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Commissioner	<u>Rechtschaffen</u>
Admin. Law Judges	<u>Poirier/Kenney</u>
SED Project Mgr.	_____
SED Witness	_____



SAFETY AND ENFORCEMENT DIVISION
California Public Utilities Commission

OPENING TESTIMONY

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

San Francisco, California
November 22, 2019

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I. INTRODUCTION

On May 16, 2019, Blade Energy Partners (Blade) published an independent root cause analysis RCA report, “Root Cause Analysis of the Uncontrolled Hydrocarbon Release from Aliso Canyon SS-25”. Drawing on the Blade report and information obtained in its own investigation, this testimony identifies numerous safety [and health] violations of California Public Utilities Code Section 451¹ related to the uncontrolled release of hydrocarbon gas, or methane, for 111 days from Southern California Gas Company’s (SoCalGas) Aliso Canyon Well SS-25 (SS-25 incident).² In addition, the testimony identifies multiple instances in which SoCalGas did not cooperate with the investigation of the Safety and Enforcement Division (SED), resulting in additional violations of Section 451, and certain violations of California Public Utilities Commission’s Rule of Practice and Procedure (Rule) 1.1. Finally, the testimony identifies violations of Section 451 due to SoCalGas’s recordkeeping problems related to the Aliso Canyon storage facility, and to the SS-25 incident.

II. BACKGROUND AND VIOLATIONS

A. Summary of Incident and Violations

At 3:15 PM on October 23, 2015, a leak was discovered in the Standard Sesnon 25 (SS-25) well.³ SS-25 was shut in⁴ at 3:30 PM that day, but gas continued to flow from the well uncontrollably for the next 111 days. Blade Energy Partners estimates that approximately 6.6 Billion Cubic Feet (BSCF) of natural gas, or approximately 120,000 metric tons of methane had leaked.⁵ SoCal Gas and its well control contractor,

¹ California Public Utilities Code Section 451 will also be referred to as “Section 451” or “451”.

² See “Root Cause Analysis of the Uncontrolled Hydrocarbon Release from Aliso Canyon SS-25”, May 16, 2019. (Blade Report) at p. 4. The Blade Report can be viewed at: ftp://ftp.cpuc.ca.gov/News_and_Outreach/SS-25%20RCA%20Final%20Report%20May%2016,%202019.pdf

³ Root Cause Analysis of the Uncontrolled Hydrocarbon Release from Aliso Canyon SS-25, Blade Energy Partners, May 16, 2019 (Blade Report) at p. 2.

⁴ The Blade Report at p. 133 uses the term “shut in” interchangeably with “not flowing”.

⁵ Blade Report at p. 13; Blade Report at p. 155, Table 26: Aliso Canyon Hydrocarbon Leak Estimates. According to the Blade Report, Table 26, the California Air Resources Board (CARB) estimated that 6.0 BSCF of gas, or approximately 109 cubic tons of the methane equivalent had leaked by well SS-25.

Halliburton’s Boots and Coots Company,⁶ made seven unsuccessful attempts to kill well SS-25 by pumping high density fluids down the tubing and casing.⁷ ⁸ Ultimately, relief well P-39A was drilled, enabling SS-25 to be successfully killed in February 2016, four months after the leak had begun.⁹ That relief well intersected with the bottom of SS-25. The Los Angeles County Department of Public Health observed that, “the health of nearby residents may have been impacted by exposure to both crude oil and natural gas during the Disaster.”¹⁰

California Public Utilities Code Section 451 provides in part, Every public utility shall furnish and maintain such adequate, efficient, just, and reasonable service, instrumentalities, equipment, and facilities. . .as are necessary to promote the *safety*, *health*, comfort, and convenience of its patrons, employees, and the public. (Emphasis added.)

Table 1 below summarizes the violations found by SED associated with this incident and identifies the section of testimony where the factual basis can be found for each violation. Except where explicitly provided in Table 1, each violation identified in Table 1 is a violation of California Public Utilities Code Section 451 (Section 451).

⁶ Southern California Gas Company Standard Services Agreement (Agreement 5660044243), Project Standard Senson (Sic) 25, October 30, 2015. (SoCalGas and Boots and Coots Well Kill Agreement).

⁷ Blade Report at p. 172.

⁸ According to the SoCalGas and Boots and Coots Well Kill Agreement, p. 1 of 21, the name of the well control company that SoCalGas hired is Boots and Coots. Though Boots and Coots were requested to kill the well, Halliburton Energy Services entered into the contract with SoCalGas.

⁹ Blade Report at p. 172.

¹⁰ Letter from Los Angeles County Department of Public Health, Deputy Director for Health Protection, Angelo J. Bellomo, MS, REHS, QEP, to SoCalGas Chief Executive Officer, Brett Lane, March 11, 2019, p. 2. Available at: https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/News_Room/NewsUpdates/2019/Aliso%20Canyon%20Facility.pdf.

Table 1: Summary of Violations¹¹

Violation Number	Summary of Violation	Begin Date	End Date	Testimony Section Number
1	No investigation of blowout from well Frew-3.	12/31/1984	10/23/2015	II.B.1.a
2	No investigation blowout from well FF-34A.	12/31/1990	10/23/2015	II.B.1.a
3	No investigation of one of four parted well casings.	12/31/1969	10/23/2015	II.B.1.a
4 through 6	No investigation of any of three parted well casings.	12/31/1994	10/23/2015	II.B.1.a
7 through 60	No investigation of 54 well leaks.	10/22/2015	10/23/2015	II.B.1.a
61 through 72	Failure to follow company's internal 1988 plan to check casing of 12 wells for metal loss.	8/31/1988	10/23/2015	II.B.1.b
73	Failure to follow company's internal 1988 plan to check casing of well SS-25 for metal loss.	8/31/1988	10/23/2015	II.B.1.b
74	Failure to implement a risk or integrity management program for Aliso Canyon storage facility (Aliso).	12/31/2009	10/23/2015	II.B.2.a
75	Failure to detect corrosion on well SS-25 resulting in part from lack of risk assessment at Aliso.	12/31/2009	10/23/2015	II.B.2.b
76	Failure to start well integrity program in 2009 because of inability to collect recovery for it in rates.	12/31/2009	10/23/2015	II.B.2.c
77	Operation of well SS-25 without backup mechanical barrier to 7-inch production casing.	8/31/1988	10/23/2015	II.B.3
78	Operation of Aliso without internal policies that required well casing wall thickness inspection and measurement.	8/31/1988	10/23/2015	II.B.4
79	Failure to successfully execute well SS-25 kill attempt numbers 2 through 7, due to lack of proper modelling.	11/13/2015	2/11/2016	II.B.5
80 through 82	Failure to provide well kill programs for relief well #2, well SS-25A and well SS-25B.	11/13/2015	2/11/2016	II.B.5

¹¹ SED reserves the right to update these violations and the dates associated with them if SED becomes aware of information that requires doing so.

Violation Number	Summary of Violation	Begin Date	End Date	Testimony Section Number
83	Prevention of surface plumbing failures on SS-25 from enabling that well to be kept filled.	11/25/2015	2/11/2016	II.B.5
84	Allowance of groundwater to cause corrosion on the 7 inch and 11 3/4 inch casings on SS-25.	8/31/1988	10/23/2015	II.B.6
85	Failure to assess the relationship between groundwater in and around the SS-25 wellsite and surface casing corrosion of SS-25.	8/31/1988	10/23/2015	II.B.6
86	Failure to have systematic practice to protect surface casing strings against external corrosion and failure to employ proper understanding of the consequences of corroded surface casings and uncemented production casings.	8/31/1988	10/23/2015	II.B.7
87	Failure to have continuous pressure monitoring system for well surveillance because it prevented an immediate identification of the SS-25 leak and accurate estimation of the gas flow rate.	10/23/2015	2/12/2016	II.B.8
88	Failure to disclose to Los Angeles County Department of Public Health Known Facts that crude oil was released from well SS-25 during the incident.	11/15/2015	2/12/2016	II.C.1
89	Lack of Cooperation: Failure to completely respond to Blade Root Cause Analysis related data requests on January 31, 2016 until no sooner than March 1, 2019.	3/31/2016	3/1/2019	II.C.2 Example 1
90	Lack of Cooperation: Failure to completely respond to Blade Root Cause Analysis related data requests on February 19, 2016 until no sooner than March 1, 2019.	4/18/2016	3/1/2019	II.C.2 Example 1
91	Lack of Cooperation: Failure to completely respond to Blade Root Cause Analysis related data requests on April 7, 2016 until no sooner than March 1, 2019.	6/7/2016	3/1/2019	II.C.2 Example 1

Violation Number	Summary of Violation	Begin Date	End Date	Testimony Section Number
92	Lack of Cooperation: Failure to completely respond to Blade Root Cause Analysis related data requests on February 18, 2018 until no sooner than March 1, 2019.	4/7/2016	3/1/2019	II.C.2 Example 1
93 through 94	Lack of Cooperation: Failure to produce two individuals from Boots & Coots present during the well kill efforts, despite an SED subpoena to do so.	8/8/2018	11/22/2019	II.C.2 Example 2
95 through 189	Lack of Cooperation: Refusal to release 95 pages of communications based upon assertion of attorney-client and/or attorney work product privilege.	3/5/2018	1/3/2019	II.C.2 Example 3
190 through 284	Lack of Cooperation: Misleading SED by representing to SED that 95 pages of documents are protected by attorney-client/attorney work product privilege, when they were not.	3/5/2018	1/3/2019	II.C.2 Example 3
285 through 302	Lack of Cooperation: Refusal to release 18 additional communications based upon assertion of attorney-client and/or attorney work product privilege.	3/5/2018	5/11/2019	II.C.2 Example 3
303 through 320	Lack of Cooperation: Misleading SED by representing to SED that 18 additional communications were protected by attorney-client or attorney work product privilege, when they were not.	3/5/2018	5/11/2019	II.C.2 Example 3
321	Lack of Cooperation: Failure to produce those individuals from Boots & Coots requested for interviews by Blade Energy Partners as part of their Root Cause Analysis.	1/24/2019	5/19/2019	II.C.2 Example 4
322 through 323	Lack of Cooperation: Breach of confidentiality promise by communicating with PG&E and Southern California Edison counsel about certain aspects of SED's Examinations Under Oath of SoCalGas.	8/14/2018	6/26/2019	II.C.2 Example 5

Violation Number	Summary of Violation	Begin Date	End Date	Testimony Section Number
324 through 325	Lack of Cooperation: Breach of confidentiality promise by communicating with PG&E and Southern California Edison counsel about certain aspects of SED's Examinations Under Oath of SoCalGas. (Rule 1.1 Violation)	8/14/2018	6/26/2019	II.C.2 Example 5
326	Lack of Cooperation: Intentionally not appearing at an SED deposition in spite of a Commission subpoena to do so.	11/1/2019	Pending	II.C.2 Example 6
327	Imprudent and unreasonable recordkeeping practices associated with well SS-25.	6/6/1973	10/23/2015	II.C.3
328	Imprudent and unreasonable recordkeeping practices associated with well SS-25A.	12/7/1972	10/23/2015	II.C.3
329	Imprudent and unreasonable recordkeeping practices associated with well SS-25B.	10/29/1973	10/23/2015	II.C.3
330	Imprudent and unreasonable recordkeeping practices associated with well SS-25: Failure to record continuous wellhead pressure.	10/15/15	10/23/2015	II.C.3

B. Root Causes and Direct Causes Related to the Uncontrolled Release of Hydrocarbons for 111 Days from Well SS-25,¹² and Resulting Violations of Section 451

The Blade Report identifies several causes related to the SS-25 incident. In this subsection, SED identifies a number of violations of Section 451 that are based upon causes identified in the Blade Report. Because SoCalGas could have requested ratepayer money to pay for safety-related Operation and Maintenance for Aliso Canyon storage facility in its General Rate Cases, its failure to implement the measures identified in this section makes each of the violations of Section 451 even more egregious.

¹² If SED becomes aware of additional information that could modify SED's findings, SED reserves the right to supplement or modify its testimony with updated information, or take further actions as appropriate.

1. SoCalGas Failed to Perform Failure Investigations, Failure Analyses or Root Cause Analyses on Failed Aliso Canyon Wells Despite More Than 60 Well Casings Experiencing Leaks, Four Having Parted Casings, and Several Wells Having Casing Corrosion Identified. Therefore, SoCalGas Lacked Important Information and Background to Properly Anticipate the Extent and Consequences of Corrosion in its Other Wells, Including Well SS-25.¹³

SED finds multiple separate violations of Section 451 related to SoCalGas's behavior regarding its lack of awareness of well casing metal loss and metal loss threats to Aliso Canyon well casings, as identified in this section.

a) SoCalGas Did Not Investigate or Analyze its Past Casing Leaks of Other Wells at Aliso Canyon

A root cause for the SS-25 incident was the lack of detailed follow-up investigation, failure analyses, or RCA of casing leaks, parted casings, or other failure events in the field in the past.¹⁴ There had been over 60 casing leaks at Aliso Canyon before the SS-25 incident, but no failure investigations were ever conducted.¹⁵ Based on the data reviewed by Blade, no investigation of the causes was performed, and, therefore, the extent and consequences of the corrosion in other Aliso Canyon storage wells were not understood.¹⁶ Specifically, external corrosion on production casings had been identified in several wells.¹⁷ However, this external corrosion had not been thoroughly investigated to determine the causes.

The Aliso Canyon storage wells had numerous casing leaks.¹⁸ These casing leaks may have been relevant to the conditions developing in Well SS-25. Blade reviewed 124

¹³ Blade Report at p. 4.

¹⁴ Blade Report at p. 4

¹⁵ Blade Report at p. 4.

¹⁶ Blade Report at pp.4, 219 and 237.

¹⁷ Blade Report at p. 4.

¹⁸ Blade Report at p. 2.

gas storage wells and identified 63 casing leaks, 29 tight spots,¹⁹ 4 parted casings, and 3 other types of failures.²⁰ Forty percent of the gas storage wells reviewed by Blade had casing failures with an average of two casing failures per well.²¹

In addition, two Aliso Canyon wells had already experienced underground blowouts from casing leaks: Frew-3 in 1984 and FF-34A in 1990.²² These wells were successfully killed by pumping fluid down the tubing. The consequences of a larger leak or a near-surface casing rupture were not encountered until the SS-25 event.²³

Between 1969 and 1994, four wells were discovered to have parted casings.²⁴ However, Blade found no evidence that SCG prepared root cause analyses, collected samples, performed lab analyses, or taken photos of failures, or developed failure analysis reports to document these failures.²⁵ The only documents found were well operations daily reports where on-site rig activities were reported.²⁶ Additionally, the FF-34A Well File mentioned a study of possible external casing corrosion problems in the southeastern portion of the field, but Blade was not able to locate any documentation related to this study.²⁷ Consequently, there was no insight into why these failures were happening.

SED views SoCalGas's failure to investigate or analyze the failures or root causes of casing leaks, parted casings, or other failure events as separate violations of Section 451, as follows:

- One violation for failure to investigate the blowout from well Frew-3 spanning from December 31, 1984, the last possible

¹⁹ According to the Blade Report at p. 162, a "tight spot" occurs "where the casing fails to perform in the manner it was designed for".

²⁰ Blade Report at p. 2.

²¹ Blade Report at pp. 2, 203. Page 203 quantifies this as 99 failures in 49 wells.

²² Blade Report at p. 2.

²³ Blade Report at p. 2.

²⁴ Blade Report at p. 165.

²⁵ Blade Report at p. 165.

²⁶ Blade Report at p. 165.

²⁷ Blade Report at p. 2.

date of the blowout,²⁸ to October 23, 2015, the date of the incident.

- One violation for failure to investigate the blowout from well FF-34A, spanning from December 31, 1990, the last possible date of the blowout,²⁹ to October 23, 2015, the date of the incident.
- Four violations: One for failure to investigate each of the parted casings discovered between 1969 and 1994. As one of the parted casings must have been discovered in 1969 to set the beginning of the range, that first violation spans from December 31, 1969 the last possible date of its parting, to October 23, 2015, the date of the incident. Assuming that the remaining three parted casings were discovered December 31, 1994, those three separate violations each span from, at the latest, December 31, 1994 to October 23, 2015.³⁰
- To avoid double counting violations, SED assumes that the 60 leaks identified before the Aliso Canyon incident included the six blowouts and parted casings identified above. As such, the remaining 54 leaks that went without investigation should constitute a separate set of up to 54 violations. At the latest, these violations began on October 22, 2015, the last possible date before the incident on October 23, 2015.³¹

²⁸ If SED becomes aware of additional information that could modify SED's findings, SED reserves the right to supplement or modify its testimony with updated information as to the point in time when this blowout occurred, or take further actions as appropriate.

²⁹ If SED becomes aware of additional information that could modify SED's findings, SED reserves the right to supplement or modify its testimony with updated information as to the point in time when this blowout occurred, or take further actions as appropriate.

³⁰ If SED becomes aware of additional information that could modify SED's findings, SED reserves the right to supplement or modify its testimony with updated information as to the points in time these parted casings were discovered, or take further actions as appropriate.

³¹ If SED becomes aware of additional information that could modify SED's findings, SED reserves the right to supplement or modify its testimony with updated information as to the point in time when these leaks occurred, or take further actions as appropriate.

b) SoCalGas Did Not Properly Follow Its Own 1988 Plan to Determine the Condition of the Casing in 12 Wells³²

SoCalGas had a two-year plan in 1988 to determine the condition of the casing in 20 wells originally completed in the 1940s and 1950s.³³ The wells, including SS-25, were prioritized based on gas deliverability, operational history, and length of time since their last workover.³⁴ SS-25 was given a low priority.³⁵ Of the 20 wells, SoCalGas ran inspection logs in seven within two years of the 2 year plan window.³⁶ The inspection logs showed metal loss indications on the outside diameter (OD) of the casing ranging from 20% to 60% of the wall thickness in 5 of the 7 wells logged from 1988 to 1990.³⁷ Some of the wells had indications above the surface casing shoe, and many had indications below the casing shoe.³⁸ Blade found no documentation indicating that investigations into the causes of external corrosion, on any of these wells, were ever conducted.³⁹ SS-25 was never logged as part of this 1988 program or at any other time.⁴⁰

SoCalGas's failure to follow its own 1988 plan to check the casing in 12 wells for metal loss, violates Section 451. The significant metal loss found on five of the wells identified in the 1988 memo presents a safety risk to the public and SoCalGas employees. Given SoCalGas's failure to check these casings in response to its own August 1988

³² Blade Report at p. 2. The Blade Report mentions 13 such wells, but SED is identifying a separate violation for Well SS-25, the thirteenth well.

³³ Blade Report at pp. 2, 204.

³⁴ Blade Report at p. 2.

³⁵ Blade Report at p. 2.

³⁶ Blade Report at p. 2. To place the import of inspection logs in context, the Blade Report stated on page 183 that DOGGR later issued an Order (Order 1109) on March 4, 2016 that stated that "SoCalGas shall run a casing inspection log for all wells that were intended for future operations; otherwise the wells shall be plugged and abandoned."

³⁷ Blade Report at p. 2.

³⁸ Blade Report at p. 2.

³⁹ Blade Report at p. 219.

⁴⁰ Blade Report at p. 3.

memo,⁴¹ twelve separate violations span from the end of August 1988 until October 23, 2015, the date of the incident.

