

SoCalGas-4-R

**Prepared Reply Testimony of Tim Hower and Charlie Stinson of MHA
Petroleum Consultants (March 20, 2020)**

I.19-06-016

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

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CHAPTER I

PREPARED EXPERT TESTIMONY OF TIM HOWER AND CHARLIE STINSON OF MHA PETROLEUM CONSULTANTS ON BEHALF OF SOUTHERN CALIFORNIA GAS COMPANY (U 904 G)

March 20, 2020

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CHAPTER I

I. INTRODUCTION.

The purpose of the following prepared reply testimony, submitted on behalf of the Southern California Gas Company (“SoCalGas”), is to address the testimonies of Margaret Felts on behalf of the California Public Utilities Commission’s (“Commission”) Safety Enforcement Division (“SED”)¹ and Mina Botros, Alan Bach, Matthew Taul, Pui-Wa Li, and Tyler Holzschuh on behalf of the Public Advocates Offices (“Cal Advocates”). SED alleges SoCalGas violated California Public Utilities Code Section 451 (Section 451) because it did not conduct failure analyses at Aliso Canyon (Violations 1-60),² failed to follow its plan to check the casing of 13 wells for metal loss (Violations 61-73),³ operated SS-25 without a backup mechanical barrier to the production casing (Violation 77),⁴ did not have a policy that required well casing wall thickness inspection and measurement (Violation 78),⁵ did not appropriately understand and address groundwater (Violations 84-85),⁶ did not fully cement or cathodically protect the casing against corrosion (Violation 86),⁷ failed to have a continuous pressure monitoring system and thereby prevented immediate identification of the leak (Violation 87),⁸ and had imprudent and unreasonable recordkeeping practices (Violations 327-329).⁹ Cal Advocates alleges further that

¹ SED’s Opening Testimony was served on parties to I.19-06-016 on November 22, 2019 without an identified witness, and remains so. Pursuant to SoCalGas Data Request 2 to SED, SED identified Margaret Felts as the sponsoring witness for the entirety of SED’s Opening Testimony. *See* Ex. I-1 (SED Response to SoCalGas Data Request 2).

² SED Opening Testimony at 7.

³ *Id.* at 10.

⁴ *Id.* at 18.

⁵ *Id.* at 25.

⁶ *Id.* at 39.

⁷ *Id.* at 45.

⁸ *Id.* at 47.

⁹ *Id.* at 67.

1 SoCalGas did not identify and resolve well integrity issues,¹⁰ did not conduct failure analyses,¹¹
2 did not take prudent action on the circa 1988 Vertilog results,¹² and generally failed to take a
3 proactive approach to maintaining the Aliso Canyon facility.¹³ However, these allegations are
4 incorrect and/or misguided, as explained in detail below. SoCalGas did conduct appropriate
5 failure analyses, had well monitoring programs that became more proactive as technological
6 advancements in tools allowed, and had an understanding of groundwater levels consistent with
7 what was necessary. Moreover, SoCalGas' practices were consistent with or exceeded what we
8 have observed in the industry. Even today, dual barrier designs are not industry standard, nor is
9 cathodic protection. And, real-time pressure monitoring would not have informed how the SS-
10 25 leak was addressed. Finally, compared to what we have seen at other operators in the
11 industry, SoCalGas' records are well organized and contain the appropriate and necessary
12 information.

13 Our expertise is based on significant experience in the gas storage industry. We, Tim
14 Hower and Charlie Stinson, have over 75 years of collective experience in the natural gas and
15 natural gas storage industries. Mr. Hower's experience includes the evaluation and optimization
16 of underground gas storage projects located in the U.S., Europe and Australia. He has conducted
17 industry training courses on the engineering of gas storage reservoirs, and he has co-authored an
18 industry textbook on gas storage reservoir management.¹⁴ Much of Mr. Hower's experience has
19 involved working directly with the operation engineers and staff at the natural gas storage
20 facilities ensuring that their field management techniques conform to industry standard practices.

¹⁰ Public Advocates Office Opening Testimony at 3.

¹¹ *Id.* at 13.

¹² *Id.* at 3.

¹³ *Id.* at 13.

¹⁴ Paul S. Schafer, Tim Hower & Raymond W. Owens, *Managing Water-Drive Gas Reservoirs* (Gas Research Institute 1993).

1 Mr. Hower has previously testified as an Expert on gas storage industry standard practices before
2 numerous jurisdictions and regulatory bodies. Mr. Hower has toured 27 gas storage fields in 8
3 states.

4 Mr. Stinson's experience includes the permitting, development and operations of
5 underground storage facilities in Oregon and California, both as an employee of operating
6 companies (1978 to 2011) as well as a professional engineering consultant (2011 to present). In
7 addition, Mr. Stinson served on the American Gas Association Underground Gas Storage
8 committee for over 20 years, including one year as its chairman. This committee served as a
9 platform for gas storage operators to share emerging technologies, current industry standard
10 practices, development and operating challenges, regulatory changes, and a host of other issues
11 facing their companies. As a result of committee meetings held at various operating company
12 sites, Mr. Stinson has toured 33 over 30 gas storage fields in 13 states.

13 **II. GENERAL DISCUSSION REGARDING INDUSTRY STANDARDS AND** 14 **SOCALGAS' OPERATIONS.**

15 In considering whether SoCalGas acted reasonably with respect to operation and
16 maintenance of the Aliso Canyon gas storage field prior to the 2015 Aliso Canyon incident it is
17 necessary to assess the relevant industry standards that applied at the time. Based on our
18 knowledge and experience from working onsite at 60 U.S. gas storage fields, and working with
19 engineers and field data on approximately 135 gas storage fields over the past 40 years, we have
20 first-hand knowledge gas storage operations and standard practices.

21 Prior to September 2015 and the publication of API Recommended Practice ("RP") 1171
22 ("API RP 1171"), "Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon
23 Reservoirs and Aquifer Reservoirs," there were no documented gas storage industry-wide

1 procedures that would have been considered industry standard practice.¹⁵ Even now, API RP
 2 1171 remains a “Recommended Practice,”¹⁶ which is in the process of implementation and does
 3 not qualify as an industry standard.

4 Of course, even absent formal documented standards, there were industry standard
 5 practices even if they were not recorded or documented. The following is a summary table
 6 comparing applicable Division of Oil, Gas and Geothermal Resources (“DOGGR”), now
 7 renamed The Geologic Energy Management Division (“CalGEM”), regulations in effect at the
 8 time of the SS-25 release, the API RP 1171 recommendations, standard industry practices we
 9 observed, and those utilized at Aliso Canyon as of October 23, 2015:

<u>STORAGE ATTRIBUTE</u>	<u>DOGGR REGULATIONS AS OF 10/23/2015¹⁷</u>	<u>API RP 1171 RECOMMENDED PRACTICES¹⁸</u>	<u>INDUSTRY STANDARD PRACTICE AS OF 10/23/2015¹⁹</u>	<u>PRACTICE AT ALISO CANYON AS OF 10/23/2015</u>
Maximum Operating Reservoir Pressure	Defined by permit (3,600 psi for Aliso) ²⁰	Not specified	36% of storage reservoirs operate higher than original discovery (delta pressure) ²¹	Original discovery only. Delta pressure approved by DOGGR but never implemented

¹⁵ For purposes of this testimony “industry standard practice” means prevailing practice within the industry.

