Order Instituting Investigation on the Commission's Own Motion into the 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 Uncontrolled Release of Natural Gas from Its Aliso Canyon Storage Facility. (U904G).

I.19-06-016
(Filed June 27, 2019)

CHAPTER IV

PREPARED REPLY TESTIMONY OF DANNY WALZEL AND DR. ARASH HAGHSHENAS ON BEHALF OF SOUTHERN CALIFORNIA GAS COMPANY (U 904 G)

March 20, 2020

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CHAPTER IV

I. INTRODUCTION

The Safety and Enforcement Division ("SED") makes a number of allegations related to the well kill operations executed by Boots & Coots Company ("Boots & Coots"). SED's allegations are based entirely on findings made by Blade Energy Partners ("Blade"), as detailed in Blade's Root Cause Analysis Report.[1] The purpose of our prepared joint reply testimony is to answer certain questions so as to correct and rebut certain inaccuracies and assumptions which serve as the factual basis for SED Violations 79-83.

Mr. Walzel and Dr. Haghshenas are both employed at Boots & Coots, located at 7908 N Sam Houston Parkway, Houston, Texas, 77064. Mr. Walzel is a senior well control specialist and engineer for Boots & Coots—A Halliburton Service. Mr. Walzel's educational and related experience is detailed in the attached curriculum vitae. Mr. Walzel was employed by Boots & Coots during the time of the Aliso Canyon well leak and contributed to Boots & Coots' well control efforts between October 25, 2015 and December 14, 2015. Aside from appearing for an Examination Under Oath before the Safety & Enforcement Divisions on August 8, 2018, Danny Walzel has not previously testified before the California Public Utilities Commission.

Dr. Arash Haghshenas is the well control engineer for Boots & Coots – A Halliburton Service. He is responsible for supporting and developing engineering programs for well control incidents. Dr. Haghshenas joined Boots & Coots' well control engineering team in 2010. His experience includes relief well and dynamic kill operations, multiphase flow modeling in the wellbore, and well control training. Dr. Haghshenas hold a BSc. from the Petroleum University of Technology, an MSc. From University of Louisiana at Lafayette, and obtained his PhD from Texas A&M University. He is a member of IADC, AADE, SPE, Pi Epsilon Tau, and an editorial board for the Journal of Natural Gas Science and Engineering. Dr. Haghshenas has authored, co-authored and collaborated on several books and technical papers, most notably the Managed

[1] Blade Energy Partners, *Root Cause Analysis of the Uncontrolled Hydrocarbon Release from Aliso Canyon SS-25*, May 16, 2019 ("Blade Report").

Pressure Drilling Book and IADC Drilling Manual. Dr. Haghshenas was employed by Boots & Coots during the time of the Aliso Canyon well leak and contributed to Boots & Coots' well control efforts between December 7, 2015 and February 18, 2016. Dr. Haghshenas educational and related experience is detailed in the attached curriculum vitae. Dr. Haghshenas has not previously testified before the California Public Utilities Commission.

Together, Mr. Walzel and Dr. Haghshenas have a combined 28 years of well control experience, and have jointly worked on 16 well control projects, including well SS-25.

II. BOOTS & COOTS WELL CONTROL ACTIVITIES

Please reference the following sections of SED Opening Testimony in responding to the below questions:

> **No transient modeling was done when designing kill attempts one through six … no transient kill modeling was done when designing these kill attempts, contributing to the lack of success in the kill attempts.[2]**
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> ***
>
> **There were no data that indicated transient modeling, any modeling, or analysis was conducted to design the second through sixth well kill attempts. Some calculations may have been done; however, gas flow rates were not incorporated into any kill design. The decisions appeared to be based on the static reservoir pressure and this would be inadequate and inappropriate for designing kills. SoCalGas-provided information suggested that the well-control company was using 30 MMscf/D as the well flow rate. It is unclear whether this information was ever used in any modeling. Flow rate and kill fluid density have to be designed by using established industry modeling tools before preparing an operational plan to ensure the well is killed. Each kill attempt caused additional damage to the wellhead and well site.[3]**
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> ***
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> **As shown in this section, the lack of modelling resulted in multiple unsuccessful well kill attempts, and extended the time before the release of gas could be controlled.[4]**
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> ***
>
> **Given that SoCalGas had no well kill control plans and there are no data indicating transient modeling -- any modeling -- or analysis conducted to design**