As discussed below, SED identifies an independent violation for SS-25, which was a thirteenth well identified in the 1988 memo that went unchecked for metal loss.

c) SoCalGas Failed to Discover Specific Corrosion Problems on Well SS-25

Because SoCalGas did not attempt to understand causes of the leaks of 60 wells at Aliso Canyon,⁴² and also did not follow its own 1988 plan to determine the condition of the casing in SS-25,⁴³ it did not discover corrosion problems on Well SS-25. Blade found that well SS-25's 7-inch casing failure originated from 85% metal loss in the 7-inch steel casing wall due to corrosion, which resulted in a 2-foot long axial rupture under an internal pressure of 2,791 psi in the space between (annulus) the 7-inch casing and the 2-7/8 inch tubing.⁴⁴

Blade identified a total of 58 through-wall-metal-loss holes in the 990-foot deep, 11-3/4-inch diameter steel surface casing walls of well SS-25.⁴⁵ Fifty of the steel surface casing holes in SS-25 were identified at depths ranging between approximately 150 feet and approximately 195 feet.⁴⁶ The through-wall-metal-loss holes were identified using various technologies, including caliper, UCI and HRVRT.⁴⁷ Camera logging data were consistent with the technology logging data, with photographs matching the sensory logging tools' metal loss locations.⁴⁸

⁴¹ See Blade Report at p. 217. "In August 1988, an internal SoCalGas memo recommended that a casing inspection survey be run on 20 wells to "determine the mechanical condition of each well casing."

⁴² Blade Report at p. 4.

⁴³ Blade Report at p. 3.

⁴⁴ Blade Report at p. 80.

⁴⁵ Blade Report at p. 119.

⁴⁶ Blade Report at p. 119.

⁴⁷ Blade Report at p. 119.

⁴⁸ Blade Report at p. 121.

Based on Blade’s RCA, a direct cause of the SS-25 incident was outside surface corrosion of the 7-inch production casing.⁴⁹ The casing was corroding from the outside as a result of contact with groundwater.⁵⁰

For the 7-inch casing to have corroded, it must have been in direct contact with an environment that allowed the corrosion mechanism to exist, and a corrosion protection mechanism must have been absent.⁵¹ The presence of bonded cement outside of the 7-inch casing would have mitigated external corrosion. However, there was no cement around the SS-25 7-inch well casing at 892 ft, because when the well was originally drilled, the cement around the 7-inch casing was intentionally brought up to 7,000 ft and not to surface.⁵²

In light of the extent of the corrosion on SS-25, and the resulting incident, SED considers SoCalGas’s failure to investigate the specific corrosion problems on Well SS-25 its own a separate violation of California Public Utilities Code Section 451. This violation spans from August 31, 1988, the last date that the SoCalGas’s 1988 memo could have identified it, to October 23, 2015.

2. SoCalGas did not have any form of risk assessment focused on wellbore integrity management, including lack of assessment of qualitative probability and consequences of production casing leaks or failures.⁵³

SED finds multiple, separate violations of Section 451 related to SoCalGas’s failure to timely have and implement a Storage Integrity Management Program.

⁴⁹ Blade Report at p. 3

⁵⁰ Blade Report at p. 3.

⁵¹ Blade Report at p.215

⁵² Blade Report at p. 215

⁵³ Blade Report at p. 4.

a) SoCalGas Did Not Implement A Risk Assessment Program or Wellbore Integrity Management Plan at Aliso Canyon Storage Facility Prior to October 23, 2015

SoCalGas's failure to implement any form of risk assessment program or wellbore integrity management plan on the Aliso Canyon storage facility prior to October 23, 2015 is a separate violation of Section 451 for each day it failed to implement the risk assessment program, beginning in 2009, the date at which it was advised by its Storage Engineering Manager, Mr. James Mansdorfer, that it should have a well integrity program.⁵⁴

According to Blade's Root Cause Analysis

Unlike robust transmission pipeline integrity and distribution pipeline integrity programs, there was no such focus on well integrity. This was also supported by SoCalGas's GRC submission in 2012. . . SoCalGas was perhaps inadequately resourced to manage Aliso Canyon prior to the 2015 incident, but because detailed data on resourcing was not available, the lack of resources was not identified as a root cause.⁵⁵

In SoCalGas's 2016 GRC proceeding, "SoCalGas had noted an increasing trend in well integrity repairs, and without the [Storage Integrity Management Program], operation would have continued in reactive mode, addressing mainly sudden and major failures and service interruptions."⁵⁶

Prior to the incident of October 23, 2015, SoCalGas had recognized that its well integrity program required significant changes, and had developed a plan, timeline, and budget.⁵⁷ Considering the age of the wells and the quantity of casing leaks, the Root Cause Analysis determined that a well integrity plan was necessary."⁵⁸

⁵⁴ For discussion about the input from Mr. Mansdorfer regarding the well integrity program, see the next subsection. SED estimates December 31, 2009 to be the start date of this violation. If SED becomes aware of additional information that could modify SED's findings, SED may modify this testimony or take further actions as appropriate.

⁵⁵ Blade Report at p. 5.

⁵⁶ Blade Report at p. 182.

⁵⁷ Blade Report at p. 183.

⁵⁸ Blade Report at p. 183.

Also in SoCalGas's 2016 GRC, SoCalGas testified about the required operations and maintenance expenses and capital investments for their underground storage facilities and proposed a new six-year Storage Integrity Management Program (SIMP).⁵⁹ The intent was to proactively identify and mitigate potential storage well safety and/or integrity issues before they result in unsafe conditions for the public or employees.⁶⁰ SoCalGas had noted an increasing trend in well integrity repairs as part of the well repair work.⁶¹ As part of the well repair work from 2008 to 2013, SoCalGas explained that mechanical damage and internal and external corrosion were identified in 15 wells with the use of ultrasonic logs.⁶² Also, the external corrosion had been observed at relatively shallow depths in the production casing.⁶³ SoCalGas cited P-50A,⁶⁴ where 400 psi was observed in the casing annulus during routine weekly pressure surveillance in 2008; a footnote provided additional information that a subsequent ultrasonic inspection revealed external production casing corrosion from 450 to 1,050 ft.⁶⁵

Including P-50A, twelve wells in the SoCalGas's 2016 GRC testimony were Aliso Canyon wells.⁶⁶

In the public records of 116 Aliso Canyon storage wells, Blade found production casing inspection logs for 76 wells.⁶⁷ The 116 wells comprised the 114 wells listed under the Comprehensive Safety Review, also known as SIMP, and 2 unique wells from the 2014 Testimony for the 2016 GRC.⁶⁸ The proposed SIMP program in SoCalGas's 2014

⁵⁹ Blade Report at p. 182.

⁶⁰ Blade Report at p. 182.

⁶¹ Blade Report at p. 182.

⁶² Blade Report at p. 182.

⁶³ Blade Report at p. 182.

⁶⁴ According to Blade Report at p. 183, well P-50A was an Aliso Canyon well.

⁶⁵ Blade Report at p. 182.

⁶⁶ Blade Report at pp. 182-183.

⁶⁷ Blade Report at p. 183.

⁶⁸ Blade Report at p. 183.

testimony included identifying threats and risk assessments for all wells.⁶⁹ SoCalGas testified about the required operations and maintenance expenses and capital investments for their underground storage facilities and proposed a new six-year SIMP.⁷⁰ The intent was to “proactively identify and mitigate potential storage well safety and/or integrity issues before they result in unsafe conditions for the public or employees.”⁷¹ The objective of the log review was to determine to what degree the shallow external corrosion found at SS-25 was an isolated event.⁷² Out of the 76 wells with production casing inspection logs, 27 of them had indications of shallow external corrosion on the production casing.⁷³

In 1994, decades prior to SIMP, SoCalGas proposed to handle well integrity management via certain types of surveys. In that year, SoCalGas proposed to DOGGR, “. . . the most economical and effective method to monitor casing integrity of gas storage wells is through the use of static temperature surveys.”⁷⁴ DOGGR’s response to SoCalGas’s proposal stated in part, “Therefore, the monitoring program and static temperature surveys currently used by the Gas Company could be used to satisfy compliance of the requirements for mechanical integrity found in this section [California Code of Regulations Section 1724.10(k)(5)].”⁷⁵ However, the Root Cause Analysis found that,

The casing leak in SS-25 showed that using temperature surveys to confirm mechanical integrity of casing was insufficient. . . A temperature survey was run in SS-25 on October 21, 2014, a year before the leak on October 23, 2015, and showed no temperature anomalies.

Noise and temperature surveys are used to identify leaks, but the sensitivity of the instruments is limited. If no leak is

⁶⁹ Blade Report at p. 183.

⁷⁰ Blade Report at p. 182.

⁷¹ Blade Report at p. 182.

⁷² Blade Report at p. 183.

⁷³ Blade Report at p. 183.

⁷⁴ Blade Report at p. 198.

⁷⁵ Blade Report at p. 198.

detected, noise and temperature data provide no indication of future integrity problems. Noise and temperature logs are trailing indicators; and by no means sufficient to manage well integrity. Alternatively, casing inspection can identify defects that may be growing with time and can be used to monitor integrity deterioration.

Numerous temperature, noise, and pressure surveys were run in SS-25 between the years of 1974 and 2014, and no major anomalies were found indicating fluid migration.⁷⁶

SoCalGas's failure to implement any form of risk assessment program or wellbore integrity management plan on the Aliso Canyon storage facility prior to October 23, 2015, beginning in 2009,⁷⁷ and continuing through October 23, 2015, constitutes a separate violation of Section 451 for each day it failed to implement the risk assessment program.

b) SoCalGas's Failure to Implement A Risk Assessment Program or Wellbore Integrity Management Plan at Aliso Canyon Storage Facility Prior to October 23, 2015 Resulted in the Failure to Detect Corrosion on the Well SS-25 Seven Inch Casing Prior to October 23, 2015

Corrosion was not detected on SS-25 because the seven inch casing wall thickness on the SS-25 had never been inspected.⁷⁸ Various tools can be run in a well with wireline to measure well thickness along the entire length of a casing or tubing string.⁷⁹ These logs were not run in the seven inch casing of well SS-25, in part because no risk assessment was performed.⁸⁰

⁷⁶ Blade Report at p. 198.

⁷⁷ Section III.B.2.c discusses that SoCalGas's Storage Engineering Manager recommended to SoCalGas that it perform a risk assessment review in 2009, but that SoCalGas failed to do so. This is the basis for the start date of the violation. SED uses December 31, 2009 as the current beginning date of this violation. If SED becomes aware of additional information that could modify SED's testimony, SED may modify it or take further actions, as appropriate.

⁷⁸ Blade Report at p. 216.

⁷⁹ Blade Report at p. 216.

⁸⁰ Blade Report at p. 216.

SED finds that the failure to detect corrosion on SS-25 that resulted in part from SoCalGas's failure to perform a risk assessment on Aliso Canyon is a separate violation of Section 451, beginning December 31, 2009, and continuing through October 23, 2015.^{81 82}

c) SoCalGas Did Not Start a Storage Integrity Management Program in 2009, Even Though It Was Recommended by Its Storage Engineering Manager at that Time, Because They Could Not Yet Collect It in Rates

SoCalGas's storage engineering manager in 2009, James Mansdorfer, recommended a storage well integrity program to SoCalGas at that time.⁸³ In recommending that storage well integrity program, he stated, "a structured program where [SoCalGas has] a schedule that will eventually result in a casing inspection and pressure test for every storage well."⁸⁴ He recommended to his direct supervisor that the storage integrity program include putting a rig on each of the storage wells,⁸⁵ running casing and inspection logs,⁸⁶ and pressure testing the casing.⁸⁷

Also, according to Mr. Mansdorfer, SoCalGas knew a storage well integrity program was needed in 2009, but had not started it because the company could not yet collect the cost of the program in rates.⁸⁸

Eight years prior to the October 23, 2015 incident, SoCalGas had recognized that its well management program required significant changes.⁸⁹ In the SoCalGas 2007

⁸¹ As discussed in Section III.B.2.c below, SoCalGas failed to implement a risk assessment review that had been recommended by its Storage Engineering Manager, Mr. James Mansdorfer, in 2009. This is the basis for the beginning of the violation.

⁸² If SED becomes aware of additional information that could modify SED's testimony, SED may modify it or take further actions, as appropriate.

⁸³ Tr. Mansdorfer, September 13, 2018 at pp. 9:7 - 10:11.

⁸⁴ Tr. Mansdorfer, September 13, 2018 at pp. 124:28 - 125:14.

⁸⁵ Tr. Mansdorfer, September 13, 2018 at p. 125:19-23.

⁸⁶ Tr. Mansdorfer, September 13, 2018 at p. 125:24-26.

⁸⁷ Tr. Mansdorfer, September 13, 2018 at p. 125:27-28.

⁸⁸ Tr. Mansdorfer, September 13, 2018 at p. 126:25 - 127:23.

⁸⁹ Blade Report at p. 183.

testimony for the 2008 General Rate Case (GRC), costs and details were outlined related to reservoir engineering studies, additional personnel, technological advances, and well expenses.²⁰ SoCalGas claimed that over a 15-year period, the number of gas storage specialists reduced from 10 to 4 for unspecified reasons, and the company “experienced a significant decline in its ability to assess the performance of individual wells due to the lack of recent data.”²¹ In 2007, SoCalGas requested two additional specialists.²² Unlike SoCalGas’s robust transmission pipeline integrity and distribution pipeline integrity programs, there was no such focus on well integrity.²³ This was also supported by the SoCalGas GRC submission in 2012.²⁴

SoCalGas’s failure to start the well integrity program in 2009 because it could not yet collect the cost of the program in rates constituted its own separate violation of Section 451. This violation began on December 31, 2009 and continued until October 23, 2015.²⁵

3. SoCalGas did not have a dual mechanical barrier system in the wellbore of SS-25, instead leaving the 7-inch production casing as the primary barrier to the gas.

In identifying the lack of a dual barrier system for SS-25, Blade stated,

SS-25 was operated so that gas injection and withdrawal was done through the 2 7/8 in. tubing and the 7 in. casing x 2 7/8 in. tubing annulus. As such, the 7 in. casing acted as a single barrier and when it failed, there was nothing behind it to contain the wellbore pressure and fluids.²⁶

To further illustrate the lack of a dual barrier in the case of SS-25, Blade added,

²⁰ Blade Report at pp. 5, 182.

²¹ Blade Report at pp. 5, 182.

²² Blade Report at p. 182.

²³ Blade Report at p. 5.

²⁴ Blade Report at p. 5.

²⁵ SED is using December 31, 2009, as the current beginning date, and October 23, 2015, as the current end date of this violation. If SED becomes aware of additional information that could modify SED’s testimony, SED may modify it or take further actions, as appropriate.

²⁶ Blade Report at p. 233, Solution 9: Tubing Packer Completion-Dual Barrier System.

According to the Blade Report,

SS-25 was drilled as a Standard Sesnon reservoir oil well in 1954. After the oil reservoir was considered depleted, SS-25 was converted to a gas storage well in 1973. Operationally, there were some key differences between the use of SS-25 in oil production mode and in gas storage mode. As an oil well, the oil was produced through a [2 7/8] inch tubing string; the primary mechanical barrier to the oil was the tubing, and the secondary one was the casing. As a gas storage well, the gas was injected and withdrawn through the tubing and the casing, making the 7-inch casing the primary barrier for the gas during gas storage operations. . .⁹⁷

Pressure tests were conducted on the SS-25 casing in 1973 during the well's conversion from oil production to gas storage.⁹⁸ The well's integrity was monitored using yearly temperature logs and occasional noise logs.⁹⁹ If a leak in the casing had occurred, then the casing would have locally cooled, and consequently the temperature would have deviated at the leak location.¹⁰⁰ Pressure measurements, which were collected at SS-25 weekly, had not indicated a leak or failure prior to the incident. Well integrity issues went undetected until the leak event of October 23, 2015.¹⁰¹

Also as noted by SoCalGas's Storage Engineering Manager, James Mansdorfer, in 2009,

Back in the 1970's our predecessors were concerned about this enough to install subsurface safety valves in all wells at Aliso. Unfortunately, at the time the technology was not up to the challenge and all of the valves failed and were subsequently removed. However due to deepwater high flow rate wells the technology is now available to install deep set valves that will withstand high flow rates. We have one of these in Miller 4. We could leave the wells in annular flow configuration so we don't have the cost, problems and

⁹⁷ Blade Report at p. 2.

⁹⁸ Blade Report at p. 2.

⁹⁹ Blade Report at p. 2.

¹⁰⁰ Blade Report at p. 2.

¹⁰¹ Blade Report at p. 2.

deliverability loss associated with conversion to tubing flow.¹⁰²

With regards to whether subsurface safety valves could work on both tubing and casing at Aliso Canyon, Mr. Mansdorfer from 2009 later clarified under oath as follows:

Q: Okay. Subsurface safety valves very quickly. What is your understanding as to whether subsurface safety valves, can they work for both tubing and casing of a well or merely tubing?

A: Well, there's different styles. PG&E has ones that work on both tubing and casing. I think they're kind of troublesome but most of them, well, almost all of them are set up to work on tubing only.

Q: I see. And that includes for deepset?

A: Right. It would have to flow through a packer and to the tubing. And then if you wanted to flow in the annulus, it would have to flow out through ports and up the annulus.¹⁰³

On April 23, 2009, Mr. Mansdorfer stated that more than 100 storage wells were set up for annular flow in the same fashion that Blade noted SS-25 was operated. In his words, "At Aliso Canyon we have over 100 storage wells that are set up for annular flow with up to 3150 psi on the casing. A few of these wells are under 10 years old, but the majority are from 35 to 70 years old."¹⁰⁴

The Aliso Canyon storage wells had numerous casing leaks.¹⁰⁵ Blade reviewed 124 gas storage wells and identified 63 casing leaks, 29 tight spots, 4 parted casings, and

¹⁰² Thursday, April 23, 2009 2:12 PM, Mansdorfer to Weibel email; I1906016_SCG_CALADVOCATES_0017314.

¹⁰³ Tr. Mansdorfer, September 13, 2018 at pp. 143:21 – 144:9. If SED becomes aware of additional information that could modify SED's testimony, SED may modify it or take further actions, as appropriate. In particular, SED may propound further discovery to inform whether SoCalGas could have successfully used subsurface safety valves on both the tubing and the casing on wells in the Aliso Canyon Natural Gas Storage facility prior to October 23, 2015. If it turns out that SoCalGas could have done so, SED reserves the right to assert additional violations of California Public Utilities Code Section 451 related to this matter.

¹⁰⁴ Thursday, April 23, 2009 2:12 PM, Mansdorfer to Weibel email; ref-VI.B-003. 2009.0423. Aliso Testimony. J. Mansdorfer at p. 1.

¹⁰⁵ Blade Report at p. 2.

3 other types of failures.¹⁰⁶ Casing leaks include both connection leaks and pipe body leaks.¹⁰⁷ Based on the data available to blade, no details regarding the nature of cause of these leaks and failures were available because no failure analyses were done.¹⁰⁸ Forty percent of the gas storage wells reviewed by Blade had casing failures with an average of two casing failures per well.¹⁰⁹ The FF-34A Well File mentioned a study of the possible external casing corrosion problems in the southeastern portion of the field, but Blade was not able to locate any documentation related to this study.¹¹⁰

In addition, two Aliso Canyon wells had underground blowouts from casing leaks: Frew-3 in 1984 and FF-34A in 1990.¹¹¹ These wells were successfully killed by pumping fluid down the tubing, and the consequences of a larger leak or a near-surface casing rupture were not anticipated until the SS-25 event.¹¹²

As noted in Section B.1.b above, SoCalGas had a two-year plan in 1988 to determine the mechanical condition of the casing in 20 wells originally completed in the 1940s and 1950s, but did not completely follow it.¹¹³

Blade reviewed SS-25 noise, temperature, and pressure surveys before the incident of October 23, 2015.¹¹⁴ There were no physical observations from well inspections and weekly pressure measurements that indicated an existing problem.¹¹⁵ Blade's interpretation is that SoCalGas complied with the monitoring components of the Operations Standard titled Gas Inventory – Monitoring, Verification and Reporting.¹¹⁶

¹⁰⁶ Blade Report at pp. 2, 203.

¹⁰⁷ Blade Report at p. 203.

¹⁰⁸ Blade Report at p. 2.