¹⁶ See Ex. I-2 (Pipeline and Hazardous Materials Storage Administration, Underground Natural Gas Storage (2020), <https://www.phmsa.dot.gov/pipeline/underground-natural-gas-storage/underground-natural-gas-storage>) (referring to API RP 1170 and 1171 as a “recommended practices”). In the final rule, PHMSA adopted most of the recommendations in 1171 with some changes, mostly related to compliance deadlines. See Ex. I-3 (Pipeline Safety: Safety of Underground Natural Gas Storage Facilities, 85 Fed. Reg. 8104) (Feb. 12, 2020) (adopting the recommended practices of API RP 1171 with changes based on comments on the interim final rule).

¹⁷ See Cal. Code Reg. § 1724 - §1724.10, et seq.

¹⁸ See Ex. I-4 (API 1171).

¹⁹ Based on personal knowledge and experience of Tim Hower and Charlie Stinson.

²⁰ Ex. I-5 (DOGGR Project Approval Letter, April 18, 1989; revised July 26, 1989).

²¹ Based on the personal knowledge and experience of Charlie Stinson.

Mechanical Integrity Test - Original	Within 3 months of initial operations	Well mechanical integrity tests required	Tested during well completion operations	Tests completed during well conversion - completion
Mechanical Integrity Test - Operations	Annual temperature surveys	Wells monitored for unexpected conditions	Annual temperature surveys	Wells visited daily. Temp logs ran annually.
Well Casing Design	Dual barrier not required	Dual barrier not required	87% of all gas storage wells are single barrier ²²	Packer installed. Single barrier operation.
Cement Bond Log	Required	Required	Typically completed	Completed on all wells
Max Age of Storage Wells	None specified	None specified	Median age of repurposed wells is 74 years ²³	SS-25 was 61 years old at the time of failure
Well Integrity Monitoring	Not required	Monitor for annular pressure	No programmatic application	Integrity logs run during well reworks
Wellsite Inspections	Not specified	Annual inspections	Highly variable	Daily visits. Monthly inspections.
Pressure Monitoring	Surface pressures weekly	Not required	Highly variable	Recorded weekly
Reservoir Integrity Monitoring	Not required	Material balance required periodically	Completed periodically	Inventory verification completed periodically
Production Casing Cement-to-Surface for Existing Wells	Not required	Not required	Highly variable	Completed in new wells post 1990

²² Ex. I-6 (Underground Natural Gas Storage Operators “Tubing and Packers in Underground Natural Gas Storage: Safety and Reliability Considerations”, AGA/API/INGAA Underground Natural Gas Storage Joint Industry Task Force, September 16, 2016).

²³ Ex. I-7 at 1 (Drew R. Michanowicz, et al., 2017 Env. Res. Lett. 12, 1 (2017)).

Emergency Shutdown Valves	Not required ²⁴	Not required. Operator to evaluate need based on criteria.	Only 11% surface ESDs installed. Only 43% have SSSV ²⁵	All IW wells with surface ESDs. SSSVs attempted but proved to be unreliable
Emergency Shutdown Valve Testing	Not required	At least annually	Highly variable	Semi-annually
Emergency Response Plan	Not required	Required	Typically completed	Completed
Well Flow Testing	Not required	Not specified	Highly variable	Periodic well flow tests for erosion control
Operation & Maintenance Procedures - Wells	Not required	Required	Typically completed	Completed
Risk Management Plan	Not required	Required	Typically informal only with little or no documentation	Informal pre-2007, Inspect and Replace, SIMP in early implementation as of 10/23/2015
Well Kill System	Not required	Not required	Not installed	Installed on all injection/withdrawal wells

²⁴ DOGGR regulations require emergency shutdown valves for critical wells only. Cal. Code Reg. § 1724.3. DOGGR defines a “critical well” as a well within 300 feet of “any building intended for human occupancy that is not necessary to the operation of the well; or any airport runway” or within 100 of “[a]ny dedicated public street, highway, or nearest rail of an operating railway that is in general use; [a]ny navigable body of water or watercourse perennially covered by water; [a]ny public recreational facility such as a golf course, amusement park, picnic ground, campground, or any other area of periodic high-density population; or [a]ny officially recognized wildlife preserve.” Cal. Code Reg. § 1720. Regardless, Aliso Canyon does not have any critical wells.

²⁵ Ex. I-8 at 53-54 (Underground Natural Gas Storage Integrity & Safe Operations (July 6, 2016), available at <https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/technical-resources/pipeline/underground-natural-gas-storage/59336/aga-white-paper-ungs-integrity-and-safe-ops-20160706.pdf> at 53-54)

1 In addition to API RP 1171, and subsequent to its publication, various members of gas
2 industry associations developed a joint industry task force (“JITF”) paper, “Underground Natural
3 Gas Storage – Integrity & Safe Operations” published in July 2016.²⁶ The JITF observed that
4 “[o]perators have projected full conformance with API 1171 following a final rulemaking could
5 take 7-10 years. . . .”²⁷ While the industry recognizes API RP 1171 as a common industry
6 recommended practice, most operators’ field facilities and operations will not be compliant for
7 several years.²⁸

8 SED’s testimony fails to identify any violation of industry standards by SoCalGas. In
9 addition, SED has generally demonstrated a lack of knowledge and of gas industry standard
10 practice. In response to SoCalGas discovery requests, SED has produced numerous documents
11 that it alleges are indicative of “industry standards.”²⁹ Many of these are industry association
12 technical research reports and case study papers. Notably, the research and case study papers
13 provided by SED are not indicative of industry standard practice because they are not

²⁶ Ex. I-8 (Underground Natural Gas Storage Integrity & Safe Operations (July 6, 2016), available at <https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/technical-resources/pipeline/underground-natural-gas-storage/59336/aga-white-paper-ungs-integrity-and-safe-ops-20160706.pdf>).

²⁷ *Id.* at 4.

²⁸ *Id.* See also Ex. I-3 (Pipeline Safety: Safety of Underground Natural Gas Storage Facilities, 85 Fed. Reg. 8104) (Feb. 12, 2020) (noting the changes in compliance deadlines under the final rule (adopting, in part, RP 1171). Specifically, while written programs need to be in place for an integrity management framework within a year after the effective date, PHMSA does not expect parties to begin risk assessments until much later – providing four years from the effective date to do initial assessments of 40% of wellbores, wellheads and associated components. Moreover, PHMSA adopted these regulations in response to the Aliso Canyon incident). Additionally, DOGGR’s regulations put in place post-incident contain long lead times to allow operators to prepare for compliance. See, e.g., Cal. Code Reg. § 1726.3(d)(1) (allowing seven years after effectiveness of the regulations for initial compliance).

²⁹ See, e.g., Ex. I-9 (SED Supplemental Data Response to SoCalGas Data Request 3 (as supplemented Jan. 23, 2020)), SED responses to questions 7(b) (naming 2007.0101.NACE-SP0186-NN as an alleged industry standard), 9(a) (citing scholarly articles and various other papers), 9(b) (same), 10(c) (same). Based on the dearth of formal industry standards, we use the term “industry standards” throughout this testimony to refer to the consistent practices we have observed first-hand through our work experiences.