[2] SED Opening Testimony at 29-30.
[3] SED Opening Testimony at 34.
[4] SED Opening Testimony at 36.

the second through sixth well kill attempts, and such modeling would have provided the necessary information to successfully kill the well, SoCalGas violated Section 451.[5]

Q. DID BOOTS & COOTS PERFORM TRANSIENT KILL MODELING PRIOR TO KILL ATTEMPT #7?

A. Yes. Boots & Coots performed transient kill modeling before kill attempt number seven. After Boots & Coots attempted its second well kill attempt on November 15, 2015, and before its well kill attempt on November 18, 2015, and for additional kill attempts thereafter, Boots & Coots performed transient modeling.

Q. WHICH MODELING SOFTWARE DID BOOTS & COOTS USE TO PERFORM ITS TRANSIENT KILL MODELING?

A. Drillbench.

Q. IS TRANSIENT KILL MODELING STANDARD PRACTICE IN THE WELL CONTROL INDUSTRY FOR WELL CONTROL EFFORTS BY TOP KILL?

A. In general, transient kill modeling depends on the situation and data collected from the initial pumping operations. But to build the transient models you need to first attempt well kills to best understand the flow paths, parameters and flow rate. Here, we started transient kill modeling after the second kill attempt.

Q. DOES BOOTS & COOTS HAVE THE TRANSIENT MODELING RECORDS RELATED TO ITS SS-25 KILL ATTEMPTS?

A. Only for the December 22, 2015, well kill. Danny Walzel had conducted the transient modeling for well kills prior to December 22, 2015. However, the transient modeling was done on his laptop. This laptop was stolen from him, along with other personal items, in late December 2015. Mr. Walzel reported the theft to the police. Mr. Walzel's transient modeling was not saved anywhere else, nor was it sent to anyone else.

[5] SED Opening Testimony at 38.

Q. DID BOOTS & COOTS INCORPORATE A GAS FLOW RATE INTO ITS KILL MODEL?

A. Yes. Boots & Coots used a range of flow rates in its models. Boots used flow rates in its kill models ranging from 15 MM to 70 MM of cubic feet per day. Given the flow rates used in the models, Boots & Coots would then attempt to kill the well using higher pumping rates than the minimum rates generated by the models.

Please reference the following section of SED Opening Testimony in responding to the below question:

> **During the second well kill attempt, Blade estimated the gas flow rate was 83 MMscf/D. The 9.4 ppg kill density fluid could not kill this well; however, 12 ppg at a flow rate of 9 to 10 bbl/min would have brought the well under control. Also, the well could have been killed by pumping 15 ppg fluid at 6 bpm.[6]**

Q. BLADE ASSERTS THAT THE SS-25 LEAK COULD HAVE BEEN KILLED BY THE SECOND ATTEMPT—DOES BOOT & COOTS AGREE?

A. Boots & Coots disagrees and Blade's assertion is purely speculative. Boots & Coots did not have the same luxury of Blade in having all the data post-well kill. Boots & Coots did not know the flow path, the exact flow rates, the depth and size of the hole in the production casing, and fluid return paths. Blade presents their perspective of viewing the project after all the variables were constrained and all the unknowns are known - - - as opposed to the reality of a well kill, which is reacting to the actual discovery of data in sequential order as the project progressed in time. Boots & Coots was akin to a surgeon trying in real time to solve a problem with variables and unknowns. Blade's after the fact modeling is more like a person performing an autopsy, after the fact, with no variables or real time events or changes to the conditions. Based on real world reservoir characteristics and available data at the time, Blade's assertion is completely unreasonable.

[6] SED Opening Testimony at 30-31.

Please reference the following sections of SED Opening Testimony in responding to the below questions:

> **At the point in time 20 days after the first unsuccessful kill attempt, and by the time of the second well kill attempt, the scope of the well-control problem should have been better understood.[7]**
>
> ***
>
> **Also in Blade's view, the scope of the well-control problem should have been better understood 20 days after the first well kill attempt because that time was spent gathering the data about well condition and preparing the site for the subsequent well kill operations.[8]**

Q. DURING ITS WELL KILL EFFORTS, DID BOOTS & COOTS KNOW THE PRECISE GEOMETRY AND FLOW PATH OF THE LEAK IN WELL SS-25 AT ANY POINT DURING ITS WELL KILL OPERATIONS?