¹⁰⁹ Blade Report at pp. 2, 203. This was 99 failures in 49 wells (See Blade Report at p. 203).

¹¹⁰ Blade Report at p. 2.

¹¹¹ Blade Report at p. 2.

¹¹² Blade Report at p. 2.

¹¹³ Blade Report at p. 2.

¹¹⁴ Blade Report at p. 202.

¹¹⁵ Blade Report at p. 202.

¹¹⁶ Blade Report at p. 202.

The catastrophic SS-25 casing leak showed that using temperature surveys to confirm mechanical integrity of casing was a flawed concept.¹¹⁷ The concept assumed that leaks would not be catastrophic, would cause a cooling anomaly, and would be detected in time to allow the well to be killed quickly and safely.¹¹⁸ A temperature survey was run in SS-25 on October 21, 2014, a year before the leak on October 23, 2015, and showed no temperature anomalies.¹¹⁹

Allowing an annual temperature survey to meet the requirements of mechanical integrity test is insufficient for several reasons:¹²⁰

- A leak and cooling must exist to develop a temperature anomaly.¹²¹
- Lack of an anomaly does not provide any data regarding the future integrity of the casing or remaining wall thickness.¹²²
- Temperature change must be within the sensitivity of the tool.¹²³
- Interpretation of the survey is subjective.¹²⁴

A large number of production casing leaks and parted casings have occurred throughout the history of the Aliso Canyon field, with a risk of gas leaks and safety and environmental repercussions.¹²⁵ In spite of the possible consequences, no data were provided to Blade to demonstrate that measures were taken to understand the root causes of the casing and well failures.¹²⁶ The wells files and data made available to Blade are

¹¹⁷ Blade Report at p. 202.

¹¹⁸ Blade Report at p. 202.

¹¹⁹ Blade Report at p. 202.

¹²⁰ Blade Report at p. 203.

¹²¹ Blade Report at p. 203.

¹²² Blade Report at p. 203.

¹²³ Blade Report at p. 203.

¹²⁴ Blade Report at p. 203.

¹²⁵ Blade Report at p. 203.

¹²⁶ Blade Report at p. 203.

mostly void of analyses of the causes of failures.¹²⁷ An interoffice memo related to FF-34A stated that “The possible regional external casing corrosion problem in the southeastern portion of the field that was going to be further studied and a report issues”; however, Blade was not able to locate any documentation regarding this study.¹²⁸

SoCalGas has a Company Operations Standard (191.01) for the Investigation of Accidents and Pipeline Failures, but a complementary standard for the investigation of a well failure had not been identified to Blade.¹²⁹ This implied that more attention was paid to surface equipment and asset failures than to well and downhole failures.¹³⁰

As part of interoffice correspondence, SoCalGas made a recommendation in 1988 to run casing inspection logs in the 20 wells that were of concern at the time, and the opportunity to inspect the casing in SS-25 was missed. It is not possible to determine what an inspection of the SS-25 casing would have shown in 1988, but it is possible that the corrosion was present and detectable, and steps could have been taken to avoid the leak in 2015.¹³¹ SoCalGas logged some of the 13 remaining wells starting in 2007, resulting in a gap from 1990 to 2007 when no inspection logs were run in the 20 wells, according to the available well records.¹³²

SoCalGas logged the High Priority wells and found significant penetration.¹³³ No documentation was found that explained why the remaining wells were not inspected as recommended in 1988.¹³⁴ Blade inquired if SS-25 was inspected based on the 1988 recommendation because it was on the list of 20 wells.¹³⁵ SoCalGas responded to a Blade information request dated December 18, 2018, that the high priority wells were

¹²⁷ Blade Report at p. 203.

¹²⁸ Blade Report at p. 203.

¹²⁹ Blade Report at p. 203.

¹³⁰ Blade Report at p. 203.

¹³¹ Blade Report at p. 204.

¹³² Blade Report at p. 204.

¹³³ Blade Report at p. 204.

¹³⁴ Blade Report at p. 204.

¹³⁵ Blade Report at pp. 204-205.

logged, and SS-25 was not inspected because the Vertilog technology was less effective at identifying casing leaks than the well diagnostic tests that SoCalGas routinely performed on its underground gas storage wells.¹³⁶ However, the objective of the 1988 inspections was to determine the mechanical condition of the casing and not to identify casing leaks.¹³⁷

There were 76 of 116 wells that had production casing inspection logs available, of which, 27 wells showed indications of shallow external corrosion on the production casing.¹³⁸ In almost all of these 27 wells, the external corrosion was below the depth of the surface casing shoe.¹³⁹ There were two exceptions, F-4 and P-50A.¹⁴⁰ The shallow corrosion in P-50A was found above the shoe and abruptly stops at the depth of the casing shoe.¹⁴¹

Although no well was found with the exact placement and pattern of corrosion as that of SS-25, Blade concluded that shallow corrosion was a common event that was found field wide, and close to the surface casing shoe.¹⁴² Shallow casing leaks occurred in a number of wells.¹⁴³ Blade found 10 shallow casing leaks in a review of 116 wells.¹⁴⁴ Blade interpreted that three of these shallow casing leaks could be attributed to shallow corrosion; three were not.¹⁴⁵ There was not enough information to determine if the remaining shallow casing leaks were corrosion related.¹⁴⁶

¹³⁶ Blade Report at p. 205.

¹³⁷ Blade Report at p. 205.

¹³⁸ Blade Report at p. 205.

¹³⁹ Blade Report at p. 205.

¹⁴⁰ Blade Report at p. 205.

¹⁴¹ Blade Report at p. 205.

¹⁴² Blade Report at p. 205.

¹⁴³ Blade Report at p. 205.

¹⁴⁴ Blade Report at p. 205.

¹⁴⁵ Blade Report at p. 205.

¹⁴⁶ Blade Report at p. 205.

Surface casing corrosion was identified in several wells where casing inspection logs were run as part of the P&A (plug and abandonment) operations.¹⁴⁷ SS-25's surface casing had the worst condition; logs showed multiple through-wall holes in the 11 ¾ in. casing from approximately 134 to 300 ft.¹⁴⁸ The holes in the surface casing likely contributed to the 7-inch production casing corrosion and allowed ground water and oxygen to enter the 11 ¾ inch x seven-inch annulus.¹⁴⁹

SED finds that SoCalGas violated Section 451 by operating well SS-25 without a backup mechanical barrier to the 7-inch production casing. In August 1988, an internal SoCalGas memo recommended that a casing inspection survey be run on 20 wells to “determine the mechanical condition of each well casing.”¹⁵⁰ Given SoCalGas's failure to inspect the casing of SS-25 in response to its own August 1988 memo,¹⁵¹ this violation spans from the end of August 1988 until October 23, 2015.¹⁵²

4. SoCalGas did not have internal policies that required inspection and measurement of the wall thickness of wellbores at Aliso.¹⁵³ Instead, SoCalGas used techniques that detected and fixed leaks only after an event occurred.¹⁵⁴

SoCalGas had no internal policies on wall thickness inspections because the company assumed that regulatory compliance was being adhered to by running annual temperature surveys in accordance with the Aliso Canyon Monitoring Plan and the

¹⁴⁷ Blade Report at p. 205.

¹⁴⁸ Blade Report at p. 205.

¹⁴⁹ Blade Report at p. 205.

¹⁵⁰ Blade Report at p. 217.

¹⁵¹ See Blade Report at p. 217.

¹⁵² If SED becomes aware of additional information that could modify SED's testimony, SED may modify it or take further actions, as appropriate. In particular, SED may propound further discovery to inform whether SoCalGas could have successfully used subsurface safety valves on both the tubing and the casing on wells in the Aliso Canyon Natural Gas Storage facility prior to October 23, 2015. If it turns out that SoCalGas could have done so, SED reserves the right to assert additional violations of California Public Utilities Code Section 451 related to this matter.

¹⁵³ Blade Report at p. 5.

¹⁵⁴ Blade Report at p. 5.

project approval letter dated 1989 requiring an annual mechanical integrity test (MIT).¹⁵⁵ The MIT monitoring system did find casing leaks on other wells in the field, which were successfully repaired or remediated.¹⁵⁶ But, no failure analysis or risk assessment was ever done on previous wells that had leaks or corrosion.¹⁵⁷ In addition, there had not been an event of similar severity to what happened on SS-25.¹⁵⁸ Further, since no formal risk assessment was conducted regarding well integrity, wall thickness inspection was not identified as a monitoring technique.¹⁵⁹

A wall thickness inspection provides a leading indicator of possible casing integrity issues.¹⁶⁰ The noise and temperature logs results are trailing indicators because the leak has to already have happened to be detected.¹⁶¹ Seven of the 20 wells recommended for a casing wall thickness inspection in the SoCalGas 1988 memo were inspected and many of them had outside diameter (OD) metal loss indications.¹⁶² There was no follow-up investigation of these anomalies.¹⁶³ Further, there was no investigation of why these wells exhibited OD corrosion and why the remaining thirteen wells did not require further analyses (the remaining thirteen wells had been ranked as medium and low priority).¹⁶⁴

¹⁵⁵ Blade Report at p. 217. According to the Blade Report at pp. 197-198 A mechanical integrity test (MIT) must be performed on all injection wells to ensure the injected fluid is confined to the approved zones. The MIT consists of two parts. 1. Prior to commencing injection operations, each injection well must pass a pressure test of the casing-tubing annulus to determine the absence of leaks. Thereafter, the annulus of each well must be tested at least once every five years. 2. The second test of a two-part MIT shall demonstrate that there is no fluid migration behind the casing, tubing, or packer.

¹⁵⁶ Blade Report at p. 217.

¹⁵⁷ Blade Report at p. 217.

¹⁵⁸ Blade Report at p. 217.

¹⁵⁹ Blade Report at p. 217.

¹⁶⁰ Blade Report at p. 218.

¹⁶¹ Blade Report at p. 218.

¹⁶² Blade Report at p. 218.

¹⁶³ Blade Report at p. 218.

¹⁶⁴ Blade Report at p. 218.

SoCalGas ran temperature surveys and periodic noise logs in SS-25 from 1974 to 2014¹⁶⁵ However, this type of monitoring program is not capable of detecting casing metal loss, corrosion or the growth of corrosion over time.¹⁶⁶ Temperature and noise surveys do not measure wall thickness; they will only detect a leak and are consequently after-the-fact, reactive techniques.¹⁶⁷

As discussed in Section B.1.b, an internal SoCalGas memo issued in August 1988 recommended that a casing inspection survey be run on 20 wells to “determine the mechanical condition of each well casing.”¹⁶⁸ Despite the number of casing failures that had occurred in the field, no failure analysis or subsequent risk assessment was done that may have led to an awareness that corrosion was a potential problem.¹⁶⁹ In addition, there had not been an event of similar severity to what happened on SS-25.¹⁷⁰ Further, since no formal risk assessment was conducted regarding well integrity, wall thickness inspection was not identified as a monitoring technique.¹⁷¹ Section B.1.b discusses in more detail the number of casing failures that had occurred at Aliso, and the failure to follow each of the recommendations in the 1988 memo.¹⁷²

Although there were no regulatory requirements for wall thickness measurements to be done,¹⁷³ SoCalGas operated its Aliso Canyon storage facility without internal policies that required well casing wall thickness inspection and measurement in violation of Section 451. The span of this violation extends from the issuance of the memo in August 1988 to October 23, 2015, the date of the incident.

¹⁶⁵ See discussion regarding temperature surveys and noise logs in Blade Report at p. 216.

¹⁶⁶ Blade Report at p. 216.

¹⁶⁷ Blade Report at p. 216.

¹⁶⁸ Blade Report at p. 217.

¹⁶⁹ Blade Report at p. 217.

¹⁷⁰ Blade Report at p. 217.

¹⁷¹ Blade Report at p. 217.

¹⁷² See also Blade Report at p. 218.

¹⁷³ Blade Report at p. 217.

5. SoCalGas did not have a well specific, well control plan that considered transient kill modeling or well deliverability. There was not quantitative understanding of well deliverability, although data were available, and well-established industry practices existed for such analysis.

With regards to Relief Well 2, Well SS-25A, and SS-25B, SoCalGas did not have kill programs as of February 4, 2016.¹⁷⁴

Between October 24 and December 22, 2015, seven kill operations were attempted to bring wells-25 under control and to stop the leak.¹⁷⁵ The date and a brief description of each kill attempt are provided in Table 2, provided below.¹⁷⁶ The first kill operation was managed by SoCalGas and the remaining six kill operations were managed by Boots and Coots, a well-control company contracted by SoCalGas.¹⁷⁷ None of the attempts were successful and each attempt made the surface conditions worse.¹⁷⁸ Kill attempt number seven appeared to be close to killing the well, but it was terminated because of undesirable movement of the wellhead and pump lines that broke during the job.¹⁷⁹

In designing a kill operation, the objective is to place a fluid of sufficient density into the wellbore such that the hydrostatic pressure exerted by this fluid is higher than the pressure of the flowing gas.¹⁸⁰ The two primary design variables are the fluid density and pump rate.¹⁸¹ The primary constraint is that the pressure rating of the surface wellhead

¹⁷⁴ Email from Brett Lane to Jimmie Cho et al., entitled “Randy Request” AC_CPUC_SED_DR_16_0043578. “Jimmie: Tried to make this easy for you. Attached is the latest draft of the intercept/kill procedure for relief well 1 to SS-25 and the dynamic kill analysis. I have also included the last 5 ranging run reports. We do not have a dynamic kill program developed yet for Relief well 2. We do not have kill programs for SS25A or 25B.”

¹⁷⁵ Blade Report at p. 144.

¹⁷⁶ Table 2 below is a copy of Table 18 of the Blade Report.

¹⁷⁷ Blade Report at p. 144.

¹⁷⁸ Blade Report at p. 144.

¹⁷⁹ Blade Report at p. 229.

¹⁸⁰ Blade Report at p. 144.

¹⁸¹ Blade Report at p. 144.

equipment must not be exceeded.¹⁸² In general, the lower fluid densities require higher pump rates and result in higher pressures at the wellhead.¹⁸³

Blade reviewed all the available data and concluded that no transient modeling was done when designing kill attempts one through six.¹⁸⁴ 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.¹⁸⁵ Kill operations where a fluid is being pumped into a well while the gas is escaping at a high rate requires a detailed transient model to define the operational parameters.¹⁸⁶

Mr. Mansdorfer identified calculations for flow rate and mud weight that may have successfully killed the well also, which was based on information from the website of the Division of Oil, Gas, and Geothermal Resources (DOGGR).¹⁸⁷

Blade conducted detailed modeling and used the more accurate estimate of flow rate and concluded that 12 pounds per gallon (ppg) fluid weight or higher at pump rates of 10 barrels per minute (bpm) or higher would have successfully controlled the well as early as November 13 or 14, 2015.¹⁸⁸ Instead, a variation of the same kill attempt design with fluid densities of around 9.4 ppg and flow rates of around 5 to 13 bpm were utilized for kill attempts two through six.¹⁸⁹

Meanwhile, the well site deteriorated with the continued flow of gas.¹⁹⁰ Blade reviewed all of the available data and concluded that no transient modeling was done when designing these kill attempts, contributing to the lack of success in the kill

¹⁸² Blade Report at p. 144. In this case, the surface equipment was rated to 5,000 psi.

¹⁸³ Blade Report at p. 144.

¹⁸⁴ Blade Report at p. 4.

¹⁸⁵ Blade Report at p. 3.

¹⁸⁶ Blade Report at p. 4.

¹⁸⁷ Tr. Mansdorfer, September 13, 2018 at pp. 81:20 – 83:9.

¹⁸⁸ Blade Report at p. 4.

¹⁸⁹ Blade Report at p. 4.

¹⁹⁰ Blade Report at p. 4.

attempts.¹⁹¹ The data indicated that the well flow rate was being significantly underestimated.¹⁹²

At the time of the first kill attempt, the estimate leak rate was 93 MMscf/D.¹⁹³ Blade's analysis indicated that the 10 ppg fluid was not dense enough to kill the well at realistic pumping rates.¹⁹⁴ The well could have been killed by pumping 12 ppg fluid at 10 bpm or a 15 ppg fluid at 7 bpm.¹⁹⁵ The first well kill attempt was a reasonable response because the extent of the failure in SS-25 was unknown.¹⁹⁶ Similar well kill operations had been carried out in the past on wells with casing leaks, namely Frew 3 in 1984 and Fernando Fee (FF) 34A in 1990.¹⁹⁷ The two wells were killed successfully by pumping fluid down the tubing.¹⁹⁸ Gas broaching to surface from cracks in the ground following kill attempt #1 indicated that SS-25 had serious problems and that a shallow casing leak likely existed.¹⁹⁹

The second through sixth well kill attempts failed because the kill fluids used were not dense enough to kill the well.²⁰⁰ For example, on November 13, 2015, the well-control company executed the second well kill attempt, which was also unsuccessful.²⁰¹ During the second well kill attempt, Blade estimated the gas flow rate was 83 MMscf/D.²⁰² The 9.4 ppg kill density fluid could not kill this well;²⁰³ however, 12 ppg at

¹⁹¹ Blade Report at p. 4.

¹⁹² Blade Report at p. 4.

¹⁹³ Blade Report at p. 148.

¹⁹⁴ Blade Report at p. 148.

¹⁹⁵ Blade Report at p. 148.

¹⁹⁶ Blade Report at p. 148.

¹⁹⁷ Blade Report at p. 148.

¹⁹⁸ Blade Report at p. 148.

¹⁹⁹ Blade Report at p. 148.

²⁰⁰ Blade Report at p. 159.

²⁰¹ Blade Report at p. 148.

²⁰² Blade Report at pp. 149, 228.

²⁰³ Blade Report at pp. 149, 229.

a flow rate of 9 to 10 bbl/min would have brought the well under control.²⁰⁴ Also, the well could have been killed by pumping 15 ppg fluid at 6 bpm.²⁰⁵ Blade's analyses assume that kill fluids would have been pumped down the tubing; it would have been impossible to kill SS-25 by pumping down the seven inch casing.²⁰⁶

Between November 14 and November 25, 2015, the well-control company executed four other kill attempts.²⁰⁷ All four kill attempts failed, and the SS-25 surface conditions worsened.²⁰⁸ All four kill attempts were similar in design.²⁰⁹ The main components of the kill fluids were 9.4 ppg CaCl₂ fluid for the third and fourth well kill attempts and fresh water (estimated 8.34 ppg density) for the fifth and sixth well kill attempts.²¹⁰ The estimated gas leak rates were 81 MMscf/D for the third and fourth well kill attempts and 78 MMscf/D for the fifth and sixth well kill attempts.²¹¹ Blade analyses indicate that the fluid densities were not high enough to kill the well at realistic pump rates for any of the four kill attempts.²¹² The well could have been killed with either 12 ppg or 15 ppg kill fluid at realistic pump rates (6-8 bpm).²¹³

Blade indicates that at the time of the fifth kill attempt, the well was flowing at 78 MMscf/D. Blade believes that 12.0 ppg fluid pumped at 8 bpm or 15.0 ppg fluid at 6 bpm would have also stopped the gas flow.²¹⁴

The sixth well kill attempt was a near repeat of the fifth well kill attempt, except that the 35 bbl barite pill was replaced with a 100 bbl 9.4 ppg LCM pill, and a higher

²⁰⁴ Blade Report at pp. 149, 229.

²⁰⁵ Blade Report at p. 149.

²⁰⁶ Blade Report at p. 149.

²⁰⁷ Blade Report at p. 150.

²⁰⁸ Blade Report at p. 150.

²⁰⁹ Blade Report at p. 150.

²¹⁰ Blade Report at p. 150.

²¹¹ Blade Report at p. 150.

²¹² Blade Report at p. 150.

²¹³ Blade Report at p. 150.

