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Commissioner	:	Cliff Rechtschaffen
Admin. Law Judge	:	Tim Kenney
	:	Marcelo Poirier
	:	

SAFETY ENFORCEMENT DIVISION
CALIFORNIA PUBLIC UTILITIES COMMISSION

CHAPTER THREE

PREPARED SUR-REPLY TESTIMONY

OF

MARGARET FELTS IN RESPONSE TO

REPLY TESTIMONY OF L. WILLIAM ABEL

San Francisco, California
June 30, 2020

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I. INTRODUCTION

The purpose of the following prepared Sur-Reply testimony, submitted on behalf of the California Public Utilities Commission's ("Commission") Safety Enforcement Division ("SED"), is to reply to testimony of William Abel regarding violations 79-83 which are failure to successfully execute Well SS-25 kill attempts 2 through 7, due to lack of proper modeling (79), failure to provide well kill programs for relief well #2, well SS-25A and well SS-25B (80-82) and prevention of surface plumbing failures on SS-25 from enabling that well to be kept filled (83). Mr. Abel restates these violations collectively in the introduction of his testimony as "allegations that SoCalGas mismanaged the SS-25 well control efforts (Violations 79-83),"[1] but does not testify directly about issues related to violation 83.

As observed by Mr. Abel, these violations are based solely on the Blade RCA Report.[2] In light of Mr. Abel's statement that there is "little to no independent verification of Blade's findings and conclusions,"[3] I provide additional evidence in this reply.

II. SOCALGAS RESPONSE, INCLUDING ENGAGEMENT OF BOOTS & COOTS

Mr. Abel states that, ". . . SoCalGas displayed the necessary expertise to monitor and manage its well control experts."[4]

I agree that SoCalGas had the necessary in-house training, experience and knowledge to oversee their contractor Boots & Coots. This is not an issue that underlies violations 79-83. Violation 79 only goes to the issue of well kill modeling, which was lacking during well SS-25 kill attempts 2-6. For reasons discussed here, violation 79 should stand. Well kill modeling can be static (steady-state) or dynamic (transient).[5]

[1] Abel Testimony, p. 1, line 19.

[2] Abel Testimony, p. 1, lines 23-24.

[3] Abel Testimony, p. 1, lines 24-25.

[4] Abel Testimony, p. 4, lines 27-28.

[5] Abel Testimony, p. 5, lines 17-18

Transient modeling is dynamic. A model "run" is a simulation. Each simulation is based on a set of data and assumptions input to the model. Each simulation run generates a unique set of results. The dynamic model Mr. Walzel (Boots & Coots) used is called Drillbench,[6]

Evidence we have from the records provided by SoCalGas and the Boots & Coots daily reports suggest that there was not much difference between the kill attempts 2-6.[7] For this testimony, my analysis relates to the kill attempts that Blade modeled using SoCalGas data that was available to Boots & Coots during the event. Although SED asked SoCalGas for data and communications between SoCalGas and Boots & Coots regarding information that could be used as inputs to the models as well as results of the models and authorizations to go ahead with kill attempts, SoCalGas has produced thousands of documents containing no particularly relevant information other than brief one page plans for some of the kill attempts.[8] I have not been able to establish the origin of those summaries, who wrote them, who had them, or whether or not they were the basis of actual kill attempts.

Most concerning is that there were at least 23 days between SoCalGas first and fourth kill attempts (October 23, 2015 was Kill Attempt 1 and November 18, 2015 was Kill Attempt 4). Boots & Coots was on site by October 25, 2015.[9] Between SoCalGas Kill Attempt numbers 1 and 2, a 20 day period of time could have been used to plan Kill Attempt 2 by running multiple simulations on information that SoCalGas provided about the well, as well as field data that was collected.[10] Walzel and Haghshenas testimony *say*

[6] A product created and marketed by Slumberger, Inc, this model applies engineering calculations to simulate changes in pump rates, well pressures and other parameters, during the kill event. As in any model, the key to getting accurate results is to input accurate data and assumptions.

[7] Boots&Coots Daily Reports (reply testimony exhibit FN.30.Boots&Coots.DailyReports.

[8] Well.Kill.Plans.AC_CPUC.0206050-206058.

[9] The Blade Report at page 13 stated that "A well-control company arrived onsite on October 25, 2019." SED infers that was Boots & Coots.

[10] Based on the Blade Report, pp. 125-126, Table 15, the first attempt was October 24, 2015 and second attempt was November 13, 2015.

that Boots & Coots performed their first transient modeling after November 15, 2015 and before November 18, 2015.[11] As shown in the Blade RCA November 15, 2015 was the date of SoCalGas Well Kill Attempt 3, and November 18, 2015 was the date of SoCalGas Well Kill Attempt 4.[12] SoCalGas concedes no modeling was done until the 4th kill attempt.[13] SoCalGas did not produce any evidence that Boots & Coots actually ran transient models for kill attempts 4-6, even though Walzel and Haghshenas say they did.