1 representative of gas storage operators’ prevailing practices. Further, SED objected to
2 SoCalGas’ questions about what SED contends SoCalGas should have done with respect to
3 various operations and maintenance practices. SED responded simply that it was not SED’s job
4 to know how to operate a gas storage field.³⁰ Finally, we note that while we are responding to
5 individual allegations made by SED and Cal Advocates, many of the violations and allegations
6 overlap and are asserted based on the same underlying concepts and issues. Therefore, this
7 testimony should be taken *as a whole* – the responses to individual allegations should be taken to
8 respond to the specific allegations identified in each section as well as any other allegations
9 related to the same underlying factual issue.

10 **III. SOCALGAS ACTED REASONABLY IN INVESTIGATING PRIOR “LEAKS” AT**
11 **THE FACILITY.**

12 As discussed below, SoCalGas met or exceeded gas storage industry and industry
13 standard practices regarding well failures and subsequent investigation into their causes.
14 Moreover, SED and Blade mischaracterize the 60 or 63 well casing issues of varying cause and
15 degree as “leaks.”³¹ Indeed, the number of actual casing leaks is less than half that number, and
16 only two of those (FF-34A and Frew 3) were of the scale where gas migrated some distance in

³⁰ See, e.g., *Id.*, SED responses to questions 1(a), 2(a), 3(a), 4(a), 5(a), 7(a), 8(a), 9(a), 10(a), and 11(d). While objecting, SED noted that it is “SoCalGas’ (not SED’s) mandated responsibility, pursuant to California Public Utilities Code Section 451” [to determine what adequate (reasonable) measures might be in a specific scenario]. See also Ex. I-10 at 215:22-216:1 (Margaret Felts Depo. Tr., 215:22 – 216:1) (Counsel for SED representing Ms. Felt’s at the deposition objecting and stating that “[i]t is not safety and enforcement division’s role to identify the kinds of investigations that Southern California Gas company should be doing on its own field.”). Later, the same counsel, in a separate objection, noted that it was “beyond the scope of SED’s purview” to recommend how to investigate. *Id.* at 252:10-14.

³¹ Note that SED’s summary of violations lists 60 violations for “leaks,” while the Blade Report lists 63 “casing leaks.” SED Testimony at 2; Blade Report at 2. Even more unclear, SED states that there were “over 60 casing leaks at Aliso Canyon before the SS-25 incident.” SED Testimony at 7. However, “[t]o avoid double counting violations that the 60 leaks identified before the Aliso Canyon included the six blowouts and parted casings identified above.” *Id.* at 9; see section III-B for further discussion of the number of “leaks.”

1 the subsurface away from the wellbore.³²

2 A. SoCalGas Detected, Investigated, and Remediated Well Casing Issues Consistent with
3 Industry Standards.

4 In its summary of violations, SED alleges 60 violations related to SoCalGas' alleged
5 failure to adequately investigate casing "leaks."³³ SED alleges that "SoCalGas did not investigate
6 or analyze its past casing leaks of other wells at Aliso Canyon. Moreover, in its
7 recommendations for fixes to SoCalGas's system, SED states that "SoCalGas should be required
8 to do an API Recommended Practice 585 level 1 analysis of all failures."³⁴ Importantly,
9 however, aside from citing to API 585, SED fails to identify any particular deficiency or describe
10 what precisely SED believes SoCalGas should have done. In response to questions from
11 SoCalGas on this issue, SED objected that "[i]t is not safety and enforcement division's role to
12 identify the kinds of investigations that Southern California Gas company should be doing on its
13 own field."³⁵ Later, in a separate objection, SED noted that it was "beyond the scope of SED's
14 purview" to recommend how to investigate.³⁶

15 As of the date of the incident there was no documented industry standard related to
16 investigation of casing failures in gas storage operations. In April 2014, API published
17 Recommended Practice 585, "Pressure Equipment Integrity Incident Investigation" ("API RP
18 585").³⁷ It is important to note that this Recommended Practice does not apply to gas storage
19 operations; it documents and details procedures for conducting incident investigations for other

³² See Vol. 4, Blade Report at 51 ("Frew 3 and FF-34A had casing leaks and underground flow and were killed by pumping down the tubing.").

³³ SED Opening Testimony at 2.

³⁴ SED Opening Testimony at 79.

³⁵ Ex. I-10 at 215:22-216:1 (Felts Depo. Tr., 215:22 – 216:1).

³⁶ *Id.* at 252:10-14.

³⁷ Ex. I-11 (*Pressure Equipment Integrity Incident Investigation*, API RP 585 (1st ed., Apr. 2014)).

1 forms of “pressure equipment.”³⁸ Blade states that “API RP 585 was developed for Pressure
2 Equipment Integrity Incident Investigation,” not gas storage well integrity management and only
3 “presents this as an option that *could* be applied” to gas storage.³⁹ Further, Blade states that there
4 “are no specific standards or practices related to ‘failure analysis or subsequent risk assessment’
5 related to gas storage well casings.”⁴⁰ We note, however, that while API RP 585 does not apply
6 to gas storage and was not issued until 2014, SoCalGas’ practices with respect to investigating
7 well casing issues isare consistent with industry standards at the time of the leak.

8 More importantly, SoCalGas’ practices regarding investigation and assessment of well
9 casing failures were consistent with standard practice across the gas storage industry. Minor
10 casing leaks or mechanical issues were inspected running a casing inspection log, determining
11 the location of the leak or issue, and remediating the leak or issues via a well workover. Based
12 on information collected from the casing inspection log and other tests and observations made in
13 the course of the workover SoCalGas was often able to assess the probable cause or causes of the
14 issue. If a pattern of failures developed, (for example erosion from sand production), then a
15 more detailed investigation was conducted and a risk management plan was employed to
16 minimize the potential impact of recurrence. Continuing the erosion from sand production
17 example, SoCalGas routinely conducted sand flow tests to determine critical gas flow rates for
18 sand production in the storage wells.

³⁸ Note that Blade states that “API RP 585 was developed for Pressure Equipment Integrity Incident Investigation,” not gas storage well integrity management and only “presents this as an option that could be applied” to gas storage. See Ex. I-132 at 14 (Blade response to the SED Data Request SED DR-49 at 14). Further, Blade states that there “are no specific standards or practices related to ‘failure analysis or subsequent risk assessment’ related to gas storage well casings.” See Ex. I-123 at 13 (Blade Response to SoCalGas Data Request, Feb. 14, 2020, at 13).

³⁹ See Ex. I-132 at 14 (Blade response to the SED Data Request SED DR-49 at 14).

⁴⁰ See Ex. I-123 at 13 (Blade Response to SoCalGas Data Request, Feb. 14, 2020, at 13).

1 Where circumstances warranted, SoCalGas performed more extensive investigations.
2 Examples of this include work done to address leaks at wells FF-34A and Frew 3, where
3 SoCalGas observed migration of gas in the subsurface away from the wellbores. SoCalGas'
4 investigations included gas sampling to confirm the source of the leaking gas and analysis of
5 offset wells to determine the extent of gas migration away from the well with the casing leak,⁴¹
6 as well as construction of numerical simulation models to determine the volume and the areal
7 extent of the leaked gas.⁴²

8 It is important to note that conducting a full Root Cause Analysis, of the sort performed
9 by Blade in connection with the leak at SS 25, is most certainly not industry standard practice.
10 Cutting and extracting the production casing, for direct examination and testing of a failed joint
11 more than thousand feet below ground, is often not feasible. Nor is it reasonable or justifiable to
12 perform such analysis for most casing failures.