²¹⁴ Blade Report at p. 151.

pump rate was applied to the kill.²¹⁵ The sixth attempt appeared to have killed the well, but fluid loss into the formation kept the annular fluid column from stabilizing.²¹⁶ It is probable that continued pumping from the surface might have kept up with the fluid loss, but surface plumbing failures prevented the well from being kept filled.²¹⁷

At this point, the wellhead and surface casing were structurally unstable.²¹⁸ Gas and fluid flow around the surface location removed enough soil and formation to allow considerable oscillation of the wellhead.²¹⁹

The final well kill attempt was executed by the well-control company on December 22, 2015.²²⁰ After installing guy wires to reduce wellhead oscillations, the pump job for this kill attempt consisted of pumping 15.1 ppg water based mud (WBM), with LCM, at a rate of five bpm.²²¹ (Reports are inconsistent—the actual rate may have been 5.8 bpm.)²²² After pumping 300 bbl, the injection rate was reduced to 0.5 bpm for 15 minutes.²²³ Pumping was terminated due to rocking of the wellhead and a subsequent failure of the injection connection.²²⁴ At 10:30 AM, the well was just about to be killed, although premature shutdown of the pumps resulted in the FBHP decreasing and the influx rate increasing.²²⁵ Pumping needed to continue for some time after the well had seemed to have been killed to ensure that the well had been effectively killed.²²⁶ This did not happen in the field because the pumps were shut down early.²²⁷ Blade's analysis

²¹⁵ Blade Report at p. 151.

²¹⁶ Blade Report at p. 151.

²¹⁷ Blade Report at p. 151.

²¹⁸ Blade Report at p. 151.

²¹⁹ Blade Report at p. 151.

²²⁰ Blade Report at p. 151.

²²¹ Blade Report at p. 151.

²²² Blade Report at p. 151.

²²³ Blade Report at p. 151.

²²⁴ Blade Report at p. 151.

²²⁵ Blade Report at p. 152.

²²⁶ Blade Report at p. 152.

²²⁷ Blade Report at p. 152.

confirms that the well should have been killed with either 12 ppg fluid pumped at 6 bpm or 15 ppg fluid pumped at 5 bpm.²²⁸

The seventh (last) top well kill attempt was the first attempt to utilize an engineered approach—some documents indicate that well kill modeling had been attempted prior to the job. It appears that the well was almost dead when the surface equipment failed, but because of the inability to continuously fill the well, the production zone resumed flowing after some (undetermined) time.²²⁹

The 11 ¾ inch x seven-inch annulus valve on the wellhead backed out during this kill attempt, which created an unrestricted gas flow path to the surface.²³⁰ The gas flow out of the two-inch threaded outlet contributed to the enlargement of the crater on the south side.²³¹ It is likely that the crater, unsupported lines and valves, wellhead movement, and vibration contributed to the valve backing out, which made the overall surface situation worse.²³²

Blade concluded that the seventh well kill attempt was a “near kill” that failed because the pumping was terminated early due to concern for potential wellhead damage.²³³ A contributing factor was the cumulative damage done by previous, unsuccessful kill attempts to the well site and wellhead, which caused this kill attempt to be terminated early.²³⁴

By December 22, 2015, after more than 4,000 bbl of various fluids had been pumped into the well, most fluids returned to the surface under high velocity.²³⁵ Additionally, a large volume of gas had escaped through the surface fissures and crater.²³⁶

²²⁸ Blade Report at p. 152.

²²⁹ Blade Report at p. 152.

²³⁰ Blade Report at p. 152.

²³¹ Blade Report at p. 152.

²³² Blade Report at p. 152.

²³³ Blade Report at p. 152.

²³⁴ Blade Report at p. 152.

²³⁵ Blade Report at p. 152.

²³⁶ Blade Report at p. 152.

The surface conditions had deteriorated to a point that it became unsafe for personnel to work near the wellhead.²³⁷ The relief well P-39A started being drilled on December 4, 2015, and it was successful in killing SS-25 on February 11, 2016.²³⁸

There were no data that indicated transient modeling, any modeling, or analysis was conducted to design the second through sixth well kill attempts.²³⁹ Some calculations may have been done; however, gas flow rates were not incorporated into any kill design.²⁴⁰ The decisions appeared to be based on the static reservoir pressure and this would be inadequate and inappropriate for designing kills.²⁴¹ SoCalGas-provided information suggested that the well-control company was using 30 MMscf/D²⁴² as the well flow rate.²⁴³ It is unclear whether this information was ever used in any modeling.²⁴⁴ 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.²⁴⁵ Each kill attempt caused additional damage to the wellhead and well site.²⁴⁶

The 20 days after the first unsuccessful kill attempt were spent gathering data about the well condition and preparing the site for the subsequent well kill operations.²⁴⁷ An ice plug in the tubing was found to be at 473 feet.²⁴⁸ A coil tubing unit was rigged up and used to clear out the plug.²⁴⁹ Noise, temperature, pressure, and spinner logs were

²³⁷ Blade Report at p. 152.

²³⁸ Blade Report at p. 152.

²³⁹ Blade Report at pp. 159, 228.

²⁴⁰ Blade Report at p. 159.

²⁴¹ Blade Report at p. 228.

²⁴² MMscf/D stands for million standard cubic feet per day.

²⁴³ Blade Report at p. 228.

²⁴⁴ Blade Report at p. 228.

²⁴⁵ Blade Report at p. 228.

²⁴⁶ Blade Report at p. 159.

²⁴⁷ Blade Report at p. 226.

²⁴⁸ Blade Report at p. 226.

²⁴⁹ Blade Report at p. 226.

run.²⁵⁰ Pressure data were recorded.²⁵¹ A bridge plug was set in the tubing at 8,393 ft, and holes were punched in the tubing at 8,387 ft to allow circulation down the tubing and into the annulus.²⁵² Gas continued to flow throughout this time.²⁵³

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.²⁵⁴ It was clear that there was a leak in the 7-inch casing at a shallow depth.²⁵⁵ Gas was flowing from the reservoir up through the 7-inch casing × 2 7/8-inch tubing annulus and then outside of the 7-inch casing at the leak depth.²⁵⁶ The gas was escaping into the surrounding formation and some was migrating to the surface.²⁵⁷ The bottomhole pressure of the reservoir and the tubing and casing pressures at surface were known.²⁵⁸ Annual flow test data were available for SS-25, and an inflow performance curve could have been generated.²⁵⁹ These data would have allowed calculation of a reasonable estimate of the gas flow rate.²⁶⁰

There is data indicating that the design of the seventh well kill attempt was modeled ahead of time.²⁶¹ The well-control company appeared to assume a gas flow rate of around 25–30 MMscf/D, whereas Blade-estimated flow rate was 60 MMscf/D.²⁶² However, the annulus pressure dropped to 0 psi for a time indicating that the well had likely been killed, but pumping had to be stopped because of severe vibrations of the

²⁵⁰ Blade Report at p. 226.

²⁵¹ Blade Report at p. 226.

²⁵² Blade Report at p. 226.

²⁵³ Blade Report at p. 226.

²⁵⁴ Blade Report at p. 226.

²⁵⁵ Blade Report at p. 226.

²⁵⁶ Blade Report at p. 226.

²⁵⁷ Blade Report at p. 226.

²⁵⁸ Blade Report at pp. 226-227.

²⁵⁹ Blade Report at p. 227.

²⁶⁰ Blade Report at p. 227.

²⁶¹ Blade Report at p. 228.

²⁶² Blade Report at p. 228.

wellhead.²⁶³ The wellhead movement caused pumping lines to break off, and operations were stopped to prevent damage to the wellhead itself.²⁶⁴ The inability to continuously fill the well allowed the production zone to resume flowing.²⁶⁵ No further attempts were made to top kill the well.²⁶⁶

It appears that the approach to killing the well was based on a static estimation of bottomhole pressure to determine the kill fluid density and concern about pump pressures exceeding the nominal wellhead pressure rating of 5,000 psi.²⁶⁷ A transient kill model would have revealed that a kill fluid density of 12 ppg or higher at flow rates around 10 bpm would have successfully controlled the well with pump pressures below the wellhead rating.²⁶⁸ The well could therefore have been top killed earlier. Instead, a variation of the same initial kill attempt was implemented during the second through sixth well kill attempts with low density kill fluids.²⁶⁹ 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. As noted by Blade, this loss of time caused the well site to deteriorate with the continued gas flow.²⁷⁰ External well-control specialists provide necessary experience and expertise; however, underground storage operators should also have personnel with the necessary skills to monitor and manage external specialists, a core skill for the gas storage operator.²⁷¹

Table 2 below shows the descriptions and results for the well kill attempts between October 23 and December 22, 2015.²⁷²

²⁶³ Blade Report at p. 228.

²⁶⁴ Blade Report at p. 228.

²⁶⁵ Blade Report at p. 228.

²⁶⁶ Blade Report at p. 228.

²⁶⁷ Blade Report at p. 240.

²⁶⁸ Blade Report at p. 240.

²⁶⁹ Blade Report at p. 240.

²⁷⁰ Blade Report at p. 240.

²⁷¹ Blade Report at p. 240.

²⁷² Blade Report at pp. 144-146, Table 18.

Table 2: Descriptions and Results for Kill Attempts #1-7 (October 23-December 22, 2015)

Kill Attempt & Date	Description	Results	Successful
#1 (October 24)	10 ppg polymer pill (down tubing)	Tubing plugged after 11.8 bbl pumped.	No
	8.6 ppg lease water (down casing in pump-and-bleed operation)	Additional gas flow noted at surface Gas broke through at surface after 89 bbl of fluid pumped.	
#2 (November 13)	10 bbl of 9.4 ppg polymer pill 683 bbl of 9.4 ppg CaCl 10 bbl of 9.4 ppg polymer pill 3 bbl of 8.6 ppg brine water Maximum pump rate 8 bpm Maximum pump pressure 1,526 psi	Observed increased gas flow and liquid from fissures. Pony motor went down. Shut down pumping. Brine, oil, and gas flowing from fissures on pad. Well blew out in the conventional sense. Blowout vent opened 20 ft from wellbore, shooting debris 75 ft into the air.	No
#3 (November 15)	170 bbl of 9.4 ppg CaCl 19 bbl of 18 ppg barite pill 50 bbl of 9.4 ppg CaCl Maximum pump rate 8 bpm Maximum pump pressure 1,645 psi	Gas rate from fissures increased, followed by oil and brine. Flow from fissures stopped briefly and then began to flow gas.	No
#4 (November 18)	230 bbl of 9.4 ppg CaCl 35 bbl of 18 ppg barite pill 50 bbl of 9.4 ppg CaCl Maximum pump rate 9 bpm Maximum pump pressure 1,975 psi	Gas rate from fissures increased. Observed oil and brine from fissure. Barite to surface was reported.	No
#S (November 24)	50 bbl of 9.4 ppg GEO Zan pill 950 bbl of fresh water 35 bbl of 18 ppg barite pill 56 bbl of 9.4 ppg CaCl Maximum pump rate 13 bpm Maximum pump pressure 4,167 psi (Reported value. Telemetry system shows maximum tubing pressure of approximately 3,600 psi)	30ft x 10ft crater developed and gas rate increased. Recovered 700 bbl of fluid from location.	No
#6 (November 25)	50 bbl of 9.4 ppg GEO Zan LCM pill 910 bbl of fresh water 100 bbl of 9.4 ppg GEO Zan LCM pill 56 bbl of 9.4 ppg CaCl Maximum pump rate 13 bpm Maximum pump pressure 4,164 psi	Gas activity increased in crater. Water flow from crater increased. Flow line from 7 in. and tubing head broke. Nipple on wellhead broke. Pump line to 7 in. casing head broke. Cratering around the wellhead increased and damaged several casing valves. Tubing pressure went to zero, and then started increasing.	No

Kill Attempt & Date	Description	Results	Successful
#7 (December 22)	107 bbl of 15 ppg WBM 100 bbl of 15 ppg WBM with LCM 125 bbl of 15 ppg WBM Maximum pump rate 5.8 bpm Maximum pump pressure 1,157 psi (at start conditions)	Mud, oil mist in crater. Liquid began to come out of the casing at surface. Shut down due to rocking of wellhead and unloading mud from crater. Pump line to top tee broke off due to movement of wellhead. Tubing pressure went to zero, and then started increasing.	No

In Blade’s view, the first well kill attempt was a reasonable response because the extent of the failure in SS-25 was unknown.²⁷³ 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.²⁷⁴ Given that SoCalGas had no well kill control plans and there are no data indicating transient modeling -- any modeling -- or analysis conducted to design 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.

The Section 451 violation began November 13, 2015, the day SoCalGas unsuccessfully executed the second well kill attempt without modeling, and continued through February 11, 2016, the date of the successful relief well kill attempt. Because the second through sixth well kill attempts should have been successful with proper modeling, shareholders should be required to pay all expenses associated with each one. Also, because the relief well was started on December 4, 2015,²⁷⁵ after the second well kill attempt, the relief well would not have been needed had the second well kill attempt been properly modeled. As such, shareholders should be required to pay all expenses associated with the relief well. SoCalGas’s failure to provide well kill programs for relief

²⁷³ Blade Report at p. 148.

²⁷⁴ Blade Report at p. 226

²⁷⁵ Blade Report at p. 13.

well #2, well SS-25A and well SS-25B each constitute one violation of Section 451, for a total of three violations. Each of these violations span from November 13, 2015, the date SoCalGas unsuccessfully executed the second well kill attempt, to February 11, 2016, the date of the successful relief well kill attempt.

Because surface plumbing failures prevented the well from being kept filled and the wellhead and surface casing were structurally unstable by kill attempt 6,²⁷⁶ such damage appears to have resulted from the prior unsuccessful kill attempt, thereby compromising the ability of kill attempt 7 to kill the well and end the safety consequences of the SS-25 leak. According to Blade, pumping for kill attempt 7 was terminated due to rocking of the wellhead and a subsequent failure of the injection connection.²⁷⁷ In other words, the ability to succeed on the seventh kill attempt was impaired by at least certain of the prior unsuccessful kill attempts, which should have been successful. This is a violation of Section 451.

The apparent conservative start date of this violation is November 25, 2015, the date that well kill attempt #6 was made.²⁷⁸ This violation continued until February 11, 2016, the date of the successful relief well kill attempt.

6. SoCalGas did not employ reasonable understanding of the groundwater depths relative to the surface casing shoe and production casing of well SS-25, until two groundwater wells were drilled for RCA purposes after the October 23, 2015 incident at SS-25.

a) Groundwater Caused Corrosion on the Corrosion on the 7 Inch and 11 ¾ Inch Casings on SS-25

One of the direct causes for the uncontrolled release of hydrocarbons for 111 days from SS-25 was an axial rupture due to external microbial corrosion on the 7 inch casing

²⁷⁶ Blade Report at p. 151.

²⁷⁷ Blade Report at p. 151.

²⁷⁸ See Blade Report at pp. 144-146, Table 18.

outside diameter caused by the groundwater.²⁷⁹ Groundwater accessed the 11 ¾ inch x 7 inch annulus and provided an environment conducive to microbial corrosion.²⁸⁰

The shallow groundwater above 400 feet accessed the poorly cemented 11¾-inch surface casing and caused localized corrosion on the outside surface of that casing.²⁸¹ The Blade RCA Report found that both the 7 inch and 11 ¾ inch metal casings were corroding from the outside as a result of contact with groundwater.²⁸² This groundwater and microbes caused the corrosion.²⁸³

The RCA field investigation stated generally that surface runoff water permeates the ground and followed fractures and faults down to various depths.²⁸⁴ At the SS-9 well location, approximately 600 ft away from SS-25, Blade observed groundwater at depths above 400 ft and below 900 ft.²⁸⁵ Except for runoff water, there are no other sources of groundwater at Aliso Canyon.²⁸⁶

In the SS-25 well, groundwater displaced the original drilling fluid over a period of time and caused the 7-inch production casing to corrode from the outside.²⁸⁷ This groundwater and biological microbes caused the corrosion.²⁸⁸ The SS-25 casing corrosion area discovered 892 feet down the well by the RCA was 9.25 inches in length and contained grooves from tunnels created by the microbes that coalesced over a period

²⁷⁹ Blade Report at p. 4.

²⁸⁰ Blade Report at p. 4.

²⁸¹ Blade Report at p. 3.

²⁸² Blade Report at p. 3.

²⁸³ Blade Report at p. 3.

²⁸⁴ Blade Report at p. 3.

²⁸⁵ Blade Report at p. 3.

²⁸⁶ Blade Report at p. 3.

²⁸⁷ Blade Report at p. 3.

²⁸⁸ Blade Report at p. 3.

of time.²⁸⁹ The corrosion removed 85% of the wall thickness in a smaller patch of 2.13 inches within the larger 9.25-inch corroded region.²⁹⁰

The 7 inch production casing exhibited external corrosion on the outside diameter at depths higher than 700 feet.²⁹¹ For corrosion to occur, an aqueous environment had to be present in the annulus.²⁹² When SS-25 was constructed, the cementing operations displaced cement to 7,000 ft, leaving drilling fluid above the top of cement.²⁹³ This drilling fluid would have been the environment that existed behind the 7-inch production casing following construction.²⁹⁴ An assessment of the drilling records revealed the possible properties of the drilling fluid that were used in 1954.²⁹⁵ The fluid was water-based with some minor additions of oil.²⁹⁶ One of the main factors for corrosion is the pH of the drilling fluid; the higher the pH, the lower the corrosion rate.²⁹⁷ The pH was elevated, ranging from 10 to 12.5, which is normal for drilling fluid.²⁹⁸ Such an environment would not corrode the carbon steel.²⁹⁹ The outside diameter of the 7 inch production casing would not have exhibited outside diameter corrosion if the environment had remained the same as the drilling fluid.³⁰⁰

The fluid behind the 7-inch production casing had to be different than the original drilling fluid since there was corrosion on the production casing outside diameter surface.³⁰¹ Groundwater was the only feasible source of water that could have occupied

²⁸⁹ Blade Report at p. 3.

²⁹⁰ Blade Report at p. 3.

²⁹¹ Blade Report at p. 87.

²⁹² Blade Report at p. 87.

²⁹³ Blade Report at p. 87.

²⁹⁴ Blade Report at p. 87.

²⁹⁵ Blade Report at p. 87.

²⁹⁶ Blade Report at p. 87.

²⁹⁷ Blade Report at p. 87.

²⁹⁸ Blade Report at p. 87.

²⁹⁹ Blade Report at p. 87.

³⁰⁰ Blade Report at pp. 87-88.

³⁰¹ Blade Report at p. 88.

the space between the 7-inch production and 11³/₄-inch surfaces casing (7 x 11³/₄-inch annulus).³⁰² Similarly, groundwater is the only water source that could have caused the 11³/₄-inch casing outside diameter wall corrosion.³⁰³

In order to confirm the presence of groundwater, Blade requested SoCalGas to drill a borehole to 1,100 ft to locate possible water sources.³⁰⁴ The intent was to confirm the source of the water that may have impacted SS-25.³⁰⁵

Blade Figure 82 shows the elevation map around Aliso Canyon field, including SS-25.³⁰⁶ The source of groundwater was found in topographic contours between 2,354-2,496 feet above sea level.³⁰⁷ Precipitation that falls within these contours can be the only source of this water.³⁰⁸

Since precipitation is the source of groundwater, groundwater level should be related to precipitation level.³⁰⁹ First, groundwater level will vary within a given rain year.³¹⁰ The groundwater level will rise during the rainy period from December to March, reaching its highest level at the end of the rainy period in March.³¹¹ The groundwater will then fall during the dry period from March to November, reaching its lowest level at the beginning of the subsequent rainy period.³¹² In addition, groundwater level will also vary from year to year.³¹³ Consequently, the water level in the production casing annulus will rise and fall with the seasons and the extent of precipitation.³¹⁴

³⁰² Blade Report at p. 88.