III. TRANSIENT MODELING

A. Because Boots & Coots Say They Chose to Do Transient Kill Modeling for their Well Kills, Whether or Not It is Standard Practice Is Irrelevant

Mr. Abel testifies from his substantial personal experience that, "[w]hile transient kill modeling may be useful in certain instances, it is not well-accepted industry practice for all well control efforts by top kill."[14] He also discusses stead state modeling.[15] There is no reason to dispute Mr. Abel's testimony. However, Mr. Walzel said he used transient modeling to prepare SoCalGas well kill plans 4 through 6 for SS-25, which Mr. Abel acknowledges.[16] Therefore, whether or not transient modeling is standard in the industry is a moot point because Mr. Walzel said that he used it after SoCalGas third well kill attempt.[17]

[11] Walzel and Haghshenas testimony, p. 3, lines 8-11. My testimony will discuss the lack of evidence to support Walzel and Haghshenas statements later.

[12] See Blade Report, pp. 125-126, Table 15.

[13] The dates showing this are explained in more detail in my response testimony to Walzel and Haghshenas, Sec II.

[14] Abel Testimony, p. 6, lines 8-9.

[15] Abel Testimony, p. 5, line 18 to p. 6 line 4.

[16] Abel Testimony, p. 6, lines 17-18.

[17] See Testimony of Walzel and Haghshenas, p. 3, lines 8-11. Mr. Walzel actually said here that he used modeling before November 18, 2015. As shown in Blade's RCA, pp. 125-126, Table 15, the attempt on November 18, 2015 was SoCalGas fourth kill attempt.

B. Mr. Abel Testifies that Boots & Coots Did in Fact Perform Transient Modeling for SoCalGas Well Kill Attempts 4 to 6. But He Relies Solely on Boots & Coots to Make that Statement, and Does Not Provide Any Evidence to Show It to Be True.

Mr. Abel claims that Boots & Coots performed transient modeling for well kill attempts 4 through 6 multiple times. For example, he states, "[a]t a February 21, 2020 deposition that I attended, Boots & Coots senior well control specialist engineer, Danny Walzel, clarified that after Boots & Coots' second well kill attempt (SoCalGas' fourth well kill attempt),[18] Boots & Coots performed transient modeling to help inform the SS-25 well control operations. Based on Mr. Walzel's testimony, it is my understanding that the computer containing the transient modeling prepared by Mr. Walzel was later stolen from Mr. Walzel's truck, and never recovered."[19] As another example, Mr. Abel states that, "Boots & Coots *did* in fact perform transient modeling after its second well kill attempt (only in time for SoCalGas' fourth well kill attempt) on SS-25 and before each subsequent attempt. . ."[20] (Emphasis in original.)

Although Mr. Walzel claims he chose to use transient modeling, there is no evidence of this, no paper trail that it was done with valid data and reasonable assumptions, and there is no record of the results. A number of points show lack of evidence of transient modeling, and some suggest that transient modeling actually was not used in designing kill attempts, as shown by the bullets below.

- I have found no evidence of transient modeling results specifically for SoCalGas kill attempts 2-6 despite extensive review. I have looked through documents provided in response to data requests for evidence that SoCalGas and Boot & Coots engaged in some level of planning for well kills 2-6. Since SoCalGas says they turned over primary operation of the well kill effort to Boots & Coots after the first well kill attempt

[18] Again, Walzel says he modeled after Boots & Coots' second attempt, but this meant he actually modelled only in time for SoCalGas' fourth attempt.

[19] Abel Testimony p. 6, line 20 to p. 7 line 4.

[20] Abel Testimony, p. 5, lines 10-11; See also Abel Testimony, p. 6, lines 17-18. "Nevertheless, here, Boots & Coots did in fact employ transient kill modeling after it determined modeling was appropriate."

failed,[21] I would expect to see data provided to Boots & Coots by SoCalGas, such as emails providing inputs to models and calculations or model simulation results provided to SoCalGas for review and concurrence by SoCalGas for Boots & Coots to use the simulation results for the specified well attempt.[22] I combed through thousands of emails and documents provided by SoCalGas and found none of this evidence. Instead, we have a few one page kill plans that were written by someone we do not know; certainly not Mr. Walzel.[23]

- Blade also stated in a data response to SED that, "There was no evidence provided to Blade that kill modeling or other analytical approaches were undertaken for kill attempts #1 through #6."[24]
- Blade said it ran its own transient model simulation using the same data that were available to onsite well control personnel during the time of well kill operations, but Blade found that all the SS-25 kill attempts were predicted to be unsuccessful.[25]
- Mr. Abel himself admitted that he had not seen Boots & Coots transient models. SED asked, "Please state how Mr. [Abel] knows that Boots & Coots' transient modeling estimated and modeled gas flow rates range from 15-70 MMscf/d." SoCalGas answered, "Mr. Abel based his response on the testimony of Boots & Coots personnel. Please see SoCalGas' Reply Testimony Chapter III (Abel), Ex. III-4 (Danny Walzel Depo. Tr. 134:18-135:7. (Feb. 21, 2020)), and SoCalGas Reply Testimony Chapter IV (Walzel/Haghshenas) at 6."[26] SED also asked, "Has Mr. [Abel] seen Boots & Coots's transient models that were on the computer allegedly stolen from Mr. Walzel in late December, 2015?" SoCalGas responded, "No. As described in SoCalGas' Reply Testimony Chapter IV (Walzel/Haghshenas), Mr. Walzel's laptop was stolen from Mr. Walzel's vehicle in or around Houston, TX, and never recovered. (See, SoCalGas Reply

[21] SoCalGas Response to DR33 Q.2.