13 It is also critical to note that of the casing failures documented by Blade, which provide
14 the basis for SED's alleged violations, there was no pattern identified that would have led
15 SoCalGas staff to determine that there was any sort of systemic issue that would have indicated
16 that an SS 25 type failure was likely. According to Blade:

17 Wells with casing failures were distributed throughout the Aliso Canyon Field. Nothing
18 seems unusual regarding the casing failures near SS-25 when comparing them to the
19 casing failures in the rest of the field. The depths of casing failures ranged from the
20 wellhead to below 8,000 feet, and *no general pattern is apparent*.⁴³

21 Further, Blade stated that "52% of the leaks were between surface and 4,000 ft. with no
22 trend of leak count vs. depth."⁴⁴ Finally, Blade stated that "[t]he failure and casing leak rate for

⁴¹ Ex. I-14 (SCG00195774).

⁴² Ex. I-15 (AC_BLD_0033633).

⁴³ Blade Report at 204 (emphasis added).

⁴⁴ *Id.* at 166.

1 the gas storage wells is around 50%, implying that well age does not correlate with casing
2 failures.”⁴⁵ All prior well failures had been identified by SoCalGas within a timely manner, were
3 contained locally, and were mitigated properly.

4 B. Many of the Casing “Leaks” Identified by SED Were Insignificant and Are Irrelevant to
5 What Occurred at SS 25.

6 SED alleges that:

7 “SoCalGas failed to perform failure investigations, failure analyses or root cause
8 analyses on failed Aliso Canyon wells despite more than 60 well casings
9 experiencing leaks, four having parted casings, and several wells having casing
10 corrosion identified.”⁴⁶ Therefore, SoCalGas lacked important information and
11 background to properly anticipate the extent and consequences of corrosion in its
12 other wells, including well SS-25.”⁴⁷

13 SED’s assertion, which is based solely on Blade’s report,⁴⁸ mischaracterizes 60 well
14 casing issues of varying cause and degree as relevant “leaks.” ~~SED seeks to show a “pattern of~~
15 SED’s and Blade’s assertions appear to be premised on the assumption that these casing issues
16 were somehow similar to the circumstances that led to the failure at SS-25.⁴⁹ In fact, Blade’s
17 report combines a number of different well conditions as “leaks,” including perforations
18 intentionally made by SoCalGas for water shut off tests and stage collar leaks. These well
19 conditions have no relation to corrosion and present little risk or reason for concern. Many of
20 these “leaks” were not even gas leaks, but rather were discovered during the conversion of the
21 field to underground gas storage (when a well was not flowing or holding gas), or initial drilling
22 of a new storage well. Others on the list were either not leaks at all or double or triple counted
23 leaks from the same event.

⁴⁵ *Id.* at 204.

⁴⁶ SED Opening Testimony at 7.

⁴⁷ *Id.*

⁴⁸ *See, e.g.*, Blade Report at 4.

⁴⁹ SED specifically alleges that the alleged lack of follow-up investigation, failure analyses, or root cause analyses of these alleged prior leaks is a “root cause” of the SS-25 incident. *See* SED Opening Testimony at 7.

1 Blade's list of 63 relevant casing failures incorrectly includes the following:

- 2 • Eleven casing leaks (Wells P-12,⁵⁰ SS-14,⁵¹ SS-17,⁵² P-47,⁵³ P-25R⁵⁴ 4x,
3 FF-35E⁵⁵ 2x and SF-2⁵⁶) identified by Blade were actually discovered in
4 wells before SoCalGas operated the field or during initial conversion of
5 the field to underground gas storage. One of these leaks (SS-17) happened
6 in 1952 and occurred during the original drilling of an oil and gas
7 production well by SoCalGas' predecessor.⁵⁷ This leak occurred 20 years
8 before the conversion of the field to gas storage and cannot be attributed to
9 SoCalGas storage operations and need not have been investigated by
10 SoCalGas. The other ten leaks that were identified during the conversion
11 to underground gas storage. SoCalGas' identification and remediation of
12 these casing failures simply validates the process that SoCalGas used to
13 inspect and repair, if necessary, all wells prior to putting them into service
14 for gas storage. This is exactly how a conversion process should be
15 performed in a depleted oil or gas field.
- 16 • One leak occurred in 1979 (Well MA-1B) during initial drilling and
17 completion operations for new storage wells.⁵⁸ This leak, occurring
18 during a pressurization test with nitrogen during drilling,⁵⁹ had nothing to
19 do with underground storage operations and was rectified prior to the well
20 ever being put into service for gas storage.⁶⁰ Moreover, this leak was much
21 deeper than the leak at SS-25.⁶¹
- 22 • Seven of the casing leaks (Wells FF-32F,⁶² SS-25A,⁶³ FF-32E,⁶⁴ P-26B,⁶⁵
23
24

⁵⁰ Ex. I-16 (SCG00197973).

⁵¹ Ex. I-17 (AC_BLD_0040033).

⁵² Ex. I-18 (SCG00173498).

⁵³ Ex. I-19 (SCG00134956-SCG00134959)

⁵⁴ Ex. I-20 at 138-144, 149 (DOGGR_03700712_DATA_03-20-2008 (Modified 8-18-16).pdf (pp. 138-144; 149)).

⁵⁵ Ex. I-21 (SCG00194921-SCG00194926).

⁵⁶ Ex. I-22 (DOGGR_03700648_DATA_03-19-2008).

⁵⁷ Ex. I-23 (SCG00173498)

⁵⁸ Vol. 4, Blade Report at 15; Ex. I-24 (SCG00161941).

⁵⁹ Ex. I-25 (SCG00161981).

⁶⁰ Vol. 4, Blade Report at 29; Ex. I-24 (SCG00161941).

⁶¹ *Id.* .

⁶² Ex. I-26 (DOGGR_03721313_DATA_03-20-2008).

⁶³ Ex. I-27 (AC_BLD_0001172); Ex. I-28 (DOGGR_03721322 Data_01-20-17.pdf).

⁶⁴ Ex. I-29 (SCG00152464); Ex. I-30 (SCG00152567); Ex. I-31 (DOGGR_03721321_DATA_03-20-2008); Ex. I-32 (DOGGR_03721321_FF 32E_WBD_04-04-2019).

⁶⁵ Ex. I-33 (SCG00142047-56); Ex. I-34 at 73-74 (DOGGR_03721357_DATA_03-20-2008 (Modified 10-27-2017); p: 73-74); Ex. I-35 (DOGGR_03721357_P 26B_WBD_05-16-2018)

1 SS-25B,⁶⁶ FF-35B,⁶⁷ and SS-44A⁶⁸) identified by Blade and forming the
2 basis of seven SED violations were actually leaking stage collars.⁶⁹ Stage
3 collars are devices used for multi-stage cementing of production casing in
4 wells.⁷⁰ The stage collar is essentially a sliding valve in the casing that
5 can be opened to allow cement to be pumped outside of the casing into the
6 annulus between the production casing and the wellbore. It is quite
7 common for stage collars to not seal completely upon closing the sliding
8 valve after the cementing procedure. This situation is easily remedied
9 with a simple casing repair. More importantly, these stage collar leaks
10 have absolutely nothing to do with corrosion or poor integrity of the
11 casing in the well, and no follow-up investigation or failure analysis is
12 required to determine the obvious root cause of these particular casing
13 leaks, which are common across the entire gas industry.
14

- 15 • One casing leak (Well P-47) identified by Blade was due to incompletely
16 plugged water shut-off holes discovered in 1977.⁷¹ A water shut-off test is
17 a well operation required by DOGGR that involves placing holes in the
18 production casing and then conducting a pressure test (with water or other
19 fluid) to confirm the integrity of the seal created by the cement behind the
20 casing. After the test, the holes have to be cemented and closed. In
21 certain instances, if the holes are incompletely closed and plugged, further
22 work is required to seal the casing. This is standard practice. Water shut-
23 off leaks have absolutely nothing to do with corrosion or poor integrity of
24 the casing in the well, and no follow-up investigation or failure analysis is
25 required to determine the obvious cause of these particular casing leaks of
26 what is a simple mechanical issue.
27

⁶⁶ Ex. I-36 (AC_CPUC_0000018); Ex. I-37 (DOGGR_03721323_SS 25B_WBD_02-14-2019); Ex. I-38 at 33-34 (DOGGR_03721323_DATA_1-1-2008 (Modified 8-19-16).pdf (pg. 33-34)).