³⁰³ Blade Report at p. 88.

³⁰⁴ Blade Report at p. 88.

³⁰⁵ Blade Report at p. 91.

³⁰⁶ Blade Report at p. 96.

³⁰⁷ Blade Report at p. 96.

³⁰⁸ Blade Report at p. 96.

³⁰⁹ Blade Report at p. 97.

³¹⁰ Blade Report at p. 97.

³¹¹ Blade Report at p. 97.

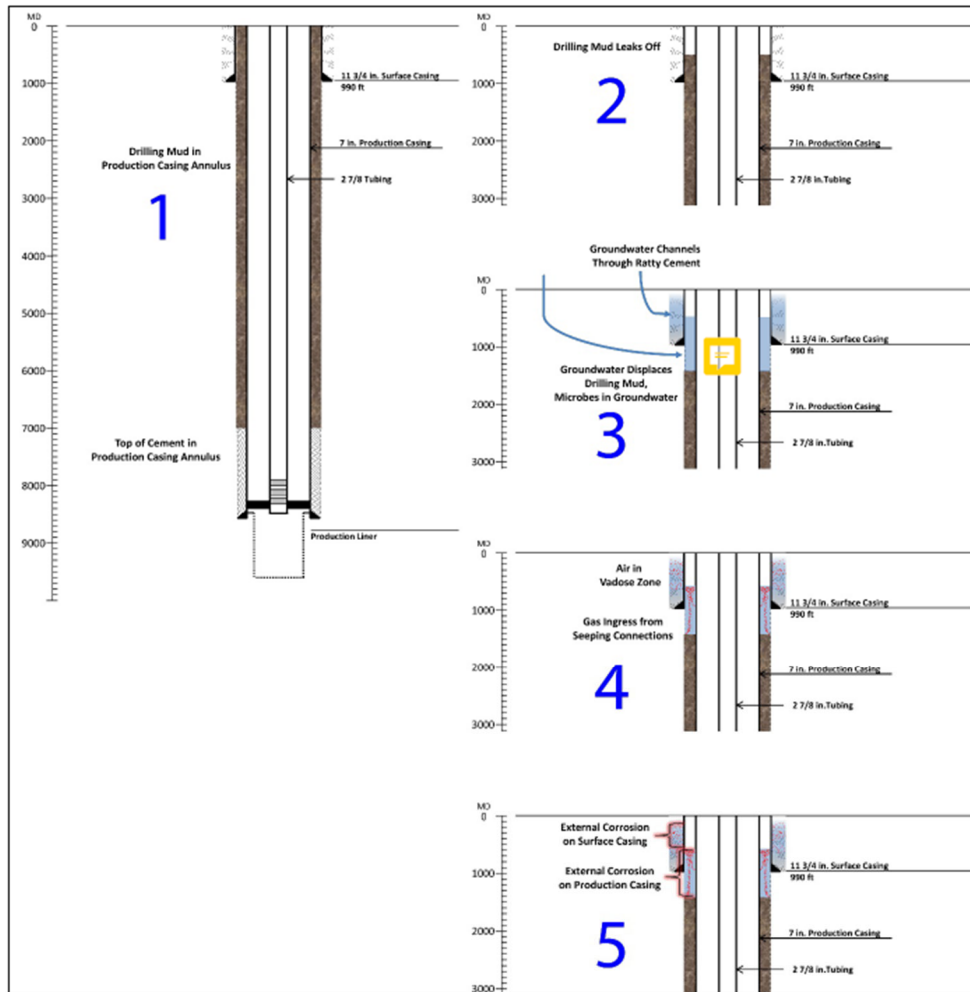
³¹² Blade Report at p. 97.

³¹³ Blade Report at p. 97.

³¹⁴ Blade Report at p. 98.

Further, the water level in the annulus would have been at its lowest during the period of the incident.³¹⁵

The groundwater resulting from run-off rainwater likely entered the annulus and replaced the drilling fluid over time; or mixed with the drilling fluid and the composition of the annulus fluid changed over time.³¹⁶ These are all possibilities, however, based on the evidence, the groundwater is ubiquitous and played a role in the external corrosion of the 7 inch casing.³¹⁷



³¹⁵ Blade Report at p. 98.

³¹⁶ Blade Report at p. 99.

³¹⁷ Blade Report at p. 99.

Figure 85 from RCA Report, shown above, is entitled “Likely Mechanism of Groundwater Ingress into the Surface Casing and Production Casing Annuli”.³¹⁸

By allowing groundwater to cause corrosion on the 7 inch and 11 ¾ inch casings on SS-25, SoCalGas violated Section 451. This violation begins on August 30, 1988, the date SoCalGas produced its Interoffice memo calling for inspections of the SS-25 casing,³¹⁹ and continues to October 23, 2015, the beginning date of the incident.

b) SoCalGas Did Not Assess the Relationship Between Groundwater In and Around the SS-25 Well Site, and The Surface Casing Corrosion of That Well.

Blade did not find any SoCalGas records that identified the location and nature of the groundwater in and around the SS-25 well site.³²⁰ Consequently, a correlation of the groundwater locations and the depth of surface casing shoes, and an assessment of the potential for surface casing corrosion were not done.³²¹ The possible corrosion risks to surface casings or production casings were unknown.³²² The corroded surface casing in SS-25 provided an easy pathway for gas to escape to the surface.³²³ There is substantial literature regarding groundwater, and in order to understand the hydrochemical nature of the water, it is necessary to understand the relation between the chemical character of the water, mineralogy of the environment, and circulation of the water.³²⁴

³¹⁸ Blade Report at p. 100.

³¹⁹ Blade Report at p. 218; Southern California Gas Company, "Candidate Wells for Casing Inspection, Aliso Canyon Field, Interoffice Correspondence, August 30, 1988 AC_CPUC_0000064-AC_CPUC_0000066 (SS-25 Well Documentation (from SoCalGas)_N.pdf at pp. 42-44)," 1988; SoCalGas Interoffice Correspondence, August 30, 1988 from D.R. Horstman to M.E. Melton, “Attached is a listing of all casing flow wells of 1940’s and 1950’s vintage currently in operation at the subject field. It is recommended that casing inspection surveys (vertilogs) be run to determine the mechanical condition of each well casing. In addition, each well should be pressure tested to identify any leaks at the casing collars. The wells included on the attached list are prioritized based upon deliverability, operational history, and the length of time since their last workover.”

³²⁰ Blade Report at p. 239.

³²¹ Blade Report at p. 239.

³²² Blade Report at p. 239.

³²³ Blade Report at p. 239.

³²⁴ Blade Report at p. 91.

SoCalGas's failure to assess the relationship between groundwater in and around the SS-25 wellsite, and the surface casing corrosion of that well on SS-25 constitute a violation of Section 451. This violation begins on August 30, 1988, the date SoCalGas produced its Interoffice Memo calling for inspections of the SS-25 casing,³²⁵ and continues to October 23, 2015, the beginning date of the incident.

7. SoCalGas did not have systematic practices to protect surface casing strings against external corrosion.³²⁶ Therefore, SoCalGas did not employ proper understanding of the consequences of corroded surface casings and uncemented production casings.³²⁷

During the RCA Investigation Phase 3 evaluation of the condition of the 11 ¾-inch surface casing, holes in the casing were found between 134 feet and 300 feet.³²⁸ These holes were caused by the escaping gas pressure following external corrosion because the casing was neither fully cemented nor cathodically protected leaving the casing exposed to an environment conducive to corrosion.³²⁹ Cathodic protection systems are commonly used to protect pipelines from corrosion and are sometimes used on well surface casing strings.³³⁰ A cathodic protection system would have provided corrosion protection to the 11 ¾-inch casing,³³¹ but would not have protected the 7 inch casing inside the 11 ¾ inch casing.³³²

³²⁵ Blade Report, p. 218; Southern California Gas Company, "Candidate Wells for Casing Inspection, Aliso Canyon Field, Interoffice Correspondence, August 30, 1988 AC_CPUC_0000064-AC_CPUC_0000066 (SS-25 Well Documentation (from SoCalGas) N.pdf at pp. 42-44)," 1988; SoCalGas Interoffice Correspondence, August 30, 1988 from D.R. Horstman to M.E. Melton.

³²⁶ Blade Report at p. 5

³²⁷ Blade Report at p. 5.

³²⁸ Blade Report at p. 226.

³²⁹ Blade Report at p. 226.

³³⁰ Blade Report at p. 215.

³³¹ Blade Report at p. 215.

³³² Blade Report at p. 215.

The presence of bonded cement outside of the 7 inch casing would have mitigated external corrosion.³³³ However, there was no cement around the 7 inch casing at 892 feet, because when the well was originally drilled, the cement around the 7 inch casing was intentionally brought up to 7,000 feet and not to surface.³³⁴

Surface casing cathodic protection had been applied to five other wells at Aliso Canyon, but not to SS-25.³³⁵ The most common method for providing corrosion protection for casing strings is to manage the environment or to modify the casing metallurgy.³³⁶

A SoCalGas Interoffice correspondence dated August 20, 1991,³³⁷ discussed an 8-5/8-inch casing inspection log showing metal loss and a corrosion protection log run in FF-34A.³³⁸ A recommendation was made to equip FF-34A with cathodic protection (CP).³³⁹ CP was implemented in FF-34A and four other wells according to SoCalGas in response to a February 18, 2018, information request.³⁴⁰ The document also states that:

...The possible regional external casing corrosion problem in the southeastern portion of the field will be further studied and a report issued. Additional investigation of well histories and well logs is required before a recommendation can be made as to whether regional CP is necessary. While casing inspection logs show shallow (1000 feet to 3000 feet ELM), casing metal loss in FF-35C, MA-1A and MA-5A, there is not enough evidence to substantiate a regional corrosion problem....³⁴¹

³³³ Blade Report at p. 215.

³³⁴ Blade Report at p. 215.

³³⁵ Blade Report at p. 226.

³³⁶ Blade Report at p. 215.

³³⁷ Blade Report at p. 173.

³³⁸ Blade Report at p. 173.

³³⁹ Blade Report at p. 173.

³⁴⁰ Blade Report at p. 173.

³⁴¹ Blade Report at p. 173, citing Attachment 7001-AC_CPUC_0022179; Southern California Gas Company Interoffice Correspondence, "FF-34A Casing Corrosion, Aliso Canyon", August 20, 1991, AC_BLD_0033271 (FF-34A Well Documentation from SoCal.pdf at p. 183)," 1991.

In the data provided, Blade was not able to find documentation with results of the proposed study or if the study was done or not.³⁴² Also, the FF-34A Well File mentioned that the possible external casing corrosion problem in the southeastern portion of the field was to be further studied and a report issued,³⁴³ but Blade was not able to locate any documentation related to this study.³⁴⁴

SoCalGas violated Section 451 because it did not have systematic practice to protect surface casing strings against external corrosion,³⁴⁵ and because it did not understand the consequences of corroded surface casings and uncemented production casings.³⁴⁶ This violation begins on August 30, 1988, the date SoCalGas produced its Interoffice Memo calling for inspections of the SS-25 casing,³⁴⁷ and continues to October 23, 2015, the beginning date of the incident.

8. SoCalGas lacked a real-time, continuous pressure monitoring system for well surveillance, which prevented an immediate identification of the SS-25 leak and accurate estimation of the gas flow rate.³⁴⁸

On October 23, 2015, the SS-25 well went back on injection between 3 AM and 4 AM.³⁴⁹ The SS-25 axial rupture likely occurred after injection had started.³⁵⁰ At the time

³⁴² Blade Report at pp. 173, 203.

³⁴³ Blade Report at p. 2.

³⁴⁴ Blade Report at p. 2.

³⁴⁵ Blade Report at p. 5.

³⁴⁶ Blade Report at p. 5.

³⁴⁷ Blade Report at p. 218; Southern California Gas Company, "Candidate Wells for Casing Inspection, Aliso Canyon Field, Interoffice Correspondence, August 30, 1988 AC_CPUC_0000064_AC_CPUC_0000066 (SS-25 Well Documentation (from SoCalGas) N.pdf at pp. 42-44)," 1988; SoCalGas Interoffice Correspondence, August 30, 1988 from D.R. Horstman to M.E. Melton, "Attached is a listing of all casing flow wells of 1940's and 1950's vintage currently in operation at the subject field. It is recommended that casing inspection surveys (vertilogs) be run to determine the mechanical condition of each well casing. In addition, each well should be pressure tested to identify any leaks at the casing collars. The wells included on the attached list are prioritized based upon deliverability, operational history, and the length of time since their last workover."

³⁴⁸ Blade Report at p. 5.

³⁴⁹ Blade Report at p. 158.

³⁵⁰ Blade Report at p. 158.

of failure, SS-25 was injecting gas into the reservoir.³⁵¹ The subsequent circumferential parting occurred between 7 AM and 8 AM the same day.³⁵²

Upon failure, the initial leak rate was 160 million standard cubic feet per day (MMscf/D).³⁵³ 90 MMscf/D from this rate originated from the gas storage reservoir, and the remaining 70 MMscf/D originated from the injection network.³⁵⁴

The injection network was capable of supplying this additional gas rate to SS-25.³⁵⁵ The pressure changes, as the injection network readjusted to supply this additional gas rate to SS-25, were too small to be detected in real time with the surveillance system in operation at the time.³⁵⁶ To detect the failure in real time, a surveillance system would have had to be monitoring wellhead injection pressures between the chokes and wellheads.³⁵⁷

The lack of real-time pressure measurements prevented the immediate identification of the SS-25 7-inch casing failure.³⁵⁸ The constant monitoring of the tubing, production casing and surface casing pressures will provide better insight into operational deviations in all wells.³⁵⁹ If this type of system had been installed on SS-25, it would have provided insight into the time of the leak, the opportunity to shut in the well immediately, size of the leak, and the extent of the problem.³⁶⁰ Furthermore, the information could have used during well-control effort improving the chances of an early success.³⁶¹

³⁵¹ Blade Report at p. 158.

³⁵² Blade Report at p. 158.

³⁵³ Blade Report at p. 158.

³⁵⁴ Blade Report at p. 158.

³⁵⁵ Blade Report at p. 158.

³⁵⁶ Blade Report at p. 158.

³⁵⁷ Blade Report at p. 158.

³⁵⁸ Blade Report at p. 233.

³⁵⁹ Blade Report at p. 233.

³⁶⁰ Blade Report at p. 233.

³⁶¹ Blade Report at p. 233.

The existing field and SS-25 well measurements were used by Blade after the event to analyze the leak.³⁶² Such measurements could have been analyzed before and during the leak event with models built from data available before the leak.³⁶³

The most recent SS-25 pressure survey occurred on October 21, 2014, to 8,720 feet.³⁶⁴ Blade's interpretation of the pressure surveys is that they were not effective in determining the presence or location of a casing leak; small leaks would go undetected.³⁶⁵ From a casing integrity perspective, pressure surveys differ from pressure tests substantially.³⁶⁶ In pressure surveys, the well is open to the storage zone, and any gas that escapes into a casing leak is replenished by the storage zone.³⁶⁷ This is considerably different than a pressure test where all external sources of pressure are isolated.³⁶⁸ Additionally, the pressures observed during these pressure surveys are the shut-in pressures.³⁶⁹ The pressure profiles during shut-in are lower than during standard gas injection operations.³⁷⁰ In other words, pressure surveys are taken at times when the casing is under less pressure than during gas injection.³⁷¹

SoCalGas operated Aliso Canyon facility according to a number of Company Operations Standards.³⁷² These standards provided policy and scope, definitions, responsibility, and procedures that are required to operate the facility on a day to day basis.³⁷³ An example standard is titled Gas Inventory – Monitoring, Verification and

³⁶² Blade Report at p. 127.

³⁶³ Blade Report at p. 127.

³⁶⁴ Blade Report at pp. 199-200.

³⁶⁵ Blade Report at p. 199.

³⁶⁶ Blade Report at p. 199.

³⁶⁷ Blade Report at p. 199.

³⁶⁸ Blade Report at p. 199.

³⁶⁹ Blade Report at p. 199.

³⁷⁰ Blade Report at p. 199.

³⁷¹ Blade Report at p. 199.

³⁷² Blade Report at p. 202.

³⁷³ Blade Report at p. 202.

Reporting.³⁷⁴ Blade’s interpretation is that SoCalGas complied with the monitoring components of the Operations Standard titled Gas Inventory – Monitoring, Verification and Reporting.³⁷⁵ Blade also reviewed SS-25 noise, temperature, and pressure surveys before the incident of October 23, 2015.³⁷⁶ Additionally, there were no physical observations from well inspections and weekly pressure measurements that indicated an existing problem.³⁷⁷

Figure 169 of the Blade Report, shows the Summary of the Aliso Canyon Monitoring Plan for Storage Zone Wells from the SoCalGas Annual Review Meeting with DOGGR, 1989.³⁷⁸ The components and frequency of the monitoring plan are listed in Figure 169, but none of them require a real time collection of data.³⁷⁹ Industry technology has evolved for real time pressure, temperature, flow, and vibration (noise) monitoring but, surprisingly, there were *no* significant differences in the monitoring plan from 1989 compared to the 2014 SCG 224.070 Operations Standard.³⁸⁰ These documents fail to mention casing inspection logs, pressure testing wells, real time pressure monitoring, investigation of leaks, and RCA.³⁸¹

SoCalGas violated Section 451 by not having a continuous pressure monitoring system for well surveillance because it prevented an immediate identification of the SS-25 leak and accurate estimation of the gas flow rate. This violation lasted from October 23, 2015 to February 12, 2016, the duration of the incident.

³⁷⁴ Blade Report at p. 202.

³⁷⁵ Blade Report at p. 202.

³⁷⁶ Blade Report at p. 202.

³⁷⁷ Blade Report at p. 202.

³⁷⁸ Blade Report at p. A-3.

³⁷⁹ Blade Report at p. A-4. See Column entitled “Minimum Frequency of Data Collection”. None of the entries under this column require collection of data real time. Instead, each shows a less frequent requirement for data collection.

³⁸⁰ Blade Report at p. A-3. Emphasis in original.

³⁸¹ Blade Report at p. A-4.

C. Additional Violations

1. SoCalGas Knew that SS-25 Released Both Crude Oil and Natural Gas During the Aliso Canyon Natural Gas Storage Incident, But Did Not Disclose This Fact to the Los Angeles County Department of Public Health

According to a letter from the Los Angeles County Department of Public Health Deputy Director for Health Protection to SoCalGas’s Chief Executive Officer, SoCalGas did not disclose to the Department of Public Health that the natural gas released from October 23, 2015 to February 12, 2016 contained crude oil, thereby impairing the Department of Public Health’s ability to timely study the associated health impacts.

This letter, dated March 11, 2019, noted that SoCalGas repeatedly stated during the disaster that the contents of the release were limited only to typical components of stored natural gas, despite the massive quantity of natural gas released from October 23, 2015 through February 2016 containing crude oil. The letter also pointed out that in November 2015, Public Health recommended a complete characterization of air quality using an expanded list of chemicals found in both crude oil and natural gas, but the testing was severely limited and delayed. At that time, the letter provides, SoCalGas knew that crude oil was contained in the natural gas but withheld this information from Public Health.³⁸²

SoCalGas responded to the Department of Public Health ³⁸³ asserting “For all the above reasons, your suggestion that SoCalGas somehow withheld information or was otherwise not fully transparent with respect to the components of natural gas released

³⁸² See Attachment U, Letter from Mr. Angelo J. Bellomo, MS, REHS, QEP, Deputy Director for Health Protection of Los Angeles County Department of Public Health to Mr. Brett Lane, Chief Executive Officer, Southern California Gas Company, entitled, “ALISO CANYON NATURAL GAS DISASTER FOLLOW-UP REQUEST FOR CRITICAL DATA ELEMENTS”, March 11, 2019. Currently available at: https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/News_Room/NewsUpdates/2019/Aliso%20Canyon%20Facility.pdf.