[22] AC_CPUC_0206050-206056.

[23] The documents provided as Well Kill plans are all authored on the dates of the well kills by Erle P. Halliburton (under details of each document). Erle Palmer Halliburton, 1892-1957, founded Halliburton.

[24] Blade Response to SED Data Request 63, Response 2.1.1, p. 6, May 5, 2020.

[25] Blade Response to SED Data Request 63, Response 2.1.1, p. 6, May 5, 2020.

[26] SoCalGas Response to SED Data Request 61, Question 7a, pdf p. 11.

Testimony Chapter III (Abel) Ex. III-4 (Danny Walzel Depo. Tr. 77:1-78:14)"[27]

- SED requested documents showing all kill modeling that SoCalGas and Boots & Coots performed, including inputs, outputs, the name of the models, etc.[28] To date, we have 5 one page "plans" that do not indicate how they were generated or who wrote them.[29] These are the same plans that Mr. Abel reviewed to arrive at his opinions.[30]
- SoCalGas admitted that it never reviewed the transient modeling that Boots & Coots allegedly did, and does not know whether the model actually informed the kill plans.[31]
- Mr. Walzel never mentioned transient modeling to SED during an Examination Under Oath before the opening of the OII, despite extensive questioning about the method for calculating mud weight, the name of that calculation, and the method for calculating kill rate. [32]

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[27] SoCalGas Response to SED Data Request 61, Question 7b, pdf p. 11, also See, SoCalGas Reply Testimony Chapter III (Abel) Ex. III-4 (Danny Walzel Depo. Tr. 77:1-78:14.

[28] DR 61 Q.7 Abel could not come up with any data that Walzel used in his models.

[29] AC_CPUC_0206050-206056.

[30] Abel Testimony, pp. 7-8.

[31] SoCalGas Response to SED Data Request 61, Question 3d and 3e.

- Question 3d: "Were Boots & Coots's recommended well kill plans based upon Boots & Coots's transient modeling?

  Answer: Based on information and belief, SoCalGas ***understands*** that the kill plan summaries prepared by Boots & Coots were informed, in part, by the transient kill modeling that Boots & Coots conducted, beginning after Boots & Coots' second well kill attempt. (Emphasis added.)

- Question 3e: If yes, did SoCalGas see the transient model prepared by Boots & Coots's that corresponded to each well kill plan?

  Answer: In the course of Boots & Coots' well control efforts, SoCalGas understood that Boots & Coots conducted modeling in connection with the SS-25 top kill operations. SoCalGas reviewed and discussed the kill plans with Boots & Coots, but ***SoCalGas did not review the model that may have informed the plans.*** (Emphasis added.)

[32] Transcript Walzel and Kopecky, p. 49, line 22 to p. 52, line 28.

(continued on next page)

- In the Walzel and Haghshenas reply testimony, it was disclosed for the first time that Mr. Walzel's transient modeling was done on his laptop, which was stolen from him.[33] The testimony says Mr. Walzel reported the theft to the police.[34] SED asked SoCalGas, "Provide the police report of the theft that Mr. Walzel reported to the police."[35] In response, SoCalGas stated, "The Houston Police Department provided Mr. Walzel with a document regarding the reported theft of Mr. Walzel's laptop and other belongings, provided here bearing the following bates number: AC_CPUC_SED_DR_57_0000001."[36] However, the document provided by SoCalGas is the size of a post-it note, and says, "Burglary Motor Vehicle", with the date December 26, 2015, not a report. The document does not corroborate that any laptop was stolen, and says nothing about a model that was on a laptop.[37] Mr. Walzel testifies that his transient modeling was not saved anywhere else, and was not sent to anyone else.[38]
- SED asked SoCalGas, "Did SoCalGas review Mr. Walzel's transient models?" SoCalGas responded in part, ". . .SoCalGas did not review the transient modeling that resided only on Mr. Walzel's laptop and required licensed software to review."[39]

Rather than paying attention to the actual dialogue of the EUO transcripts cited here, and Mr. Walzel's failure to tell SED about the transient model that Mr. Walzel now claims was stolen, Mr. Abel instead suggests his surprise at SED for not asking Mr. Walzel about transient modeling, stating:

> I find it unusual SED asserts violations against SoCalGas for not employing transient kill modeling without first having verified this fact during SED's August 8, 2018 examination of Mr. Walzel. While SED asked Mr. Walzel about the formulae and calculations used in Boots & Coots' dynamic kill of SS-25, none of SED's five questioners asked Mr. Walzel whether the dynamic kill of SS-25 involved transient modeling. (See Abel Testimony, p. 7, fn 16, citing SED-'s Opening Testimony, SED 000635-000786 (D.Walzel and J. Kopecky EUO Examination Under Oath (EUO) Tr.(Walzel and Kopecky) p. 49 line 52 to p 52 line 28 (Aug. 8, 2018)).)