⁶⁷ Ex. I-39 at 45 (DOGGR_03721458_DATA_03-19-2008 (Modified 6-13-2016); p. 45).

⁶⁸ Ex. I-40 (SCG00177604).

⁶⁹ Vol. 4, Blade Report at 25-28, 39.

⁷⁰ See Vol. 4, Blade Report at 13 (“The well design included a cement stage collar to pump a two-stage cement job”).

⁷¹ Ex. I-41 (SCG00135098).

- A further eight of the casing leaks (Wells F-3,⁷² FF-35C,⁷³ P-32⁷⁴ 2x, P-35,⁷⁵ SS-4A,⁷⁶ P-42C,⁷⁷ and Ward-3A⁷⁸) identified by Blade were not leaks at all. These were situations where there was a suspicion of a potential leak, but further investigation by SoCalGas, such as pressure testing or noise logging, confirmed there was no leak to the exterior of the well.⁷⁹ Or in the case of F-3 and P-32, SoCalGas discovered holes in an external casing, that had been protected by an inner string during gas operations but the inner string was removed for purposes of the inspection. As such there was no leak. In the case of P-42C there was a hole in the liner top, an internal component of the well.
- Blade's list of casing leaks included four instances (Wells P-32B⁸⁰ 2x, SS-4A⁸¹ and MA-5A) of double and triple counting situations where two or more holes in a casing were discovered in a single inspection.⁸² These were not separate events, but rather singular investigations discovering multiple proximate holes. These should have only been counted once.
- With regards to the four parted casings alleged by SED (P-45,⁸³ SS-12,⁸⁴ P-42B, and SS-4-0⁸⁵) the circumstances of each of these events, which do not involve corrosion and did not occur in the course of normal operations, are entirely distinct from what occurred at SS 25. As such they did not warrant further investigation.
- The alleged parted casing at P-42B simply does not exist. In 2017 a contractor, in the course of preparing a wellbore diagram for P42B, noted

⁷² Ex. I-42 (AC_BLD_0031644); Ex. I-43 (AC_BLD_0031647).

⁷³ Ex. I-44 (SCG00155950); Ex. I-45 (SCG00155964).

⁷⁴ Ex. I-46 (AC_BLD_0067628-AC_BLD_0067629); Ex. I-47 (DOGGR_03700719_DATA_03-19-2008 (Modified 8-18-16).pdf).

⁷⁵ Ex. I-48 (DOGGR_03700722_HRVRT_02-26-16 ano II); Ex. I-49 at 32-34 (DOGGR_03700722_DATA_03-19-2008 (Modified 2-28-2018), pp. 32-34).

⁷⁶ Ex. I-50 (DOGGR_03721375_Magnetic Flux Leakage Inspection_9-17-2016); Ex. I-51 at 6-9 (DOGGR_03721375_DATA_03-19-2008 (Modified 9-15-2017), pg. 6-9); Ex. I-52 (DOGGR_03721375_SS 4A_WBD_05-16-2018).

⁷⁷ Ex. I-53 at 54-59 (DOGGR_03721878 Data_01-20-17 (Modified 5-23-2019), pg. 54-59).

⁷⁸ Ex. I-54 at 26-32 (DOGGR_03722306_DATA_03-20-2008 (Modified 10-25-2017), pg. 26-32).

⁷⁹ This further goes to refuting SED's allegations that SoCalGas somehow "failed to perform failure investigations."

⁸⁰ Ex. I-55 (SCG00146041).

⁸¹ Ex. I-56 (SCG00209334-SCG00209339).

⁸² Vol. 4, Blade Report at 24-25, 28-29, 31.

⁸³ Ex. I-57 (P-45 Well File Excerpts).

⁸⁴ Ex. I-58 (SS-12 Well File Excerpts).

⁸⁵ See SS-4-0 well file at 122, available at

https://secure.conservation.ca.gov/WellRecord/037/03722063/03722063%20Data_03-19-08.pdf.

1 that an anomaly on a 1993 USIT log may indicate either a parted casing or
2 a landing collar.⁸⁶ The drilling records from 1979 show installation of a
3 float collar on top of the first three joints of casing at approximately 7490
4 feet, the same depth as the anomaly noted by the contractor.⁸⁷ In addition,
5 P-42B passed the complete battery of tests per Order 1109 including
6 caliper, USIT, HRVRT, and pressure test, with no indication of a parted
7 casing.

- 8
- 9 • The casing failure at SS-12 occurred in the course of a workover to
10 investigate a potential leak in a threaded connection (which was later
11 determined to be due to a jumped thread, not any sort of corrosion or wall
12 loss). SoCalGas had intentionally cut the casing below the leak point and
13 the casing parted when SoCalGas pulled on the casing to extract it. The
14 fact SoCalGas had run bridge plugs through this area prior to cutting and
15 pulling the casing indicates there was not a part until SoCalGas actually
16 pulled on the casing. In addition, as Blade notes, SoCalGas pulled all the
17 casing joints with Speedtite connections.⁸⁸ It is unclear what more SED
18 believes SoCalGas should have done to investigate this event.
 - 19
 - 20 • The failure at SS-4-0, as Blade acknowledges, occurred in connection with
21 the 1994 Northridge earthquake, not in the course of normal operations.⁸⁹
 - 22
 - 23 • The failure at P-45 occurred in 1969 when Getty Oil owned the well,
24 many years before storage operations. As above it is not reasonable to
25 expect that an operator would investigate discrete isolated failures that
26 occurred years before it owned and operated the field.

27 In summary, rather than 63 casing “leaks,” as alleged by SED, in fact there were less than
28 half that number. There were ~~32~~ casing “leaks” documented by Blade which were not leaks at
29 all, were double or triple counted leaks from the same event, or did not occur during the
30 conversion of the field to underground gas storage, initial drilling of a new storage well, routine
31 casing repairs of stage collars, and a water shut-off test. Further, only two of the actual casing
32 leaks documented by Blade (FF-34A and Frew 3) involved situations where gas was known to

⁸⁶ Ex. I-59 (DOGGR_03721877_DATA_03-19-2008 (Modified 11-16-2017).pdf).

⁸⁷ See Ex. I-60 (See 1979 Drilling Record P 45).

⁸⁸ Blade Main Report, p. 165, Table 33.