³⁸³ See Attachment V, *Available at*: https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/News_Room/NewsUpdates/2019/Letter-to-Angelo-J-Bellomo-2019-03-21-1.pdf.

during the incident, and your statements concerning DPH’s ability to perform a health assessment, are simply incorrect.”³⁸⁴

The statements in the Los Angeles County Department of Public Health Letter and statements related to that letter identify SoCalGas’s failure to furnish reasonable service, instrumentalities, equipment and facilities as are necessary to promote the health of its patrons, employees, and the public, and constitute at least one violation of Section 451. At a minimum, this violation begins at least as early as November 2015, when “SoCalGas knew that crude oil was contained in the natural gas but withheld this information from Public Health,”³⁸⁵ and continues until at least February 12, 2016, because SoCalGas “repeatedly stated during the disaster that the contents of the release were limited only to typical components of stored natural gas” through that date. These dates and the precise nature of this violation may be modified pending additional testimony from intervening parties to this proceeding with expertise in public health.

2. In Multiple Instances, SoCalGas Did Not Cooperate with SED During Its Pre-Formal Investigation Following the Incident on Aliso Well SS-25 that Began on October 23, 2015

The Assigned Commissioner’s Scoping Memo and Ruling (Scoping Memo) asks, “Did SoCalGas cooperate sufficiently with SED and Blade during the pre-formal investigation that preceded the issuance of the OII/OSC?”³⁸⁶ As shown by the list of examples below, SoCalGas has not cooperated with SED’s investigation. Each example constitutes a violation of Section 451 because it impaired SED’s ability to investigate SoCalGas’s practices related to the safe operation of the Aliso Canyon Storage Facility, as it relates to the incident at SS-25. Where identified in the examples, the lack of cooperation also constitutes a violation of Commission Rule of Practice and Procedure Rule 1.1.

³⁸⁴ See Attachment V, *Available at*: https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/News_Room/NewsUpdates/2019/Letter-to-Angelo-J-Bellomo-2019-03-21-1.pdf.

³⁸⁵ Attachment U at p. 2.

³⁸⁶ I.19-06-016, Assigned Commissioner’s Scoping Memo and Ruling at p. 4, Question 3.

a) **Example 1: SoCalGas Did Not Completely Answer the Discovery of the Aliso Root Cause Analysis Consultants, Blade Energy Partners, and Then Provided a Data Dump As a Supplement These Incomplete Responses Up to Three Years Later, and Weeks Before Blade’s Announced Release Date of Its Root Cause Analysis**

On March 15, 2019, Blade Energy Partners (Blade) was required to move its estimated RCA date from March 31, 2019 to May 1, 2019.³⁸⁷ As stated by Blade in explanation of the move.³⁸⁸

Just prior to the week of February 27, 2019 SoCal Gas, for the first time, informed Blade that it was supplementing its data responses to certain Blade data requests that Blade issued as part of its RCA, all of which were previously thought to be complete. The original dates of these Blade data requests were Jan 31, 2016, Feb 19, 2016, April 7, 2016, and Feb 18, 2018.

On March 1, 2019 and March 6, 2019 Blade received over 25,000 Bates numbered pages along with electronic files for these 2016-2018 data requests.

Blade is currently reviewing this massive set of data to determine if it significantly impacts the RCA.

The Safety and Enforcement Division is investigating SoCal Gas’s timing and practices related to this significant data dump on Blade.

In reaction to Blade’s statement, on March 19, 2019, the Commission’s Executive Director provided a letter to SoCalGas’s Chief Executive Officer which stated in part,

I am writing regarding the Southern California Gas Company’s (SoCalGas) March 1 and 6, 2019 supplemental data dump on Blade Energy Partners (Blade). .On March 1 and 6 of this year, SoCalGas surprised Blade with

³⁸⁷ See

https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/News_Room/NewsUpdates/2019/RCA%20timeline%20CPUC%20website.pdf; “Blade Energy Partner’s Root Cause Analysis (RCA) – Updated Schedule (3/15/19).

³⁸⁸ See

https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/News_Room/NewsUpdates/2019/RCA%20timeline%20CPUC%20website.pdf; “Blade Energy Partner’s Root Cause Analysis (RCA) – Updated Schedule (3/15/19).

over 25,000 pages of data, plus additional electronic files in Excel and other formats. This data dump is allegedly a supplemental data response to questions submitted by Blade to SoCalGas in 2016 and 2018. As SoCalGas was aware, Blade intended to release its RCA of the failure of SS-25 by the end of this month. I am particularly shocked and concerned that SoCalGas would dump these additional 25,000 pages plus of documents and cause delay in the analysis of the well failure. Due to the size and extreme tardiness of SoCalGas's data dump, Blade's RCA will now be delayed as Blade attempts to review, digest, and analyze this new information for purposes of producing its report. . .

SoCalGas's lack of cooperation impaired Blade's ability to deliver a complete RCA in a timely fashion.³⁸⁹ Each of the four data dumps constitutes its own separate violation of Section 451. Out of an abundance of caution, the beginning date for each violation should not start until two calendar months after Blade issued each data request. The end date of each violation is March 1, 2019, the first of SoCalGas's supplemental data dumps. In short, the violation dates are:

- Violation 1: March 31, 2016 to March 1, 2019.
- Violation 2: April 18, 2016 to March 1, 2019.
- Violation 3: June 7, 2016 to March 1, 2019.
- Violation 4: April 7, 2016 to March 1, 2019.

³⁸⁹ Letter from Ms. Alice Stebbins, California Public Utilities Commission's Executive Director, to Mr. Bret Lane, SoCalGas Chief Executive Officer, entitled, "Failure of Southern California Gas Company (SoCalGas) to Timely Provide Data to Blade Energy Partners and Request to Modify the Existing Injection and Withdrawal Protocols at Aliso", March 19, 2019.

b) Example 2: Despite SED’s Subpoenas to Do So, SoCalGas Did Not Produce Boots and Coots’s Team Lead Well Kill Specialist, and Another Boots & Coots Safety Representative, Both of Whom Were Onsite for Certain of the Boots & Coots Efforts to Kill Well SS-25, for SED to Examine Under Oath

On July 11, 2018, SED issued a letter to SoCalGas entitled, “Memorialization of Southern California Gas Company’s (SoCalGas) Failure to Cooperate with Safety and Enforcement Division (SED) in SED’s Preliminary Investigation”. In this letter, SED’s director stated,

I have been informed that SoCalGas is not producing certain of its own contractors for SED to examine under oath, even though SED has requested that SoCalGas produce them to appear at the California Public Utilities Commission (Commission) headquarters in San Francisco, CA. Specifically, SED has requested SoCalGas produced its contractors from Halliburton’s subsidiary, Boots and Coots, that were hired as part of SoCalGas’s efforts to kill well SS-25. In response to SED’s request, SED’s counsel learned from SoCalGas’s counsel on or about the week of June 18, 2018 that SoCalGas would produce only one of these contractors to talk with SED investigators and attorneys, either by phone, or in Houston.³⁹⁰

By not producing all of these requested individuals in person at the Commission headquarters, SoCalGas is not cooperating with SED’s direction in this preliminary investigation. . .³⁹¹

SED’s letter continued,

SED puts SoCalGas on notice that it is formally requesting SoCalGas produce at the Commission headquarters in San Francisco the following individuals from Boots and Coots:

³⁹⁰ Letter from Ms. Elizaveta Malashenko, Director, Safety and Enforcement Division, CPUC, to Mr. Bret Lane, President and Chief Operating Officers, Southern California Gas Company, dated July 11, 2018.

³⁹¹ Letter from Ms. Elizaveta Malashenko, Director, Safety and Enforcement Division, CPUC, to Mr. Bret Lane, President and Chief Operating Officers, Southern California Gas Company, dated July 11, 2018 at p. 1.

Danny Clayton
Danny Walzel
James Kopecky
Mike Baggett³⁹²

On July 13, 2018, SED served four subpoenas on SoCalGas, each requiring that SoCalGas produce an individual who worked for Boots & Coots.³⁹³ Thus, in total, the subpoenas required SoCalGas to produce four individuals on August 8th and 9th, 2018.³⁹⁴ With the exception of the name, which was specific to each subpoena, in each of these subpoenas, SED attested as follows:

[Name of subpoenaed individual-Mr. Clayton, Baggett, Walzel or Kopecky] of Boot & Coots Services, a division of Halliburton, may have important information that would help the CPUC as it investigates the cause of the Aliso Canyon gas leak. The CPUC understands that Mr. [Clayton, Baggett, Walzel, or Kopecky] is/was an agent of the Southern California Gas Company and was present at the Aliso Canyon facility in or around November 2015 and the ensuing days, and was actively involved in attempting to “kill” the leaking well.³⁹⁵

Also, on July 13, SoCalGas responded to SED with a letter entitled, “Southern California Gas Company’s Response to California Public Utilities Commission Letter dated July 11, 2018”. The letter stated in part,

I am writing on behalf of Southern California Gas Company (“SoCalGas”) in response to Ms. Malashenko’s letter dated July 11, 2018 regarding SoCalGas’ purported failure to

³⁹² Letter from Ms. Elizaveta Malashenko, Director, Safety and Enforcement Division, CPUC, to Mr. Bret Lane, President and Chief Operating Officers, Southern California Gas Company, dated July 11, 2018 at p. 3.

³⁹³ See Attachments C, D, E, and F. These documents are subpoenas for the appearance of Danny Clayton, Mike Bagget, Danny Walzel, and James Kopecky, respectively. The date of service is shown on the proof of service in each subpoena.

³⁹⁴ See subpoenas for the appearance of Danny Clayton, Mike Bagget, Danny Walzel, and James Kopecky, respectively.

³⁹⁵ See subpoenas for the appearance of Danny Clayton, Mike Bagget, Danny Walzel, and James Kopecky, respectively. Declaration in Support of the Subpoena, point 5.

cooperate with the Safety and Enforcement Division’s (“SED”) Preliminary Investigation.

First and foremost, SoCalGas has at all times cooperated—and will continue to cooperate—with SED’s investigation of the SS-25 gas leak. However, as SoCalGas has previously stated, it is legally unable to produce current and former employees of an independent, out-of-state, third-party corporation for examination before SED at the California Public Utilities Commission (“Commission”) in San Francisco.³⁹⁶

SoCalGas has cooperated to the best of its ability with SED’s request for an interview with Boots & Coots through discussions with Halliburton, Boots & Coots’ parent corporation. SoCalGas has in fact obtained Halliburton’s agreement to produce Boots & Coots personnel for such an interview. SoCalGas has also provided SED with contact information for Halliburton’s outside counsel and worked diligently to produce non-privileged information in its custody, control or possession related to Boots & Coots’ work regarding the gas leak. In fact, Halliburton has agreed that its current employees can be interviewed via phone, video conference or in person in Houston by the Commission. . .

Unlike its own currently employed employees, which SoCalGas can and must produce for SED examinations under oath (and has, in fact, done multiple times in connection with the SS-25 gas leak, including producing on short notice its President and Chief Operating Officer), SoCalGas cannot order Boots & Coots’ personnel to follow SoCalGas directives. Again, SoCalGas has asked for Boots & Coots’ cooperation and Boots & Coots has offered it, albeit not in precisely the manner that SED prefers. There is nothing else SoCalGas can do to compel Boots & Coots’ employees or former employees to fly to California to appear for an interview. . .

Next, SED contends that because SoCalGas has asserted a (limited) agency relationship with Boots & Coots, during a

³⁹⁶ Letter from SoCalGas Assistant General Counsel, Sabina Clorfeine, to SED counsels, Messrs. Nicholas Sher and Darryl Gruen, entitled, “Southern California Gas Company’s Response to California Public Utilities Commission Letter dated July 11, 2018. footnote 1 stated, “Other than Halliburton’s limited provision of services to SoCalGas as an independent contractor, SoCalGas and Halliburton are currently unaffiliated. SoCalGas does not own and holds no interest in Halliburton or any of its subsidiaries, and vice-versa.”

limited period of time, for the purposes of preserving privilege over certain communications, SoCalGas must ipso facto be required to produce Boots & Coots under section 702 [of the California Public Utilities Code]. The fact that Boots & Coots may be deemed SoCalGas' agent, during a limited period of time, for the limited purpose of assessing attorney-client privilege does not, however, make Boots & Coots SoCalGas' agent in other contexts. That does not change the fact that the two Boots & Coots employees requested by SED were, at all times during the incident, employees of Boots & Coots which was acting as an independent contractor to SoCalGas under a separate contractual agreement.

Contrary to your claim that SoCalGas is trying to "evade[]" SED's investigation and discovery rights" by delegating work to contractors, SoCalGas has in fact cooperated fully with SED's request and arranged for SED to interview Boots & Coots, albeit not on SED's preferred terms. In addition, there is nothing that prevents SED from exercising its own authority to subpoena Boots & Coots directly.

Because SoCalGas has in fact cooperated with SED's request and obtained Halliburton's agreement to submit to an SED interview, and for the other reasons stated above, SoCalGas respectfully requests that SED withdraw its letter.³⁹⁷

SoCalGas's contract with Boots & Coots to do the well kill did not include a provision that required Boots & Coots to subject itself to the same provisions to cooperate with SED's pre-formal investigation that SoCalGas itself was required to follow.³⁹⁸

On August, 8, 2018, SoCalGas produced only two of the four subpoenaed Boots and Coots Services employees to be examined under oath by SED.³⁹⁹ The two individuals who appeared testified that a third subpoenaed individual who did not appear, Ms. Danny Clayton, was a senior well control specialist who joined Messrs. Walzel and

³⁹⁷ Letter from SoCalGas Assistant General Counsel, Sabina Clorfeine, to SED counsels, Messrs. Nicholas Sher and Darryl Gruen, entitled, "Southern California Gas Company's Response to California Public Utilities Commission Letter dated July 11, 2018.

³⁹⁸ Southern California Gas Company Standard Services Agreement (Agreement 5660044243), Project Standard Senson (Sic) 25, October 30, 2015. (SoCalGas and Boots and Coots Well Kill Agreement).

³⁹⁹ Examination Under Oath Transcript (Tr.) of Danny Walzel and James Kopecky at pp. 1, 5:10-17.

Kopeccky on a visit to the site.⁴⁰⁰ Mr. Clayton was also the team leader of Messrs. Walzel and Kopeccky.⁴⁰¹ They also testified that the fourth individual, Mr. Mike Baggett, was the safety representative for Boots & Coots.⁴⁰²

As team lead, Mr. Clayton's role was to communicate with the client directly, and coordinated a plan with the client and then Messrs. Walzel and Kopeccky would execute the plan.⁴⁰³ As such, Mr. Clayton was the person to receive information from SoCalGas once Messrs. Walzel, Kopeccky and Clayton arrived in Los Angeles to begin work on the Aliso Canyon well SS-25.⁴⁰⁴ Mr. Clayton was the main liaison with Mr. Bret Lane of SoCalGas, and "he was in the trailer with him most of the day", and took over receiving information throughout the Aliso incident while both Messrs. Kopeccky and Walzel were on site.⁴⁰⁵ Messrs. Walzel and Kopeccky reported directly to Mr. Clayton, and Mr. Clayton was making the decision for Boots & Coots about how to move forward with input from the rest of the Boots & Coots team.⁴⁰⁶

Mr. Baggett stayed on site with Messrs. Kopeccky and Walzel for approximately one month.⁴⁰⁷ Mr. Baggett's main role was to look out after the Boots and Coots team, explain to SoCalGas if Boots & Coots is doing something in a way that might not be normal, and check people in and out of location and keep track of the personnel on location.⁴⁰⁸

Boots and Coots was under contract with SoCalGas to kill well SS-25.⁴⁰⁹ SED's review of that contract shows that SoCalGas did not provide a term in that contract that

⁴⁰⁰ EUO Tr. Walzel and Kopeccky at pp. 26:3 – 29:19.

⁴⁰¹ EUO Tr. Walzel and Kopeccky at p. 41:2-4.

⁴⁰² EUO Tr. Walzel and Kopeccky at p. 119:24-28.

⁴⁰³ EUO Tr. Walzel and Kopeccky at p. 80:10-16.

⁴⁰⁴ EUO Tr. Walzel and Kopeccky at pp. 134:1-7, 134:13-22.

⁴⁰⁵ EUO Tr. Walzel and Clayton at p. 130:8-12.

⁴⁰⁶ EUO Tr. Walzel and Kopeccky at pp. 80:18, 81:12.

⁴⁰⁷ EUO Tr. Walzel and Kopeccky at p. 120:20-26.

⁴⁰⁸ EUO Tr. Walzel and Kopeccky at p. 121:3-15.

⁴⁰⁹ Southern California Gas Company Standard Services Agreement (Agreement 5660044243), Project Standard Senson (Sic) 25, October 30, 2015. (SoCalGas and Boots and Coots Well Kill Agreement).

would require Boots and Coots to respond to investigation related inquiries from SED or from Blade.

SoCalGas's failure to produce Mr. Clayton and Mr. Bagget in response to an SED subpoena to do so constitutes two separate violations of Section 451. The beginning date for these violations is August 8, 2018, when neither of them appeared to be Examined Under Oath by SED. As SoCalGas has not produced either of these two individuals, the violation could reasonably continue, but SED will put an end date on the due date of this testimony, November 22, 2019.

c) Example 3: Despite SoCalGas Not Producing Boots & Coots's Team Lead Well Kill Specialist, It Refused to Provide Certain Communications Between SoCalGas and Boots & Coots, Including Some Between that Individual and SoCalGas's President and CEO, Claiming Them to Be Privileged As Attorney-Client Communications. SoCalGas Later Revealed Some of the Communications It Initially Claimed to Be Privileged by Attorney-Client Communications

On February 12, 2018, SED Data Request 16 Question 10 specifically asked of SoCalGas, "Please provide any and all communications relating to Aliso Canyon between SoCalGas and Boots and Coots for the time period October 1, 2015 – January 31, 2018."⁴¹⁰

On March 5, 2018, SoCalGas responded,

"SoCalGas objects to this request to the extent the response involves attorney-client privileged information and/or attorney work product." A list of the documents in response to this data request were not disclosed.⁴¹¹

Partly in response to data request 16, SED's July 11, 2018 letter to SoCalGas observed:

⁴¹⁰ SoCalGas' Supplemental Response Dated March 15, 2019 to Multiple SED Data Requests, Including Portions of Data Request 16 at p. 1. SED initially propounded Data Request 16 February 12, 2018.

⁴¹¹ SoCalGas' Supplemental Response Dated March 15, 2019 to Multiple SED Data Requests, Including Portions of Data Request 16 at p. 2. SED initially propounded Data Request 16 February 12, 2018.

SoCalGas has suggested an agency relationship with Boots & Coots via the attached privilege log (Attachment A), where it specifically asserted attorney-client privilege over multiple communications between SoCalGas and Boots and Coots personnel. Then, SoCalGas refused to produce some of those same Boots and Coots personnel for examination under oath on the basis that they were neither employees nor agents of SoCalGas.⁴¹²

SED specifically noted that “SoCalGas asserts attorney-client privilege-over communications between SoCalGas and Boots and Coots in entries 3, 5, 7, 9, 12, 13, 14, 16, 23, 29, 30, 53 and 54.”⁴¹³

As shown by this attorney-client log, several of these communications are between SoCalGas President and CEO, Mr. Bret Lane, and Mr. Clayton, the Boots & Coots team lead, and the same individual SoCalGas did not produce for examination under oath despite SED’s letter and subpoena to do so.⁴¹⁴

On January 3, 2019, SoCalGas supplemented its response to SED Data Request 16, stating:

As explained in response to Question 1 of SED Data Request 34, SoCalGas has agreed to withdraw its claim of privilege and produce certain additional documents that may be responsive to this Request. Without limiting or waiving any other objections asserted, SoCalGas provides the following Supplemental Response to Data Request 16: please see electronic documents with Bates Range AC_CPUC_SED_DR_16_0043471 – AC_CPUC_SED_DR_16_0043550 (continuous) and the following documents (non-continuous).⁴¹⁵

⁴¹² Letter from SoCalGas Assistant General Counsel, Sabina Clorfeine, to SED counsels, Messrs. Nicholas Sher and Darryl Gruen, entitled, “Southern California Gas Company’s Response to California Public Utilities Commission Letter dated July 11, 2018 at p. 2.