A. No. Boots & Coots did not know the precise flow path or exact geometry at any point during its well kill operations, nor would it have been possible.

Q. DURING ITS WELL KILL EFFORTS, WAS BOOTS & COOTS AWARE THAT HOLES HAD DEVELOPED IN SS-25'S 11 3/4 INCH SURFACE CASING AS A RESULT OF THE RUPTURE IN THE 7 INCH CASING?

A. No.

Q. WOULD KNOWLEDGE OF THE PRECISE GEOMETRY AND FLOW PATH OF THE SS-25 LEAK HAVE IMPACTED BOOTS & COOTS' TRANSIENT MODELING?

A. Yes. If Boots & Coots had precise knowledge of the flow path and geometry, we could have designed a more accurate model. However, even with knowing the precise flow path, other variables such as flow rates, pipe roughness which effects friction pressure, integrity of the tubing, casing and wellhead, formation, all could affect the results of the modeling. Thus, although knowing the precise geometry and flow path would have had a positive impact on the modeling and increased the success rate, it would not have guaranteed the well kill.

[7] SED Opening Testimony at 35.
[8] SED Opening Testimony at 38.

Q. DID BOOTS & COOTS' WELL KILL ATTEMPTS ACCOUNT FOR A SAFETY FACTOR?

A. Yes.

Q. IS A SAFETY FACTOR IMPORTANT WHEN PLANNING A WELL KILL?

A. Yes. A safety factor is an industry accepted practice. In this situation, the well head equipment was rated for 5000 psi. Boots & Coots will not pump to 5000 psi and imposes its own safety factor to not exceed a certain pressure limit. Boots & Coots and SoCalGas agreed to not get to 5000 psi and wanted to stay near 4000 psi for safety concerns and to not damage the pumping equipment and well head. If the well head is lost then we cannot pump into the well and the only option is drilling a relief well. Other safety factors include not pumping at a rate or using fluid that would damage the integrity of the formation or the well's tubulars. At the time, it was believed that pumping very heavy fluid could result in fracturing the formation and exacerbate the situation. In addition, there is always a possibility that if we used heavier fluids, then the solids used to increase the weight and fluid will be more abrasive and could damage the tubing.

Q. WHAT ARE THE POTENTIAL NEGATIVE CONSEQUENCES OF DAMAGING THE WELL'S TUBULARS, WELLHEAD, OR FORMATION BY USING TOO HEAVY A FLUID OR TOO HIGH A RATE?

A. If we used too heavy of a fluid it can fracture the formation. As aforementioned, there is always a possibility that if we used heavier fluids, then the solids used to increase the weight and fluid will be more abrasive and could damage the tubing. By managing the well kill efforts as we did, we were able to save the well head and thus were able to run a Gyro during the relief well efforts so we would know of the position of SS-25 underground which allowed for ultimate interception. Running the Gyro enabled us to intercept the wellbore on the first attempt, and prevented a longer and more extensive relief well operation. By preserving the tubing, we were

also able to measure bottom hole conditions after the well was killed to ensure the well was killed. Also, in pumping cement during relief well, we were able to monitor pressure on the tubing because we kept the well intact, and we could also cement the plug in the well and pressure the plug to make sure it was plugged. We could not have done this without keeping the wellhead intact. Keeping integrity of the well helped with relief well operations as stated above.

Q. DID YOU INSPECT THE SS-25 WELLHEAD AND ABOVEGROUND SURFACE PIPING AFTER ARRIVING TO THE ALISO CANYON FACILITY?

A. Yes.

Q. WHEN YOU EXAMINED THE SS-25 WELLHEAD AND ABOVEGROUND SURFACE PIPING, DID YOU BELIEVE THAT THEY WERE FIT FOR PURPOSE?

A. Yes.

III. CONCLUSION

This concludes our prepared reply testimony.

WITNESS QUALIFICATIONS OF DANNY WALZEL

For my witness qualifications, please reference my curriculum vitae, attached to this testimony as **Ex. IV-1**.

WITNESS QUALIFICATIONS OF DR. ARASH HAGHSHENAS

For my witness qualifications, please reference my curriculum vitae, attached to this testimony as **Ex. IV-2**.