⁸⁹ *Id.*

1 have migrated some distance in the subsurface away from the wellbore.⁹⁰

2 **IV. SOCALGAS USED REASONABLE INDUSTRY PRACTICES TO PREVENT**
3 **AND MEASURE CORROSION.**

4 SED makes a number of allegations regarding corrosion and the impact of such corrosion
5 on causing the incident. However, SED's allegations appear to be based on misunderstandings,
6 are contradicted by the Blade report or are simply irrelevant to whether or not SoCalGas acted
7 reasonably in operating the Aliso Canyon Facility.

8 A. Corrosion from Groundwater Did Not Create the Holes on the 11 3/4-Inch
9 Production Casing.

10 SED alleges that SoCalGas failed to investigate specific corrosion problems at SS-25.⁹¹
11 Although unclear, SED's testimony appears to assume that the 58 holes in the surface casing
12 were due to corrosion, caused the corrosion and resulting failure on the SS-25 production casing,
13 and could have been identified using the various technologies listed in the statement. SED states
14 that "Blade identified a total of 58 through-wall-metal-loss holes in the 990-foot deep, 11-3/4-
15 inch diameter steel surface casing walls of well SS-25. Fifty of the steel surface casing holes in
16 SS-25 were identified at depths ranging between approximately 150 feet and approximately 195
17 feet. The through-wall-metal-loss holes were identified using various technologies, including
18 caliper, Ultrasonic Corrosion Imaging (UCI) and High Resolution Vertilog (HRVRT). Camera
19 logging data were consistent with the technology logging data, with photographs matching the
20 sensory logging tools' metal loss locations." This logic is flawed and the allegations are without
21 support.

22 However, SED's testimony fails to mention that Blade concluded that the incident itself,

⁹⁰ In connection with violation 86, SED alleges that the FF-34A well file mentioned exploring potential regional casing corrosion in the southeastern portion of the field for study and issuance of a report, but none was located. We note that SS 25 is in the northern portion of the field and 1.5 miles away from FF-34A.

⁹¹ SED Opening Testimony~~Blade Report~~ at 11.

1 not corrosion, likely caused the holes. While the groundwater may have “accessed” the surface
2 casing and there might have been corrosion on the outside of the surface casing, there is no
3 evidence that this corrosion compromised the integrity of the surface casing. In fact, Blade
4 concluded that the holes found in the surface casing were likely a consequence of the pressure
5 surge caused by the axial rupture of the production casing and, thus occurred post-leak.⁹² Since
6 there is no evidence that the integrity of the surface casing led to the SS-25 leak, and since it is
7 very likely that the holes were caused by, and not a consequence of, the incident, the reference to
8 the holes in the surface casing in this section of the SED testimony is irrelevant.

9 B. There Were and Are No Tools Available to Perform the Kind of Inspections SED
10 Demands.

11 In connection with violations 83, 84 and 85, related to SoCalGas’ alleged failure to
12 discover specific corrosion problems on Well SS-25, SED states that “[c]orrosion was not
13 detected on SS-25 because the seven inch casing wall thickness on the SS-25 had never been
14 inspected.”⁹³ SED further alleges that “[v]arious tools [could have been] run in a well with
15 wireline to measure well thickness along the entire length of the casing or tubing casing. These
16 logs were not run in the seven-inch casing of well SS-25.”⁹⁴

17 The testimony from SED and Cal Advocates implies that various technologies were

⁹² Blade Report at 119. Blade states that “[s]ome of these approximately 58 holes [in the 11 ¾-in surface casing] could have existed prior to the 7 in. casing axial rupture,” but that “[m]any of the holes exhibited sharp corners that may have been more typical of a burst failure, implying that they occurred due to a pressure surge in the surface casing.”

⁹³ SED Opening Testimony~~Blade Report~~ at 16. It should also be noted that SED’s apparent premise underlying this argument is that SoCalGas failed to inspect and identify the 58 holes in the surface casing described above in Section III-A. However, as noted above, Blade determined the holes were most likely caused by the explosion itself. It would likely have been impossible for SoCalGas to have found these holes using any inspection techniques.

⁹⁴ *Id.*

1 available which could have easily identified these holes.⁹⁵ This is incorrect. Blade was able to
2 analyze the surface casing and identify the holes only because the production casing had been *cut*
3 *off and extracted* from the SS-25 well after the incident. Extracting the production casing
4 exposed the surface casing for inspection and examination. During the normal operation of the
5 SS-25 well, the production casing, of course, would have remained cemented in the well.⁹⁶ As
6 such, caliper logs, cameras and casing inspection logs would *not* have been able to evaluate the
7 integrity of the surface casing ~~because~~ due to the presence of the production casing.⁹⁷

8 C. SoCalGas had a Sufficiently Reasonable Understanding the Location of the
9 Groundwater and its Relationship to the Well for the Purposes of Safely
10 Operating the Site.

11 SED alleges that “SoCalGas did not employ [a] reasonable understanding of the
12 groundwater depths relative to the surface casing shoe and production casing of well SS-25”
13 until the two groundwater wells were drilled for RCA purposes.⁹⁸ However, such an
14 understanding of groundwater depth is only relevant and necessary when initially drilling the
15 well and SoCalGas had the information on groundwater necessary for the continued operation of
16 the well.

17 Much of the SED testimony focuses on the surface casing in the SS-25 well. However,
18 as discussed above, there is no conclusive evidence that groundwater or corrosion created any

⁹⁵ See Public Advocates Office Opening Testimony at 3-4, 6-7. In fact, CA Advocates openly states that SoCalGas would have been able to identify corrosion as far back as 1988. *Id.* at 9 (“Had SoCalGas’ management properly administered the [1988] program, the corrosion issues on SS-25 would have been timely identified.”). This is directly contradicted by the Blade Report which states “[i]t is not possible to determine what an inspection of the SS-25 casing would have shown in 1988.” Blade Report at 2045.

⁹⁶ As discussed in detail below in Section VII, this kind of workover requires a substantial amount of work and is dangerous.

⁹⁷ Notably, SED’s witness testified that she had never dealt with inspection logs in a gas storage field and that she has never been present when an inspection log was run. See Ex. I-10 at 65:10-15 and 66:19-20 (Felts Depo. Tr., 65:10-15 and 66:19-20).

⁹⁸ ~~SED Opening Testimony~~ Blade Report at 39.

1 holes in the surface casing. Additionally, both the Blade Report and the SED testimony present a
2 figure which shows the groundwater entering the annulus of the 7-inch production casing and the
3 wellbore below the depth of the surface casing.⁹⁹ Thus, the postulated mechanism by which the
4 groundwater accessed the annulus of the 11 ¾ inch surface casing and the 7 inch production
5 casing is via ingress below the surface casing shoe where the production casing is not cemented
6 and then mixing with the fluids outside the production casing which extend upwards into the
7 annulus between the production casing and the surface casing.

8 This is important because, as acknowledged by Margaret Felts in her deposition,
9 “[a]nybody who drills a well has to at least have a preliminary idea of where the groundwater is;
10 so that starts because you case down to the bottom of the groundwater, fresh groundwater.”¹⁰⁰
11 The SS-25 well was drilled in late 1953 and early 1954 by Tidewater Associated Oil Company.
12 At the time that Tidewater drilled the well, they would have set the 11 ¾ inch surface casing at a
13 depth reviewed and approved by the DOGGR, which was below all known shallow groundwater
14 sources based upon local hydrogeology.¹⁰¹

15 The purpose of surface casing is to isolate freshwater strata so that they are not
16 contaminated during the drilling and completion of a well. Surface casing is not designed to
17 prevent oil and gas from escaping the well and getting to the surface. SoCalGas took over
18 operation of the SS-25 well during the conversion of the Aliso Canyon field to gas storage. This
19 is not uncommon. Of the approximately 400 gas storage fields in the U.S., roughly 80% are in
20 depleted fields that originally were developed to produce oil and gas. Thus, conversion of older

⁹⁹ See Blade Report at 100; SED Opening Testimony at 43.