⁴¹³ Letter from SoCalGas Assistant General Counsel, Sabina Clorfeine, to SED counsels, Messrs. Nicholas Sher and Darryl Gruen, entitled, Southern California Gas Company’s Response to California Public Utilities Commission Letter dated July 11, 2018 at p. 2, fn. 3.

⁴¹⁴ SoCalGas Attorney-client privilege-log in response to SED Data Request 16. For example, see entries 3 and 5.

⁴¹⁵ SoCalGas’ Supplemental Response Dated March 15, 2019 to Multiple SED Data Requests, Including Portions of Data Request 16 at p. 2. SED initially propounded Data Request 16 February 12, 2018.

The continuous documents totaled 80 pages.⁴¹⁶ Making up the non-continuous documents, the response revealed 15 documents that had previously been marked attorney-client privilege-confidential.⁴¹⁷

On March 15, 2019, SoCalGas released its claim of privilege on a batch of additional documents, stating:

Pursuant to SoCalGas's email communication dated May 11, 2019, SoCalGas has agreed to withdraw its claim of privilege and produce certain additional documents that may be responsive to this Request. Without limiting or waiving any other objections asserted, SoCalGas provided the Supplemental Response to Data Request 16.⁴¹⁸ The Supplemental Response withdrew SoCalGas's privilege claims on certain documents, as described in the next two paragraphs.

By SED's count, approximately 18 additional documents were released.⁴¹⁹

Each of the 95 pages that SoCalGas did not release on the grounds of attorney-client or attorney work product privilege is a Section 451 violation because it delayed SED's ability to get this information as part of its pre-formal investigation. These also constitute separate violations of Commission Rule of Practice and Procedure Rule 1.1 because SoCalGas represented to SED that these items were protected by attorney-client or attorney work product privilege, when they were not. Each of these violations began March 5, 2018, the date SoCalGas asserted the privilege to January 3, 2019, the day SoCalGas finally released the documents to SED.

The 18 additional communications that SoCalGas did not release until May 11, 2019 each constitutes its own violation of Section 451 due to the delay it caused to SED's

⁴¹⁶ Bates number ending in 43550 minus Bates number ending in 43471 equals 80.

⁴¹⁷ See Attachment L-SoCalGas' Supplemental Response Dated March 15, 2019 to Multiple SED Data Requests, Including Portions of Data Request 16 at p. 2. SED initially propounded Data Request 16 February 12, 2018.

⁴¹⁸ SoCalGas' Supplemental Response Dated March 15, 2019 to Multiple SED Data Requests, Including Portions of Data Request 16, page 3. SED initially propounded Data Request 16 February 12, 2018.

⁴¹⁹ SoCalGas' Supplemental Response Dated March 15, 2019 to Multiple SED Data Requests, Including Portions of Data Request 16 at p. 3, showing Bates Number ranges. SED initially propounded Data Request 16 February 12, 2018.

ability to get this information as part of its pre-formal investigation. They also constituted a violation of Rule 1.1 on the grounds that SoCalGas represented to SED that these items were protected by attorney-client or attorney work product privilege, when they were not. Each of these violations began March 5, 2018, the date SoCalGas asserted the privilege to May 11, 2019, the day SoCalGas finally released the communications to SED.

d) Example 4: Blade Asked for Boots and Coots to Appear for Blade to Interview Them as Part of Blade’s Root Cause Analysis, But SoCalGas Failed to Produce Boots and Coots for This Purpose

On December 19, 2018, Blade requested of SoCalGas that Boots and Coots appear for questions.⁴²⁰ In response to Blade’s request, SoCalGas asked and re-asked Halliburton to produce Boots & Coots personnel to answer Blade’s questions related to the Root Cause Analysis (RCA) investigation,⁴²¹ reminding Halliburton that Blade’s RCA investigation was independent of SED’s.⁴²²

However, on January 24, 2019, Boots and Coots’s representative stated in part as follows:

As you know, Boots and Coots has been cooperative with the California Public Utilities Commission with respect to the investigation including taking employees to interviews in California at the CPUC to provide testimony in its investigation. Additionally, Boots and Coots has provided a number of documents responded to questions and provided a multitude of information related to its work at Aliso Canyon to California agencies and Southern California Gas.

After reviewing the further request for information and interviews from Blade, my client believes that it has provided

⁴²⁰ Request for Factual Data Verification Discussion December 19th, 2018-Boots and Coots.

⁴²¹ Email thread from SoCalGas outside counsel, James Dragna, to Halliburton’s counsel, Michael Helsley, January 7-8, 2019. See also Attachment Q, “Email Correspondence Between James Dragna (SoCalGas counsel) and Michael Helsley.

⁴²² Email thread between SoCalGas outside counsel, James Dragna, Halliburton’s counsels, Timothy Jones and Michael Helsley, January 25, 2019, and February 22, 2019.

all of the relevant information related to the Blade inquiry as mentioned above. . .

Based on the above, my client is not willing to provide any further information as requested by Blade in its letter.⁴²³

On February 21, SED wrote a letter memorializing SoCalGas's failure to cooperate with SED's Pre-formal investigation. SED's letter provided in part,

Moreover, the correspondence from SoCalGas to Halliburton is deficient. SoCalGas' act of generally encouraging Halliburton to cooperate with Blade's investigation is not the same thing as directly asking Halliburton to produce those individuals Blade requests and answering questions Blade has as part of the Root Cause Analysis (RCA). This much is apparent because of Boots & Coots' posture that it can cooperate and refuse to provide additional information at the same time.

Blade's RCA is part of the Commission's, and Division of Oil, Gas, and Geothermal Resources's (DOGGR) investigations, and Blade is performing its RCA work at the direction of the Commission and DOGGR. It remains our position that SoCalGas and its contractors both have the same duty to comply with the Public Utilities code provisions authorizing the Commission to do discovery. In this role, Blade's discovery rights apply to both SoCalGas' employees and its contractors. Failure to appropriately respond to discovery may result in sanctions.⁴²⁴

Because SoCalGas failed to contract in its Master Services Agreement with Halliburton and Boots and Coots in a fashion that explicitly required Boots and Coots to address inquiries from Blade in the fashion Blade requested, Boots and Coots did not respond to a direct request from Blade that was within the course of Blade's duties to perform its Root Cause Analysis. As such, SoCalGas's failure to contract in this fashion violated Section 451. The violation begins on January 24, 2019, the date the Boots & Coots representative refused to produce the Boots & Coots officials, and continues until May 19, 2019, the date of the release of the Blade Report.

⁴²³ Letter from Boots and Coots Counsel, Timothy Jones, to SoCalGas Outside Counsel, James Dragna, dated January 24, 2019.

⁴²⁴ Letter from SED Director Elizaveta Malashenko to SoCalGas Chief Executive Officer, Brett Lane, entitled, "Second Memorialization of Southern California Gas Company's (SoCalGas) Failure to Cooperate with Safety and Enforcement Division's (SED) Preliminary Investigation, February 21, 2019.

e) **Example 5: In Response to SED’s Question Asking Whether SoCalGas Disclosed to Non-SoCalGas Entities Anything that Would Reveal That SED Was Conducting EUO’s, SoCalGas Revealed that It Had Communicated with Counsel representing Pacific Gas and Electric Company and Counsel Representing Southern California Edison Company**

SED asked SoCalGas, “Have any personnel representing or working for Southern California Gas Company disclosed to others who do not work for Southern California Gas Company anything that would reveal that SED is conducting these EUO’s?”⁴²⁵

SoCalGas revealed in response to this data request that, “SoCalGas had conversations with counsel representing the Pacific Gas and Electric Company [PG&E] and counsel representing Southern California Edison Company [Edison] regarding legal principles related to the attendance of counsel at EUOs.”⁴²⁶

In the first SED Examination Under Oath, counsel for SoCalGas clarified, “Just a point for the record based on our off-the record-conversation. First, it’s our understanding that the transcript is and shall remain confidential.”⁴²⁷

SoCalGas’s discussions about the nature of the presence of counsel at SED’s EUO’s constitutes a violation of the understanding of SoCalGas counsel to keep the EUO contents confidential, which includes discussing with other utilities whether counsel was present for them. Revealing such information breached SoCalGas’s promise to treat the EUO transcripts confidential, and compromised the ability of SED to keep the contents of its safety-related pre-formal investigation confidential, thereby violating Section 451 on two counts; one for each of the two communications with PG&E’s and Edison’s counsel. In addition, by breaking its promise on the record to keep the contents of SED’s EUO confidential, SoCalGas violated Commission Rule of Practice and Procedure Rule 1.1.

⁴²⁵ SoCalGas Response to SED Data Request 23, Dated August 14, 2018.

⁴²⁶ SoCalGas Response to SED Data Request 23, Dated August 14, 2018 at p. 2.

⁴²⁷ EUO Tr. Bret Lane, January 24, 2018, at p. 10:27 – 11:3.

Each violation begins on August 14, 2018, the date that SoCalGas formally disclosed its breach of confidentiality until June 26, 2019, the date SED’s pre-formal investigation ended, and the day before the date that the Commission opened the instant proceeding.

f) Example 6: SoCalGas Intentionally Did Not Appear for a Deposition Despite of a Commission-Issued Subpoena Requiring It to Do So⁴²⁸

SoCalGas intentionally did not appear for a deposition by Safety and Enforcement Division on November 1st, 2019. This is shown by the transcripts of that deposition,⁴²⁹ and the email correspondence between SoCalGas’s and SED’s counsel (SoCalGas Intent to Not Appear for Deposition Email).⁴³⁰

As shown by the “SoCalGas Intent to Not Appear for Deposition Email”, SED clarified that:

. . . SoCalGas intends to file a motion to quash the subpoena for SoCalGas’s person or person(s) most knowledgeable related to the PHC transcripts pages 88-90 and related documents to appear at the Commission headquarters at 505 Van Ness Avenue. . . SoCalGas’s motion to quash is not sufficient to cancel the deposition. Short of the ALJ granting the motion to quash the subpoena, it is SED’s position that SoCalGas is still required to attend the deposition. Failure to do so will constitute another failure on SoCalGas’s part to cooperate with the investigation of Safety and Enforcement Division.”⁴³¹

In its response in the SoCalGas Intent to Not Appear for Deposition Email, SoCalGas stated,

SoCalGas has consistently cooperated with SED’s investigation and, in fact, that was the purpose of my call yesterday. I left you a courtesy voicemail letting you know that were filing our motion to quash today so

⁴²⁸ This example occurred during the OII; not the pre-formal investigation. However, SED was unaware that SoCalGas would continue to not cooperate during the OII.

⁴²⁹ Tr. Statement of Non-Appearance, November 1, 2019 at p. 3:5-28.

⁴³⁰ Email correspondence between SED Staff Counsel, Mr. Darryl Gruen, and SoCalGas Senior Counsel, Ms. Avisha Patel, dated October 30 and October 31, 2019. (SoCalGas Intent to Not Appear for Deposition Email.)

⁴³¹ SoCalGas Intent to Not Appear for Deposition Email.

that you could timely cancel the court reporter. . .To confirm your understanding: we are filing the motion to quash today and we will not be attending the deposition tomorrow.⁴³² (Emphasis added).

On October 22, 2019, SED timely served SoCalGas with a subpoena “to have the Person or Persons most knowledgeable at SoCalGas about SoCalGas’ allegations that SED’s “lead investigator” interfered with the RCA into the Aliso Gas leak, appear at the Commission’s offices at 505 Van Ness Avenue, San Francisco at 10:00 a.m. on November 1, 2019.”⁴³³

At SoCalGas’s request, SED met and conferred with SoCalGas once, and in response to SoCalGas’s request to meet again, agreed that SoCalGas could file its motion to quash.⁴³⁴

By intentionally not appearing at a deposition, SoCalGas impaired SED’s safety-related inquiries in the instant proceeding, thereby violating Section 451. This violation begins November 1, 2019, the date SoCalGas did not show up for the deposition. SED views this violation as not yet having an end date as of the publication of this testimony because SoCalGas has not yet remedied it.

3. SoCalGas Did Not Keep Complete, Accurate, or Accessible Records That Were Necessary for the Safe Operation and Maintenance of Its Wells at Aliso Canyon Natural Gas Storage Facility

On October 23, 2015, Well SS-25 at the SoCalGas Aliso Canyon Underground Storage Unit (Aliso Canyon Unit) failed. SoCalGas and its contractors were unable to kill (stop the release of gas) the well using industry standard methods. The well was ultimately killed 111 days later by drilling a relief well to the bottom of SS-25 and capping it there. During the ensuing time, about 6.6 BCF of natural gas were continuously released to the atmosphere, impacting local residents and the environment.

⁴³² SoCalGas Intent to Not Appear for Deposition Email.

⁴³³ Email from SED Counsel Nicholas Sher to SoCalGas Counsel Sabina Clorfeine providing service of subpoena, and attached subpoena.

⁴³⁴ Email Communication Between SED Counsel Nicholas Sher and SoCalGas Outside Counsel, Pejman Moshfegh, dates October 28, 2019 to October 29, 2019.

As identified in the Assigned Commissioner’s Scoping Memo and Ruling at page 4, issue number 4 raises a question that includes whether or not SoCalGas’s record keeping practices related to the Aliso Canyon Unit were imprudent and unreasonable and therefore violated Section 451. If so, the violations extended from 1973 through October 23, 2015.

SoCalGas failed to keep complete, accurate and accessible records for the Aliso Canyon Unit, which created an ongoing unsafe condition as evidenced by the failure of Well SS-25 and subsequent inability to kill the well in a timely manner. The following summary of a review of SoCalGas’s record keeping for Aliso Canyon Unit since it was acquired in the 1970’s reveals that SoCalGas failed to create and/or retain vital historical design, maintenance and operating records related to the Aliso Canyon Unit. This failure to maintain basic records led to the inability to maintain wells in safe conditions and to supply critical operating data in response to emergencies. The failure and inability to immediately kill Well SS-25 was the most visible and alarming result of SoCalGas’s inadequate record keeping. However, evidence also reveals a history of less publicly obvious well failures at the Aliso Canyon Unit that could have been prevented had SoCalGas kept and used better records to predict necessary maintenance to keep wells in safe operating condition. By SoCalGas’s own admission, it operated the Aliso Canyon Unit on a “reactive” basis, responding to failures rather than preventing them.⁴³⁵

Missing or lost records and unorganized records; an inherently unsafe practice.

Certain basic records are kept for producing oil and gas reservoirs,⁴³⁶ including operating underground gas storage units, which are depleted oil & gas reservoirs that are used by utilities to store natural gas.⁴³⁷ At minimum, these basic records should include original design, modifications to the design, construction, maintenance, inspection data, and

⁴³⁵ Blade Report at p. 182, referencing SoCalGas 2016 GRC Testimony.

⁴³⁶ Pub. Resources Code, §§ 3106, 3180, 3181, 3220 and 3403.5.

⁴³⁷ Aliso Canyon OII/OSC SED Opening Testimony Supporting Attachments, Bates SED 01369-01497, 2017_GasStorageRegulatoryConsiderations-reduce.pdf, p.24, 49-52, 76-77, 101-102. NOTE: While this document was published in 2017, it draws on industry standards to identify records that are typically retained for the life of the facility.

ongoing operational data. The SoCalGas Well File for SS-25 is missing some of these basic records and the records that are in the file are not organized and are combined with records from other wells. There is no index, although invoices and work tickets are in separate subfolders. SED assumes the Well File for SS-25 provided to SED is a complete copy of the SoCalGas Well File for SS-25.⁴³⁸

Well SS-25 was constructed by Tidewater Associated Oil Company in 1953. SoCalGas acquired the depleted Aliso Canyon gas reservoir in 1973 and converted existing wells to inject and withdraw natural gas for use in the utility system. SS-25 was one of the wells converted for this purpose. Minimal records for the original design, construction and testing of SS-25 as a production well were provided to SoCalGas at acquisition and are the oldest documents in the SoCalGas Well File for SS-25.⁴³⁹ SoCalGas continued to add documents to the original Well File, including records showing the conversion and testing of the well for natural gas injection and extraction as well as records for periodic temperature and pressure testing.⁴⁴⁰ There are few maintenance records,⁴⁴¹ no operational records, and no integrity inspection records. The records in the file are not organized in any recognizable fashion. SoCalGas' failure to retain Well SS-25 records and keep them organized in a way that is easily retrievable violates Section 451. Key records, including operating data, interoffice memos related to leaks, and technical reports appear to be missing from June 6, 1973 to October 23, 2015.

In the early 1970's SoCalGas drilled additional wells, including SS-25A (IW 69) and SS-25B (IW 77), both on the same site near SS-25. SoCalGas produced Well Files for these wells along with the Well File SS-25.⁴⁴² The significance of these files is that they contain record types, such as Interoffice Memos, handwritten field notes, analyses and reports that are not included in the SS-25 Well File. Because Wells SS-25A and SS-

⁴³⁸ SS-25 Well File, "Supporting Attachments" SED 01499.

⁴³⁹ SS-25 Well File, Supporting Attachments SED 01499; note: documents in Well File are chronological.

⁴⁴⁰ SS-25 Well File, Supporting Attachments SED 01519, 01523-01524, 1529-1541.

⁴⁴¹ SS-25 Well File, Supporting Attachments SED 01542, 1552, 1569-1573.

⁴⁴² SS-25A & SS-25B Well Files, Supporting Attachments SED 01768 and SED 01879.

25B share similar design to SS-25, are completed through similar geology because they are near each other on the same site, are exposed to the same gas extraction conditions and are exposed to similar groundwater conditions, one could expect the contents of the files to be similar. For instance, some records and incidents found in Well Files SS-25A and SS-25B would be relevant to the ongoing safe operation of Well SS-25.

Since SED does not know what records might have been created, but then lost, for Well SS-25, it looks to SoCalGas Well Files for SS-25, SS-25A (IW-69) AND SS-25B (IW-77) for examples of the types of records that might have existed in Well File SS-25 prior to October 23, 2015. In comparing the contents of these files, a striking finding is that SS-25 lacks inter-office memos, integrity investigations, logs, and inspection reports that should have been created between 1973-2015. Data in the SS-25 file reveals an ongoing detection of leaks at the bottom of the well. Although temperature and pressure records are in the file, there are no analyses of these records other than notes provided by contractors on the data records themselves, whereas the other Well Files include inter-office records by SoCalGas employees with analyses and recommendations for follow-up and, in some instances, reports.⁴⁴³

For instance, there was a finding of a shallow leak at 460 feet recorded in December 1991 in Well SS-25A, which is next to SS-25, yet no mention of this leak in the record for SS-25.⁴⁴⁴ The same leak was documented in a list of history of the well in 1993. In the same year, a repair was made to the 5 1/5 inch large tubing due to externally aligned pitting.⁴⁴⁵ In November 22, 1993, T.W. Schroeder wrote an inter-office memo to J.D. Mansdorfer requesting a rig to repair the shallow tubing leak as soon as possible.⁴⁴⁶ There is not an Interoffice memo or other correspondence regarding the pitting on the tubing. However, on November 29, 2010, a wellbore schematic for Well SS-25A summarizes repair work completed in August 2010 “Replaced 5 1/2” X 3 1/2”

⁴⁴³ SS-25 Well File, Supporting Attachments SED 01774-01778, 01804-018010, 01894-01895.