[33] Walzel and Haghshenas Testimony, p. 3, lines 30-31.

[34] Walzel and Haghshenas Testimony, p. 3, line 32.

[35] SoCalGas Response to SED Data Request 57, Question 3, p. 4 of 27, May 7, 2020.

[36] SoCalGas Response to SED Data Request 57, Question 3, p. 4 of 27, May 7, 2020.

[37] I1906016_SCG_SED_DR_57_0000001.

[38] Testimony of Walzel and Haghshenas, p. 3, lines 32-33.

[39] SoCalGas Supplemental Response to SED Data Request 57, Question 25, dated, May 19, 2020.

- In a follow up data response, SoCalGas stated that the transient model used was Drillbench,[40] which can be purchased from Schlumberger.[41] This is a product that performs dynamic well kill simulations, which would be the same as transient modeling as opposed to static modeling. The model used by Mr. Walzel was apparently purchased software licensed for use on his computer.[42]
- On December 14, 2015, Boots & Coots prepared a document that states on its title page that it was prepared for SoCalGas, and is entitled "Dynamic Kill Analysis SoCalGas Porter 39A".[43] This report states that it "covers dynamic kill analysis for Southern California Gas Company, Porter 39A".[44] The listed contact information is Mr. Arash Haghshenas, with a Boots & Coots email.[45] The report states, "This report presents the key results from a blowout and dynamic kill analysis performed for SoCalGas, Porter 39A well as part of relief well planning.[46] (Emphasis added, and in original.) I have not observed any document like this one showing transient kill modeling related to the top kill attempts that Boots & Coots allegedly performed for SoCalGas.

[40] During my review of data responses, I saw images among emails provided by SoCalGas that appear to be from Drillbench simulations, but are not represented as such by SoCalGas or Boots & Coots in response to data requests link to simulation video: HYPERLINK https://www.software.slb.com/products/drillbench https://www.software.slb.com/products/drillbench.

[41] 2015. June. Drillbench_Blowout_Control_Web.

[42] SoCalGas Response to DR 57

[43] AC_CPUC_SED_DR_16_0019665. The entire document spans from AC_CPUC_SED_DR_16_0019665 to 19680.

[44] AC_CPUC_SED_DR_16_0019666.

[45] AC_CPUC_SED_DR_16_0019666.

[46] AC_CPUC_SED_DR_16_0019668.

C. Mr. Abel's Statement that "SoCalGas' Operating Standards for Well Kill Operations Were Reasonable and Consistent with Industry Standard Practice" Is Not Applicable to the SS-25 Failure Event.

In section C of his testimony, Mr. Abel states that, "SoCalGas' Operating Standards for Well Kill Operations Were Reasonable and Consistent with Industry Standard Practice."[47]

I do not disagree with Mr. Abel. However, the standards SoCalGas has for well kill operations do not apply to the SS-25 emergency situation, other than to provide a roadmap regarding who to contact and a process for responding in general to a well emergency.[48] Another standard for well kills provides a procedure for routine well kills for well maintenance when the well is not out of control and there is no emergency.[49] This standard is not applicable to the SS-25 well failure event because it only applies to routine well kills, not emergencies when the well is out of control.[50]

IV. BLADE'S WELL KILL MODELING WAS DONE USING THE SAME INFORMATION THAT WAS AVAILABLE AT THE TIME OF THE WELL KILLS

Mr. Abel claims that "SED's well kill modeling derives from perfect hindsight fails to consider safety, and is entirely speculative."[51] He specifically alleges that I have made "speculative assertions, particularly in support of SED's allegation that transient kill modeling would have resulted in an earlier well kill. . ."[52] In support of this allegation, he cites several conclusions in my opening testimony.[53] Each of the statements Mr. Abel cites were made by Blade in their RCA Report. It is true that Blade's analysis

[47] Abel Testimony, p. 8, lines 6-7, Subheading C.

[48] DR 35 Emergency.Plan.2008.

[49] Well Standards DR 17.Well.Kills.

[50] Walzel and Haghshenas Opening Testimony, p. 3, lines 9-11.

[51] Abel Testimony, p. 10, lines 20-21, Heading IV.

[52] Abel Testimony, p. 10, lines 22-23.

