these  
27 pressure tests would have revealed at that  
28 time?

1           A     Well, the 1973 pressure test was a  
2 big one. Okay. And then they had some  
3 workovers after that, '76, '79. And there  
4 were pressure tests at each site. That is my  
5 understanding from the records from SS-25.

6           Q     So the pressure tests that you were  
7 discussing with Mr. Lotterman yesterday is  
8 that the 1973 pressure test? The one that  
9 was done at a certain level above the  
10 reservoir?

11          A     That's correct. The others we  
12 would have to calculate because it was a  
13 single number. So we need to look at --  
14 because remember you have a hydrostatic of  
15 2,500 on surface. What is it on bottom? We  
16 haven't checked all that. But either equal  
17 or higher. I'll have to check.

18          Q     And is that something that you can  
19 do and report back on?

20          A     Sure.

21          MS. FRAZIER: Let me just interject.  
22 And maybe I can visit with Dr. Krishnamurthy  
23 off line and figure out what is involved and  
24 whether we're able to comply with that  
25 request.

26          MS. BONE: Understood.

27          Q     So you said that the 1976 and 1979  
28 tests were associated with workovers. Is

1 that something that would normally occur with  
2 a workover? You would then do a pressure  
3 test?

4 A No. It would not be normal. It  
5 would be something you would have to actually  
6 do.

7 Q And do you have any understanding  
8 of why it was done?

9 A No. My guess would be because it  
10 was being converted to a gas storage well.  
11 It was part of that process would be my  
12 guess. That would be a guess though. I  
13 don't want --

14 Q Okay. And we don't want you to  
15 guess. So thank you.

16 MS. BONE: That's all I have.

17 ALJ POIRIER: We'll go around once  
18 more.

19 Ms. Frazier, any redirect?

20 MS. FRAZIER: Nothing from me.

21 Thank you.

22 ALJ POIRIER: Mr. Lotterman, do you  
23 have anything based on what Ms. Bone just  
24 asked?

25 MR. LOTTERMAN: No, your Honor.

26 Thank you.

27 ALJ POIRIER: And, Mr. Gruen?

28 MR. GRUEN: Nothing from SED at this

1 time.

2 Thank you, your Honor.

3 ALJ POIRIER: Okay. Dr. Krishnamurthy,  
4 sounds like you're done. Thank you.

5 We'll go off the record.

6 (Off the record.)

7 ALJ POIRIER: We'll be back on the  
8 record.

9 While off the record, we just  
10 discussed some matters in terms of witness  
11 order and who is going to be on for tomorrow.  
12 And we also determined that there was an  
13 outstanding answer from Dr. Krishnamurthy to  
14 one of Ms. Bones' questions, and that will be  
15 provided another day on the record. And we  
16 will be reconvening tomorrow at 10:00 a.m.

17 And thank you, everybody.

18 We'll be off the record.

19 (Whereupon, at the hour of 3:57 p.m.  
20 this matter having been continued to  
21 10:00 a.m. March 24, 2021. The  
Commission then adjourned.) ]

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