¹⁰⁰ Ex. I-10 at 251:17-20 (Felts Depo. Tr., 251:17-20). However, Ms. Felts goes on to note that beyond that general statement, she does not know what practices at other gas storage facilities are (she does not know what industry standard is). *Id.* at 251:24-25.

¹⁰¹ See SoCalGas Reply Testimony Chapter VII (Neville), noting that DOGGR set the presumed groundwater level at the time of drilling.

1 oil and gas wells is a common industry practice.

2 Given that the purpose of the surface casing is to protect groundwater zones during the
3 initial drilling and completion of the well, which was done in 1953 and 1954, and that the
4 oversight of the surface casing operation was reviewed and approved by the DOGGR, there
5 really is no reason for SoCalGas to have a “reasonable understanding of the groundwater depths
6 relative to the surface casing shoe and production casing of well SS-25” as is alleged by in the
7 SED testimony.¹⁰² Moreover, it is not standard practice for gas storage operators to assess water
8 depths relative to the wellbore after the surface casing has been set.

9 Once SoCalGas took over operation of the SS-25 well, there was no way for them to
10 conduct an evaluation of the integrity of the surface casing. The surface casing was cemented in
11 the wellbore. The production casing was inside of the surface casing and was also cemented. At
12 the time of the conversion of the Aliso Canyon field to gas storage in the 1970’s, and even in
13 2015 at the time of the SS-25 incident, the casing inspection logging tools used by the gas
14 storage industry could only evaluate a single string of pipe. It was not possible to evaluate the
15 integrity of the surface casing by running the logging tool down inside the production casing
16 string.

17 Based on the historical data in the Aliso Canyon field, there was no reason for SoCalGas
18 to anticipate there might be a potential problem with corrosion of the production casing at a

¹⁰² Notably, in response to discovery questions relating to the laws, regulations and industry standards underlying this allegation, SED responded that “[g]ood completion practices include the use of drilling mud with an alkaline Ph [sic]; the circulation of cement for the entire length of the casing; use of similar metals in all parts of the structure; and the insulation of the well line from the casing.” SED then cites to an alleged industry standard. However, as stated above, the knowledge of groundwater location is relevant to the initial drilling – this is where completion practices would come into play as well. Such practices are *irrelevant* to the ongoing operation of the well. *See* Ex. I-9 (SED Supplemental Data Response to SoCalGas Data Request 3 (as supplemented Jan. 23, 2020), SED response to 9(b)). Additionally, Blade noted that it did not identify any industry standards, laws or other regulations that required such an “understanding of groundwater depth” as demanded by SED. *See* Ex. I-61 (Blade Response to SoCalGas Data Request, Jan. 9, 2020, Response to Questions 1b, 1c and 1d).

1 depth above the surface casing shoe inside the annulus between the production casing and the
2 surface casing, as occurred in the SS-25 well. Blade investigated the occurrences of shallow
3 corrosion throughout the field. Regarding the 27 wells they identified that demonstrated shallow
4 corrosion, Blade determined that almost all of the wells had production casing external corrosion
5 present below the surface casing shoe. Excluding the SS-25, only one well, P-50A, had
6 production casing external corrosion above the surface casing shoe.¹⁰³ Thus, corrosion on the
7 production casing above the surface casing shoe was very rare.

8 SED's allegations that SoCalGas is at fault for failing to employ a reasonable
9 understanding of the groundwater depths relative to the surface casing shoe and production
10 casing of the SS-25 well are unsupported. Knowledge of the hydrogeology and groundwater is
11 only relevant for the design and implementation of the surface casing.¹⁰⁴ This was done almost
12 20 years prior to SoCalGas taking over operations of the SS-25 well and was done with DOGGR
13 approval. Moreover, DOGGR established the levels to assume for the base of freshwater at
14 Aliso. There was no reason for SoCalGas to expect or anticipate possible corrosion of the
15 production casing above the surface casing shoe because historically, prior to the SS-25 incident,
16 it had only happened once and was very rare. Further, the production casing in the well had been
17 installed and cemented consistent with the industry standards of the U.S. gas storage industry at
18 the time of installation.

¹⁰³ Blade Report at 189.

¹⁰⁴ Ms. Felts appears to confirm this in her own testimony, where she agrees that "it would be necessary to have an understanding of groundwater depths for purposes of setting the surface casing." Ex. I-10 at 254:1-5 (Felts Depo. Tr. 254:1-5). As stated above, the surface casing was set when the well was installed.

1 D. Corrosion of the Surface Casing did not cause Corrosion in the Production Casing and the
2 Surface Casing is not Intended as a Gas Barrier.

3 SED argues that SoCalGas violated Section 451 because it did not “understand the
4 consequences of corroded surface casings.”¹⁰⁵ However, it is interesting to note that nowhere in
5 their testimony does SED indicate what the consequences were of external corrosion of the
6 surface casing in the SS-25 well.¹⁰⁶ In other words, SED faults SoCalGas for not understanding
7 the consequences of corroded surface casing, yet they do not offer an explanation of what those
8 consequences were.

9 Further, SED makes no mention in their testimony of any link or connection between
10 corrosion of the surface casing in the SS-25 well and the rupture in the production casing of the
11 well which caused the leak. As was stated in Section IV-A, *corrosion in the surface casing did*
12 *not provide the ingress for groundwater to access the production casing at the point of the*
13 *leak.*¹⁰⁷ Instead, this was caused by groundwater entering the wellbore opposite the uncemented
14 production casing below the surface casing shoe. This is a completely different issue and will be
15 discussed further below.

16 The Blade report also correctly points out that “[t]he function of the surface casing is to
17 isolate fresh water sources and also provide a string for drilling the deeper hole for gas storage or
18 oil production. The surface casing is not intended to provide any further barriers to gas or
19 oil.”¹⁰⁸ Thus, SoCalGas cannot be faulted for the condition of corrosion on the surface casing

¹⁰⁵ SED Opening Testimony at 47.

¹⁰⁶ Further, SED’s follow-up answers to discovery state the same – alleging serious consequences but merely stating that corrosion will occur. *See, e.g.*, Ex. I-9 (SED Supplemental Data Response to SoCalGas Data Request 3 (as supplemented Jan. 23, 2020), SED response to question 9(a)).

¹⁰⁷ Felts acknowledges this in her deposition, where she states that she does not contend that the corrosion of the surface casing was the point of entry for the water that caused corrosion at the SS-25 production casing. *See* Ex. I-10 at 241: 10-17 (Felts Depo. Tr. 241:10-17).

¹⁰⁸ Blade Report at 192.

1 and any escaping gas through holes in the surface casing, which were caused post-leak,¹⁰⁹
2 because the purpose and objective of surface casing is not to provide a barrier to gas or oil
3 leaving the wellbore.