[53] Pp.10-11 bullet points.

occurred after the SS-25 well kill attempts failed. However, Mr. Abel fails to consider that Blade accounted for what he calls the "perfect hindsight" problem. In response to an SED data request, Blade explained that it used the same information that was available at the time of the kills, but that Blade's modeling still predicted unsuccessful kill attempts. In Blade's own words:

> Blade conducted a transient kill simulation study to evaluate the likelihood of success of the actual kill attempts. Blade intentionally used the same field data that were available to the onsite well control personnel during the time of well kill operations for this evaluation. According to Blade's modelling, all the SS-25 kill attempts were predicted to be unsuccessful.
>
> It is not clear to Blade how Boots and Coots selected the pump rates and kill fluid densities for each kill attempt. The kill fluid densities did not change materially until kill attempt #7.[54]

However, a Root Cause Analysis (RCA) always occurs after an event occurs and looks back at the events as they unfolded as part of the RCA process. Especially considering the lack of data provided by SoCalGas and Boots & Coots regarding data and assumptions they used in their simulations, Blade developed reasonably designed models with the data they could find or develop and used reasonable assumptions. As Blade explained to SoCalGas in response to SoCalGas' data request "[a]n outcome of the RCA process was that the lack of understanding of the well deliverability was a root cause and affected the well-control planning as discussed in the Blade Report on pages 132 – 133—Section 3.2.1. Well gas flow rate is a key parameter used in dynamic kill modeling and in estimating the total gas leak volume."[55] In my Opening Testimony, I adopted Blade's well kill modeling, findings and conclusions, and I continue to find them valid.

[54] Blade Response to SED Data Request 63, Response 2.1.1, p. 5, May 5, 2020.

[55] 2020-02-14 Blade Response to SoCalGas Data Request Jan 23, 2020 Rev 1-Feb 14, 2020.

V. I AM WITHDRAWING VIOLATIONS 80-82

Mr. Abel's testimony responds to violations 80-82,[56] which are "failure to provide well kill programs for relief well #2, well SS-25A and well SS-25B."[57] I agree with Mr. Abel's testimony regarding violations 80-82. Blade included in its RCA Report a suggestion that well kill programs for Aliso wells might be useful in the event of well failure incidents. SoCalGas has a standard for Emergency Well Kills.[58] This standard is not specific to any well, but provides response guidelines. Because every incident is different even on the same well, it would be difficult to develop a useful well kill plan for each well that would go beyond the general emergency well kill standard already in place. With this, I am withdrawing violations 80-82.

VI. MR. ABEL FAILS TO ARGUE AGAINST SED'S VIOLATION 83

Mr. Abel mentions violation 83 only in his introduction in a way that is grouped with violations 79 through 82.[59] Other than making general allegations in his introduction about that violation, Mr. Abel provides no specific discussion in his testimony or evidence against violation 83. Violation 83 is for failure to prevent surface plumbing failures on SS-25 from enabling that well to be kept filled.[60] As Blade discusses, SoCalGas facilities at the surface of the well system failed, pumps went down and well kill efforts that might have been successful were discontinued because fluids could not be pumped.[61] This problem on kill attempt 6 could have been averted by having back up capacity.[62] Violation 83 should stand.

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[56] Abel Testimony, p. 15.

[57] See my Opening Testimony, p. 3.

[58] DR 35 Emergency.Plan.2008.

[59] Abel Testimony, p. 1, lines 18-20.

[60] See my Opening Testimony, p. 4.

[61] Blade Main Report at p. 151.

[62] Blade Main Report at p. 151.

VII. BLADE RESPONSES TO ALLEGATIONS FROM MR. ABEL'S TESTIMONY

Mr. Abel makes a number of assertions in his testimony. To clarify the merits of six of these assertions, SED asked Blade for its views regarding them, and the fact-based reasons for those views. Six of Mr. Abel's assertions and Blade's responses are shown in this section.

Abel Assertion 1 and Blade Response: Mr. Abel stated that "Blade's modeling simply represents an academic exercise to calculate the kill fluid density and pump rate that theoretically could have killed SS-25, and fails to account for several important safety considerations that impacted Boots & Coots' well kill efforts. First, as Boots & Coots explained to SED during SED's August 2018 examination, the first step upon arriving at a well control event is to secure the area and ensure the safety of personnel. [Footnote omitted.]. Indeed, as discussed in SoCalGas' opening testimony, safety is a paramount consideration in any well control operation, and the response to the SS-25 leak was no different—extensive measures were implemented to mitigate the risk of ignition. [Footnote omitted]. Second, in designing a well kill plan, a well control company must take extreme caution not to implement a well kill operation that may worsen the leak, and thereby increase the risk of ignition, or jeopardize the success of subsequent kill attempts. Boots & Coots appropriately considered these factors, and made adjustments to its kill operations accordingly."[63]

When SED asked whether Blade agreed that, "Blade's modelling simply represents an academic exercise to calculate the kill fluid density and pump rate that theoretically could have killed SS-25." Blade said no. Blade explained that its efforts to model kill operations were: [S]pecifically to ascertain why the top kill well-control efforts were unsuccessful and why it took 111 days to stop the gas from the Aliso Canyon gas storage reservoir from escaping to the atmosphere. As discussed in the Blade Report [1] (page 229), Blade conducted a transient kill simulation study to evaluate the

[63] Abel Testimony, p. 12.

likelihood of success of the actual kill attempts. Blade intentionally used the same field data that were available to the onsite well control personnel during the time of well kill operations for this evaluation. According to Blade's modelling, all of the SS-25 kill attempts were predicted to be unsuccessful.