⁴⁴⁴ SS-25 Well File, Supporting Attachments SED, 01783-01789.

⁴⁴⁵ SS-25A Well File, Supporting Attachments SED. 01792, see notes on right of figure.

⁴⁴⁶ SS-25A Well File, Supporting Attachments SED 01783.

tubing string due to external corrosion in 3 ½ [inch]. Pulled leaking Pengo Patch. Ran USIT log. Installed a Homco casing patch (2970 [feet] – 3010 [feet]). Patch did not pressure test. Completed with 5 ½ [inch] X 3 ½ [inch] tubing.”⁴⁴⁷

Also, well patches were documented for SS-25A and SS-25B, but there was no mention of such, or the potential for one, in the Well File record for SS-25, even though there was an ongoing leak in well SS-25 documented in Temperature Surveys from the 1978 to the late 1990s.⁴⁴⁸ There is no mention of repair in Well File SS-25, so presumably this leak still existed at the time of the well failure in October 2015.

In the Well File for SS-25, there is data showing increasing casing erosion (from sand in the gas extracted at high velocity) over a period of years.⁴⁴⁹ However, these measurements were not continued into the 1990’s and beyond and the file contains no analysis or report regarding these findings. There are no documents showing inspection of the damage and no calculations for the remaining life of the damaged well pipe.

There is some reference in Well Files for SS-25A and SS-25B to repairs for external pitting and corrosion.⁴⁵⁰ These records would certainly have been relevant to the Well SS-25, which was exposed to similar environmental conditions. However, there is no mention of these problems in the Well File for SS-25. One would think that the similarity in design, construction, operation, maintenance and the fact that they are next to each other, completed in the same zones and exposed to the same external environments, would lead SoCalGas to share the information with those who would review the SS-25 Well File for purposes of managing that well. Yet no cross references are in the files.

⁴⁴⁷ SS-25A Well File, Supporting Attachments SED 01809.

⁴⁴⁸ SS-25 Well File, Supporting Attachments SED, *Examples:* 01686-01702, 01711-01713, 01639-01645, 01544-01545, 01554-01556, 01592-01594, 01621-01622, 01627-01631, 01636-01638. 01717-01719, 01606

⁴⁴⁹ SS-25 Well File, Supporting Attachments SED *Examples:* 01597, 01602, 01634 See also SS-25A, SED 01777-01780.

⁴⁵⁰ SS-25A and SS-25B Well Files, Supporting Attachments SED 01797, 01808.

The Well File for SS-25 is not kept in any particular order. Typically, such a file would be maintained in chronological order. However, as presented by SoCalGas, the file is only loosely chronological, with many duplicates and misfiled records. (For example, a drawing for construction of SS-25A appears as document number 19 in SoCalGas's SS-25 Well File.)⁴⁵¹ Generally, the file provided contains only original construction data, pressure and temperature test data, contractor tickets and invoices. No historical operational data is included, which seems odd. If one was looking for a specific record, it might be necessary to read through multiple sub-folders and a total of about 800 pages. At the end of the review, the information sought might well not be found, but it could exist in SS-25A or SS-25B Well Files. If this is the only data SoCalGas maintained for SS-25, SoCalGas was operating the well in the blind and unsafely.

Well File for SS-25A contains information that might have been useful to SoCalGas and its contractor in calculating the appropriate requirements to kill the well in October 2015 and thereafter. For example, the Permeability of the Aliso reservoir is in a record in that file.⁴⁵² In the SS-25A Well File, there is an example of a well kill that failed due to use of an incorrect bottomhole pressure.⁴⁵³ Other examples include the shallow leak on SS-25A and the formation of hydrates in an instance of leak repair, which may have been useful information.⁴⁵⁴ These records were apparently not made available to SoCalGas employees and contractors, contributing to failed kill attempts on Well SS-25. Other SoCalGas records may well contain useful information that is simply not readily available to those who need it.

The hit-or-miss, unorganized record keeping in SoCalGas files made it impossible for a new person or contractor assigned to management of well SS-25 to fully understand existing pipe damage, or the potential for ongoing damage to the well casing. Instead, the

⁴⁵¹ SS-25A Well File, Supporting Attachments SED 01782 (moved from SS-25 Well File for these exhibits).

⁴⁵² SS-25B Well File, Supporting Attachments SED 01813-01878 permeability page found on table under "PERM" column).

⁴⁵³ SS-25A Well File, Supporting Attachments SED 01797.

⁴⁵⁴ SS-25A Well File, Supporting Attachments SED 01783-01789.

records could easily lead to an unfounded assurance that there was no impending problem with well SS-25. The occurrence of missing records in Well File SS-25 extends back to at least 1973. Each time there was a new note of a leak at the bottom of the well, or erosion of the pipe, memos and, potentially, reports may have been created but not retained in the file. The loss of these records created an unsafe condition that hampered the safe operation of SS-25 and could easily have resulted in overconfidence in the stability of well SS-25, leading to the well failure in October 2015.

Missing Failure Analysis Reports; unsafe practice. 1988 and 1991 FF-34A Casing Studies were referenced among records, but were not produced in the Well Files, and have not been produced by SoCalGas.⁴⁵⁵ Maintenance of such studies, as well as Failure Analysis reports on well pipe failures would normally be kept indefinitely, but not necessarily in a Well File. It would, however, be normal to see a memo or reference to such a study in the relevant Well File. SoCalGas had numerous opportunities to create such reports. It apparently did not perform or retain failure analysis records for failure events, limiting future reference and use of data on 63 casing leaks, 29 tight spots, 4 parted casings, 3 other leaks, (2 casing failures per well for 40% of wells) and 2 blowouts.⁴⁵⁶ The fact that SoCalGas has not produced any such reports suggest they disposed of these important records at some time.

Missing Ground Water and Cathodic Protection Records; an Unsafe Practice. There is also no evidence that SoCalGas created or kept ground water records, or other records of measurements relative to external corrosion of underground pipe in their SS-25, SS-25A or SS-25B Well Files. It is reasonable to expect a prudent well field operator to collect such records so they would be able to predict the life of pipe and plan for replacements or repairs in a safe and timely manner. Because SoCalGas lacked records, it had limited ability to assess the potential for, or predict external corrosion in well piping. Groundwater records would be a basic record kept by any company utilizing steel in underground construction. SoCalGas is well aware of this requirement because it

⁴⁵⁵ DR 45 Qs 8 and 9 Supporting Attachments SED.

⁴⁵⁶ Blade Report at pp. 162-163, 165, 166.

maintains underground natural gas pipelines all over Southern California which has cathodic protection to prevent corrosion. For the same reason, SoCalGas should have utilized cathodic protection on the wells. However, SoCalGas Well File records for SS-25, SS-25A, and SS-25B contain no report or studies regarding well corrosion from exposure to groundwater, or cathodic protection.⁴⁵⁷

Operating Records Missing; an Unsafe Practice. SoCalGas records do not show operating records that would be reasonable to keep and mirror typical record retention policies in the industry. For instance, collecting and recording of basic operational data on a regular (typically continuous or daily basis) is a prudent and reasonable requirement to ensure ongoing safe operations and timely identification of problems. At the very least, any measurements made or calculated on a routine basis should be recorded in the Well File for future reference. For instance, SoCalGas was not monitoring well head pressure continuously, or even daily for the injection/extraction wells. In SoCalGas' words, "Underground gas storage wells at Aliso Canyon were not equipped with continuous pressure monitoring. Pressure measurements were collected on a weekly basis. The last pressure reading on SS-25 casing was collected on 10/15/15. The measurement was 2595 psig."⁴⁵⁸ As a result, when the company needed to kill the well on October 23, 2015, it did not have a current bottom hole pressure, a key piece of data for their selection of the appropriate weighting materials. SoCalGas was not monitoring reservoir or bottom hole pressure for the wells and only calculated reservoir pressure from well head pressure on two wells, one in the east and one in the west field. SoCalGas states that "At Aliso Canyon, surface wellhead pressures in designated pressure monitoring wells are used to determine 'bottom hole' or 'reservoir pressure.' During the timeframe requested, wells Standard Sesnon 5 (SS5) and Ward 3A (W3A) were primarily utilized for this purpose, for the west field and east field, respectively."⁴⁵⁹ Blade reports that the Bottom Hole pressure for SS-25 that SoCalGas was using to design the kill weight of fluid to pump

⁴⁵⁷ Intentionally left blank.

⁴⁵⁸ Supporting Attachments SED DR 45 Q4.

⁴⁵⁹ Supporting Attachments SED DR 45 Q3.

down SS-25 after it failed was too low, leading to multiple failures in kill attempts.⁴⁶⁰ This multi-staged disaster was a direct result of not collecting and recording accurate well data.

In conclusion, SoCalGas' imprudent and unreasonable record keeping practices violated Section 451 three times; once for well SS-25, a second time for well SS-25A, and a third time for well SS-25B. The violation associated with well SS-25 begins June 6, 1973, the date that SoCalGas hydrotested their gas conversion of well SS-25.⁴⁶¹ The violation associated with well SS-25A began December 7, 1972, the date that well SS-25A became operational according to DOGGR records.⁴⁶² The violation associated with well SS-25B began October 29, 1973, the date that well SS-25B became operational according to DOGGR records.⁴⁶³

Each of these three violations end on October 23, 2015, as safety records in Well Files SS-25, SS-25A and SS-25B appeared to be missing up through the date of the well SS-25 incident.

Also, SoCalGas's failure to monitor the wellhead pressure of well SS-25 continuously, a problem throughout Aliso Canyon natural gas storage facility, was a violation of Section 451 because it deprived SoCalGas of a key piece of information that would have helped kill the well leak that began on October 23, 2015. This violation began October 15, 2015, the last time SoCalGas collected a pressure reading on the well, and continued until October 23, 2015, the beginning of the incident.

III. RECOMMENDED FIXES TO SOCALGAS'S SYSTEM

Blade identified twelve solutions that would have mitigated or prevented the uncontrolled release of hydrocarbons for 111 days from well SS-25.⁴⁶⁴ SED recommends

⁴⁶⁰ Blade Report at p. 131-133.

⁴⁶¹ SS-25 File, Supporting Attachments SED 01517.

⁴⁶² SS-25A File, Supporting Attachments SED 01768.

⁴⁶³ SS-25B File, Supporting Attachments SED 01879.

⁴⁶⁴ Blade Report at p. 231.

that SoCalGas be required to implement each of these to the extent that they have not done so already. The solutions identified below are based on those proposed by Blade.

Solution 1: Production Casing Should Be Cemented to the Surface

Corrosion initiated on the outside diameter of the 7 inch casing because the environment in the annulus around that casing, above 11 ¾ inches casing set at 990 feet, was conducive to corrosion.⁴⁶⁵ Cementing the casing to surface changes the environment to one that is not conducive to corrosion, and the cement as a barrier that protects the outside diameter from corrosion.⁴⁶⁶

This only applies to new wells and not existing wells that may not have originally been cemented to the surface.⁴⁶⁷ For these wells, the uncemented section needs to be inspected for wall loss and then re-inspected at regular intervals.⁴⁶⁸ The fact that there is an uncemented interval does not automatically mean that corrosion will occur, but the casing wall thickness needs to be monitored.⁴⁶⁹ The fact that the casing may have wall loss from corrosion also does not automatically mean that the casing is bad or unsafe.⁴⁷⁰ Once the amount of wall loss is known, a new burst pressure rating can be calculated to determine whether the well can be safety operated or not.⁴⁷¹ Whether the casing is cemented or not, periodic wall thickness monitoring is a current regulatory requirement.⁴⁷²

Solution 2: SoCalGas Should be Required to Do Periodic Wall Thickness Inspections

⁴⁶⁵ Blade Report at p. 231.

⁴⁶⁶ Blade Report at p. 231.

⁴⁶⁷ Blade Report at p. 231.

⁴⁶⁸ Blade Report at p. 231.

⁴⁶⁹ Blade Report at p. 231.

⁴⁷⁰ Blade Report at p. 231.

⁴⁷¹ Blade Report at p. 231.

⁴⁷² Blade Report at p. 231.

Wall thickness inspections should be included in the mechanical integrity test program since they are a leading indicator of possible casing integrity issues with the wells.⁴⁷³

Solution 3: SoCalGas Should Create Internal Policies that Require Casing Wall Thickness Inspections

SoCalGas's internal well inspection policies should be expanded to include wall thickness inspections. The wells should be prioritized based on risk.⁴⁷⁴

Solution 4: A Risk Based Well Integrity Management System Should Be Implemented

An integrity management system should proactively identify potential problems, determine the associated risks, and then implement actions to prevent the problem from occurring or mitigates the risks. This is similar to the PHMSA required Transmission Integrity Management Program, Distribution Integrity Management Program, and the Storage Integrity Management Program that SoCalGas requested implementation funding for in 2014. Key components of such a system include:

- A scope that is field-wide.
- A baseline understanding of well conditions and operating environment.
- An identification of well integrity risks such as the estimation of corrosion rates and other field wide trends.
- Well design and operating standards.
- The use of multiple diagnostic methods for integrity testing (e.g., noise, temperature, corrosion, inspection, and cement bond logs and pressure tests).
- The establishment of safe operating limits for each well.

⁴⁷³ Blade Report at p. 231.

⁴⁷⁴ Blade Report at p. 231.

- Risk management that evaluates risks and consequences in order to guide well integrity monitoring requirements and development of mitigation plans.
- A data tracking and reporting system.
- Periodic reviews to assess the system effectiveness.

Despite the casing leaks and casing failure of the Aliso Canyon field, well integrity can be effectively managed with a robust risk management plan that includes probability of failure balanced with consequence of failure. Both aspects have to be addressed.⁴⁷⁵

Solution 5: Conduct a Casing Corrosion Study

Developing an understanding of why corrosion occurs is important for the establishment of corrosion rates and appropriate mitigation plans. The production and surface casing strings should be studied separately. At Aliso Canyon the extent of groundwater and its access to the surface and production casing were not understood before the incident. Detailed investigation, including a study of all forms of corrosion in the field, should be undertaken. The differences in various sectors of the field should be understood and quantified. For example, using cathodic protection should be evaluated for surface casings and applied as needed. Production casings at risk of corrosion should be identified after a detailed assessment of the well design, drilling and completion data, and failure history. Corrosion can be monitored and mitigated. However, the causes and associated risks need to be formally evaluated and understood, and safe operating limits of a well need to be defined.⁴⁷⁶

Solution 6: Conduct a Casing Failure Analysis

Despite numerous casing failures, no data were provided to indicate that failure causes were investigated. Casing failures need to be formally investigated so that their

⁴⁷⁵ Blade Report at pp. 231-232.

⁴⁷⁶ Blade Report at p. 232.

causes are identified and their implications are understood. Understanding and interpreting failures are critical to defining the propensity or risk of such failures field wide. Such analysis is an important part of any risk assessment. The cause may be straightforward, well specific, and easily mitigated. However, if the cause appears systemic, or the potential consequences are serious, then a more comprehensive investigation is needed to evaluate the potential risks to other wells in the field so that the appropriate mitigation steps are taken. For example, failure investigation of casing outside diameter corrosion in another well might have directed attention to SS-25 and other similar wells. Running an inner string or plugging a well are valid mitigations, but prior to such actions, the cause of the casing leak or failure should be understood. The type of investigation should be commensurate with the risk and consequence of the failure, and should be part of the well integrity management system.⁴⁷⁷

Solution 7: SoCalGas Should Be Required to do a Level 1 Analysis of All Failures

American Petroleum Institute (API) Recommended Practice 585 Pressure Equipment Integrity Incident Investigation, discusses failure investigation of pressure equipment. The Aliso Canyon wells are a form of complex pressure vessels. A Level 1 type analysis of failures, as a minimum requirement, will identify the immediate causes of the failures or near misses and allow operators to understand the implications, if any.⁴⁷⁸

Solution 8: Well Specific Detailed Well-Control Plan

The top-kill attempts were unsuccessful. There were many causes for this that have already been discussed. Every storage well should have the following at a minimum:

⁴⁷⁷ Blade Report at p. 232.

⁴⁷⁸ Blade Report at pp. 232-233.

- A well-specific IPR curve. A clear understanding of this deliverability based on pressure.
- A well specific kill plan based on transient modeling. Plans may be similar; however, a plan should be quantitatively developed for various scenarios (e.g., deep or shallow failure).
- A relief well plan for each well that considers the surface location and overall approach.⁴⁷⁹

Solution 9: Tubing Pack Completion-Dual Barrier System

SS-25 was operated so that gas injection and withdrawal was done through the 2 7/8 inch tubing and the 7 inch casing x 2 7/8 inch tubing annulus. As such, the 7 inch casing acted as a single barrier and when it failed, there was nothing behind it to contain the wellbore pressure and fluids. A tubing-packer completion provides two barriers. Gas injection and withdrawal is done only through the tubing. The packer isolates the production casing by tubing annulus from the gas flow. If the tubing fails, the casing acts as a second barrier preventing the wellbore pressure and fluids from escaping the wellbore. This allows the well to be killed and the tubing to be replaced. However, the casing must be designed to withstand the wellbore operating pressures throughout the life of the well.⁴⁸⁰

Solution 10: Implement Cathodic Protection as Appropriate

Following the corrosion study there should be a good understanding of the groundwater intervals and the associated corrosion risk for existing wells. The surface casings that have inadequate cements isolation should be cathodically protected. This would prevent or stop the shallow corrosion of surface casings that might fail and allow water to enter the surface by production casing annulus causing corrosion on the production casing.⁴⁸¹

⁴⁷⁹ Blade Report at p. 233.

⁴⁸⁰ Blade Report at p. 233.

⁴⁸¹ Blade Report at p. 233.

Solution 11: Ensure Surface Casings Are Cemented to Surface for New Wells

Surface casing strings are not intended to act as a pressure barrier once the well has been completed. However, a fully cemented surface casing provides protection from corrosion. It will therefore isolate the production casing by surface casing annulus thereby reducing the risk of corrosion on the production casing.

It is difficult to assess the quality of the surface casing cement on existing wells because the casing is not directly accessible. Wellbore integrity assessments therefore need to focus on the production casing.⁴⁸²

Solution 12: Well Surveillance Through Surface Pressure (Tubing and Annuli)

The lack of real-time pressure measurements prevented the immediate identification of the 7 inch casing failure. The constant monitoring of the tubing, production casing and surface casing pressures will provide better insight into operations deviations in all wells. If this type of system had been installed on SS-25, it would have provided insight into the time of the leak, the opportunity to shut in the well immediately, size of the leak, and the extent of the problem. Furthermore, the information could have been used during the well-control effort to improve the chances of an early success.⁴⁸³

In addition to Blade's recommendations, SED recommends that the Commission require SoCalGas to make the following additional fixes.

Recommendation 1: SoCalGas should create an emergency record for each operating and any temporarily out of service (but not formally abandoned) well. The record should include a list of all critical information about the well, including records of operating well head and bottom hole pressures. This record should be strategically placed at the beginning of a Well File or the top of the database well record so that it is easily accessible in the event of an emergency. The same document should be updated as necessary to provide current, timely and relevant well information.

⁴⁸² Blade Report at p. 233.

⁴⁸³ Blade Report at p. 233.

Recommendation 2: Require a recordkeeping audit into SoCalGas's safety-related well records. SoCalGas should be required to provide SED with three qualified experts with no prior experience working for SoCalGas to conduct such an audit, at shareholder expense. SED should be the final decision maker as to the final auditor, and SoCalGas should be required to arrange for the contract with the auditor. The scope and timing of the audit should be determined by SED, and should be reflected in the contract. The auditor should be required to provide SED's Director or an SED manager or managers of the Director's choosing with periodic updates and results of the audit. The auditor should answer to SED.

Recommendation 3: Given the passage of time since the Blade investigation, require an industry wide survey of the best available safety technology to meet new requirements and the latest understanding of risk associated with Aliso Canyon natural gas storage facility.