Blade explained it was not clear to Blade how Boots and Coots selected the pump rates and kill fluid densities for each kill attempt. The kill fluid densities did not change materially until kill attempt #7.[64]

Abel Assertion 2 and Blade Response:

Mr. Abel stated, "Mr. Walzel testified that while the SS-25 wellhead equipment was rated to 5,000 PSI, given the unknown condition of the leak, Boots & Coots set a "safety limit" or "safety factor" well below the working pressure of the equipment. [Footnote omitted]. I believe that it was prudent for Boots & Coots to have set a safety factor so as not to risk damaging the wellhead."[65]

SED requested Blade to weigh in about the merits of this statement. In response to SED's questions, Blade answered: 1) Blade's modeling considered the wellhead rated working pressure of 5,000 psi and all simulations stayed below that. Blade's highest kill simulation in kill attempt #2 had a maximum predicted pump pressure of 3,644 psi, with decreasing maximum pump pressure for subsequent kill attempts;[66] 2) Blade agreed with using a wellhead safety factor, and Blade's model results honored that wellhead safety factor;[67] and 3) using data available at the time of the kill attempts, well kill modeling would have demonstrated that the pump rate and fluid density were inadequate to kill well SS-25.[68]

[64] Blade Response to SED Data Request 63, Response 2.1.1, p. 5, May 5, 2020.

[65] Abel Testimony, p. 12.

[66] Blade Response to SED Data Request 63, Response 2.2.1, p. 10, May 5, 2020.

[67] Blade Response to SED Data Request 63, Response 2.2.1, p. 10, May 5, 2020.

[68] Blade Response to SED Data Request 63, Response 2.2.1, p. 10, May 5, 2020.

Abel Assertion 3 and Blade Response:

Mr. Abel stated, "[f]urther, Boots & Coots' pumping operations were implemented not only in consideration of the pressure rating of the surface equipment, but also based on observation of the wellhead's physical response to pumping operations. Mr. Walzel described that during certain pumping operations, the SS-25 wellhead was 'moving around a lot,' which at times caused Boots & Coots to slow or stop pumping operations an [sic], in one case, broke the flow lines on the 7 inch tubing and casing, and the nipple on the wellhead. [Footnote omitted] While it does not appear that Blade's modeling accounted for these safety considerations, Boots & Coots appropriately tailored its kill operations—in real-time—to limit the potential risk of further damaging the well and compromising safety."[69]

SED asked Blade to respond to Mr. Abel's assertion that "it does not appear that Blade's modeling accounted for these safety considerations" that Abel identified in this passage. Blade provided a detailed response, including the following statements:

- "Although requested, Blade did not have direct access to the Boots & Coots personnel to determine what Boots & Coots had considered and the rationale for kill operations.";[70]
- Information that Boots & Coots appropriately tailored to its kill operations-in real-time-to limit the potential risk of further damaging the well and compromising safety was not provided to Blade. . .Blade requested data regarding kill planning, modeling, and operations many times, but such data were not provided.";[71]
- "Blade made multiple data requests for data related to kill operations and kill modeling in addition to a request for a face-to-face meeting with the Boots & Coots personnel with firsthand knowledge of the SS-25 kill operations. A meeting with Blade and Boots & Coots could not be arranged."[72]

[69] Abel Testimony, p. 13.

[70] Blade Response to SED Data Request 63, Response 2.3.1, p. 12, May 5, 2020.

[71] Blade Response to SED Data Request 63, Response 2.3.1, pp. 12-13, May 5, 2020.

[72] Blade Response to SED Data Request 63, Response 2.3.1, p. 13, May 5, 2020.

- Blade data requests to SoCalGas related to killing the SS-25 well includes the following:
  - Data Request February 11, 2016 [11]
  - Data Request May 4, 2016[12]
  - Data Request June 29, 2018[13]
  - Data Request August 29, 2018[14]
  - Data Request October 26, 2018[15]
  - Data Request December 19, 2018[9]
  - Data Request January 2, 2019[16][73]
- "Safety considerations always take precedence when carrying out the field operations."[74]

Abel Assertion 4 and Blade Response:

Mr. Abel stated, "[s]econd, Blade had the benefit of gathering more precise data points that were not available to Boots & Coots while planning, modeling, and executing its well kill attempts: 1) the precise depth and severity of damage to the production casing, and 2) the flow path of the gas from the 7" casing leak to the surface. Indeed, computer modeling is sensitive to the well geometry (i.e., leak depth, severity, and flow path), which means that more precise information will produce more accurate modeling outputs. However, precise flow path geometry is typically unavailable during an active leak response. . .While Blade was able to determine that the production casing had completely parted 892 feet after extracting and examining the 7" casing, Boots & Coots could only estimate the flow path geometry based on real-time observation and analysis of pumping operations. Second, after extracting the 7" casing, Blade had the advantage of using a video camera to analyze the 11-3/4" casing an observe holes—which Blade determined were the "likely consequence of the axial rupture" of the 7" casing. [Footnote omitted.]. The existence of holes in the surface casing is significant because it impacts the flow path of the leak and, in turn, the accuracy of the transient modeling. Accordingly,

[73] Blade Response to SED Data Request 63, Response 2.3.1, p. 13, May 5, 2020.

[74] Blade Response to SED Data Request 63, Response 2.3.1, p. 13, May 5, 2020.

while Blade was able to extract the 7" casing to gather additional data to incorporate into its modeling, Boots & Coots could not have done the same. The practical impact of this disparity in information is that Blade's modeling was refined by additional data points that were not available to Boots & Coots."[75]

SED's asked Blade whether Blade agreed that Boots & Coots could not have gathered the information that Abel listed in this passage at the time it was attempting the well kills of SS-25. In response, Blade stated it did not agree.[76] When asked about which of the data points Boots & Coots could have attained at the time of its well kill attempts, Blade provided an extensive list of data points available at the time of the well kills, stating,

Assumptions regarding the leak path and leak depth were made within a few days of the leak event on October 23, 2015, and likely within hours because a wellbore schematic (WBS) with well details information was needed for kill planning. Examples of the evolution of wellbore schematics prepared post October 23, 2015, include wellbore schematics from SoCalGas, a Boots & Coots WBS from a December 16, 2015, presentation, a WBS from an Add Energy Report released in February, 2016 (work done prior to February), and a Blade WBS with final data. Log surveys run on November 8, 2015, were also available that indicated possible leak depths. A review of these documents shows there were no material changes to the leak path and there would be no impact on modeling results. . .[77]

Precise data of the leak location and leak path were not needed for transient kill modeling."[78]

Per SED's request, Blade also explained why Boots & Coots could have attained these data points at the time of the well kill.[79]

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[75] Abel Testimony, p. 13.

[76] Blade Response to SED Data Request 63, Response 2.4.1, p. 14, May 5, 2020.

[77] Blade Response to SED Data Request 63, Response 2.4.1, p. 14, May 5, 2020.

[78] Blade Response to SED Data Request 63, Response 2.4.1, p. 14, May 5, 2020.

[79] Blade Response to SED Data Request 63, Response 2.4.1, p. 21, May 5, 2020.

SED also asked, with the data that Boots & Coots had at the time it was attempting to kill well SS-25, could Boots & Coots successfully have killed well SS-25?

Blade answered, "Yes, assuming that available data and reasonable assumptions had been used for the kill modeling (and assuming that the pumping was carried out according to plan developed through modeling), Boots & Coots could likely have killed SS-25. By 'reasonable' we mean that assumptions were made based on engineering analysis, experience, and judgment. In addition, uncertainties in the input data should have been evaluated using the modeling to determine the sensitivities to a given parameter. Conservative assumptions are normally made in designing kill plans to improve the chances for a successful outcome."[80]

SED also asked Blade, on which attempt Boots & Coots could have successfully killed well SS-25. Blade answered in part:

Kill attempt #2 (the first Boots & Coots attempt) or kill attempt #3 were possible to achieve a successful kill assuming proper modeling was done with valid input data and a successful pumping operation according to the modeling results. This is discussed in the Blade Report [1] (page 4).[81]

Abel Assertion 5 and Blade Response:

Lastly, Mr. Abel asserts that "Blade's model disregarded other key variables in pertinent well control operations. Blade's primary design variables were fluid density and pump rate. Other parameters such as viscosity, fluid stability, availability, and toxicity must also be considered. Further, not only must a kill operation stop the gas flow, the well must be stable when the kill fluid column is in a static state (i.e., after pumping stops). The pressure profile and corresponding tubular and wellbore integrity (which changes with depth) must also be considered and not exceeded. Because the Blade Report

[80] Blade Response to SED Data Request 63, Response 2.4.1, pp. 21-22, May 5, 2020.

[81] Blade Response to SED Data Request 63, Response 2.4.1, p. 22, May 5, 2020.

did not analyze these additional parameters, it is unknown if the fluid characteristics proposed by Blade (and alleged by SED) would have killed the well."[82]

SED asked Blade if it agreed that its model disregarded other key variables in pertinent well control operations. Blade answered, "No.",[83] explaining in part, "[t]he parameters, fluid stability, availability, and toxicity are not input data to a kill model. Blade used fluid viscosity in the modeling analysis. Fluid viscosity is an important parameter used to estimate the friction pressure calculations which affect the pressure profile in the fluid flow path in the wellbore and the surface pump pressure."[84]

Abel Assertion 6 and Blade Response:

Mr Abel states "[i]n sum, Blade's post-hoc transient modeling was an academic exercise that cannot fairly be compared to Boots & Coots' task of working on site under real-time constraints, and dealing with practical, field-level concerns (e.g., severe weather, wellhead condition, and safety of personnel). Even assuming Blade's transient modeling generated reasonable outputs, there is no basis for SED to claim that Boots & Coots should have killed SS-25 sooner—particularly as early as the second attempt (on November 13, approximately 3 weeks after the leak commenced)—when Blade needed 5-6 weeks to model a well kill, [Footnote omitted] not including time spent on the investigation and casing removal. Boots & Coots' approach of increasing pump rate and fluid density over well kill attempts 2 through 7 reflects a measured and logical process that did not compromise the safety in the process of bringing the well under control.[85]

SED asked Blade to identify the portions of Mr. Abel's statement with which it disagrees, and why. In response, Blade stated it disagreed with the following statements,

- "In sum, Blade's post-hoc transient modeling was an academic exercise that cannot fairly be compared to Boots & Coots' task of working on site under real-time constraints, and dealing with

[82] Abel Testimony, p. 14.

[83] Blade Response to SED Data Request 63, Response 2.5.1, p. 23, May 5, 2020.

[84] Blade Response to SED Data Request 63, Response 2.5.1, p. 23, May 5, 2020.

[85] Abel Testimony, pp. 14-15.

practical, field-level concerns (e.g., severe weather, wellhead condition, and safety of personnel)."[86]

- "Even assuming Blade's transient modeling generated reasonable outputs, there is no basis for SED to claim that Boots & Coots should have killed SS-25 sooner—particularly as early as the second attempt (on November 13, approximately 3 weeks after the leak commenced)—when Blade needed 5-6 weeks to model a well kill, [Footnote omitted] not including time spent on the investigation and casing removal."[87]
- "Boots & Coots' approach of increasing pump rate and fluid density over well kill attempts 2 through 7 reflects a measured and logical process that did not compromise the safety in the process of bringing the well under control."[88]

SED also asked Blade why it disagreed with these points. Blade answered as follows:

> Regarding bullet 1, Blade said: "Blade's efforts to model the kill operations were not an academic exercise—it was specifically to ascertain why the top kill well-control efforts were unsuccessful and why it took 111 days to stop the gas from the Aliso Canyon gas storage reservoir from escaping to the atmosphere. As discussed in the Blade Report, Blade conducted a transient kill simulation study to evaluate the likelihood of success of the actual kill attempts. Blade intentionally used the same field data that were available to the onsite well control personnel during the time of well kill operations for this evaluation. According to Blade's modeling, all the SS-25 kill attempts were predicted to be unsuccessful."[89]
>
> Regarding bullet 2, Blade said: "[t]he statement that Blade needed 5 to 6 weeks to model a well kill was taken out of context. The accurate statement is "So for us [Blade] it took much longer; four, five, six weeks to analyze all of the seven kills" [21] (page 1058:14-16). Blade modeling included a detailed assessment of gas flowrates

[86] Blade Response to SED Data Request 63, Response 2.6.1, pp. 25-26, May 5, 2020.

[87] Blade Response to SED Data Request 63, Response 2.6.1, p. 26, May 5, 2020.

[88] Blade Response to SED Data Request 63, Response 2.6.1, p. 26, May 5, 2020.

[89] Blade Response to SED Data Request 63, Response 2.6.1, p. 26, May 5, 2020.

and history matching. This level of accuracy was not required for kill modeling prior to kill attempts.

"Blade believes that more accurate kill modeling, using data available as early as the second kill attempt, would have led to a better well kill plan. Such modeling would have taken less than a week to complete. Drillbench software is intended to be used prior to well kill operations. A properly designed well kill plan, if implemented correctly, would have increased the chances of success. However, operational uncertainties are not reflected in the modeling."[90]

Regarding bullet 3, Blade said: "[b]ased on kill attempt data and reports provided to Blade, the fluid density did not increase during kill attempts #2 through 6. The majority of the kill fluid pumped was 9.4 ppg brine and 8.34 ppg fresh water with some 18 ppg barite pills. This assertion is supported by Mr. Walzel with Boots & Coots. He stated ". . . I think the fluid weights stayed the same." in the SED CPUC Opening Testimony Supporting Attachments document [8] (page SED 00717:18 – 19). The fluid density did increase to 15 ppg for kill attempt #7. The data does show the pump rate increased from 8 to 9 bpm for kill attempts #2, 3, and 4 to 13 bpm for kill attempts #5 and 6. The pump rate for kill attempt #7 was 5.8 bpm.

'As discussed in the Blade Report [1] (page 4), Based on the data reviewed by Blade, the well control company appeared to have designed the kill attempts solely by calculating a kill fluid density that was higher than the static bottom hole pressure. The result was that the well was not killed and the surface conditions continued to deteriorate. The well was brought under control in February 2016 from the relief well, not from top kill attempts in November and December of 2015.'[91]

SED also asked Blade, "Does Blade view that its transient modeling generated reasonable outputs?" Blade answered, "Yes." When asked why, Blade explained that, "Blade used available data (as described in response to Question 2.c.) to construct its model. This model demonstrated that the well could be killed using 12 ppg or 15 ppg fluids pumped at reasonable rates.[92]

[90] Blade Response to SED Data Request 63, Response 2.6.1, pp. 24-25, May 5, 2020.

[91] Blade Response to SED Data Request 63, Response 2.6.1, pp. 24-25, May 5, 2020.

[92] Blade Response to SED Data Request 63, Response 2.6.1, p. 24, May 5, 2020.