4 E. The Production Casing was Cemented Properly pursuant to Industry Standard Practices.

5 SED alleges that SoCalGas violated Section 451 because it “did not understand the
6 consequences of uncemented production casings.”¹¹⁰ Based on our experience, in the 1970’s,
7 when many of the Aliso Canyon wells were completed or converted for gas storage, it was not
8 industry standard for underground gas storage wells to have the production casing cemented to
9 surface. Rather, it was common practice that the production casing was cemented in a fashion
10 such that the storage reservoir was isolated and cement extended above the storage zone for
11 several hundred to a few thousand feet. This was the case in the SS-25 well where the top of
12 cement was approximately 2,0001,500 feet above the gas storage reservoir interval.

13 Of the 31 U.S. states with gas storage operations in October 2015, only six states had
14 added requirements that production casings on existing, retrofitted wells be cemented to surface.
15 California was not one of those states. In addition, it is not practical nor prudent to attempt to
16 remediate a well by attempting to squeeze cement behind the production casing in those areas
17 where the well was originally not cemented. The amount of damage caused to the casing would
18 far outweigh any potential benefit of such remedial work.

19 With respect to the quality of the cement behind the surface casing, during the original
20 well drilling operations in 1953 and 1954, attempts were made to cement the 11 ¾ - inch surface
21 casing from 990 feet to the surface. However, during the cementing operations, no cement was
22 returned to the surface indicating an incomplete cementing job. Thus, two top cement jobs were

¹⁰⁹ See Section IVX, *infra*.

¹¹⁰ SED Opening Testimony at 47.*Id.*

1 performed where cement is pumped from the surface down behind the surface casing to fill the
2 annulus with cement up to the surface. This is a typical, industry standard operation when there
3 are no surface returns, as was the case in the SS-25 well.

4 It is important to note that for most gas wells, the quality and completeness of cement
5 behind the surface casing is unknown. The only indication that a surface casing cement job is
6 satisfactory is whether or not cement is returned to surface. It is not customary, and it is
7 considered unnecessary, to run a cement bond log on surface casing. Surface casings are not
8 designed to be a barrier to oil and gas escaping the wellbore. Therefore, in cases such as this one
9 where cement does not return to surface, it is industry standard practice to remediate the problem
10 by augmenting the cementing procedure with one or more top cement jobs. This is exactly what
11 was done in the drilling and completion of the SS-25 well.

12 Prior to 1990, Cementing of the production casing in gas storage wells to the surface
13 was not industry standard. Rather, the industry standard and common practice was that the
14 production casing was cemented in a fashion such that the storage reservoir was isolated and
15 cement extended above the storage zone for several hundred to a few thousand feet. This was
16 the case in the SS-25 well.

17 F. Cathodic Protection is not Industry Standard and Was Not Necessary for SS-25.

18 SED alleges that “[c]athodic protection systems are commonly used to protect pipelines
19 from corrosion” and goes on to imply that SoCalGas is in violation of Section 451 for not
20 employing cathodic protection on SS-25.¹¹¹ However, cathodic protection is not the industry
21 standard for gas storage wells.

22 The gas storage industry remains divided as to the effectiveness of cathodic protection

¹¹¹ SED Opening Testimony at 45-47.

1 systems for storage wells. While it is recognized that there are certain localized conditions
2 where such a system can be beneficial, for most gas storage wells, the benefits of cathodic
3 protection system are questionable. As a result, cathodic protection of surface casing in gas
4 storage fields is not an industry standard practice.

5 The SED faults SoCalGas for not having installed cathodic protection to prevent
6 corrosion of the surface casing in the SS-25 well. What the SED testimony does not mention;
7 however, are the limitations and downsides of using cathodic protection in a gas storage field
8 such as Aliso Canyon. Cathodic protection can be an effective tool to prevent corrosion in
9 shallow surface casing strings. While not an industry standard, the technology is used in some
10 gas storage fields with known areas of high corrosion. Recall that, Aliso Canyon is not one of
11 these areas; the Blade report documented finding no pattern of corrosion associated with well
12 age, well location, or depth. Thus, given that the SS-25 well is not in a corrosion “hot spot,” the
13 operator must balance the limited benefits of using cathodic protection to shield the surface
14 casing versus the potential limitations and downsides.

15 In areas of high well density, such as the three-well pad at the SS-25 location where wells
16 are located within a few hundred feet of one another, the application of cathodic protection is
17 complex and problematic. If the induced currents are not properly balanced, well casings that
18 are not receiving adequate current will be unprotected and through oxidation reactions will
19 actually see increased corrosion and casing leaks, above what would have occurred with no
20 cathodic protection. In these situations, corrosion of surface casings is actually increased rather
21 than prevented.

22 Similarly, within the areal “footprint” of a cathodic protection system, all wells must be
23 protected. The Aliso Canyon field is not only a gas storage field, but there are non-storage

1 operations within the field boundaries accessing shallower hydrocarbon production. These
2 shallow wells are not operated by SoCalGas. If SoCalGas were to install cathodic protection
3 only on its gas storage wells, any shallow hydrocarbon wells operated by others at the field
4 would suffer increased corrosion and loss of well integrity because of the cathodic protection
5 currents.

6 Cathodic protection typically works very well on protecting surface pipelines or shallow
7 gas gathering lines, where the resistivity of the environment around the steel is known and
8 relatively uniform. However, in the case of vertical surface casing which extends to a depth of
9 approximately 1,000 feet, such as the SS-25 well, the resistivity of the soils can change suddenly
10 and dramatically with variations in depth. This results in an extremely difficult engineering
11 solution to design a cathodic protection scheme that accounts for the rapid changes in soil
12 resistivity and balances the current applied in the cathodic protection system. When multiple
13 wells are added to the equation, such as would be the case around the SS-25 well pad, the
14 problem becomes increasingly more difficult and complex. Any imbalance in the applied current
15 will have the undesired effect of increasing corrosion.

16 Finally, the axial rupture of the production casing occurred at a depth of 892 feet, which
17 was inside the surface casing of the well. The Blade report clearly states, “While a cathodic
18 protection system would have provided corrosion protection to the 11 ¾ in. casing, it would not
19 have protected the 7 in. casing inside the 11 ¾ in. casing.”¹¹² Thus, an independent corrosion
20 protection mechanism like cathodic protection would not have been useful in this case, contrary
21 to the suggestions made in the SED testimony.

¹¹² Blade Report at 215.

1 **V. SOCALGAS HAD WELLBORE INTEGRITY MANAGEMENT PROGRAM**
2 **BEFORE THE INCIDENT THAT MET OR EXCEEDED INDUSTRY**
3 **STANDARD PRACTICES.**

4 SED’s Opening Testimony alleges, “SoCalGas did not have any form of risk assessment
5 focused on wellbore integrity management, including lack of assessment of qualitative
6 probability and consequence of production casing leaks or failures.”¹¹³ SED further criticizes
7 SoCalGas for not initiating a storage integrity management program in 2009, even though such a
8 program was recommended by Mr. James Mansdorfer, who was the Storage Engineering
9 Manager at the time.¹¹⁴ Lastly, SED faults SoCalGas for relying upon temperature and noise
10 surveys for monitoring the casing integrity of gas storage wells at Aliso Canyon. Based on our
11 review of the records and evidence, SED’s assertions (which are the basis for asserted violations
12 74, 75 and 78) are unfounded.

13 First, prior to 2007 SoCalGas did assess risk as part of ongoing operations, even if it was
14 not documented as a formal risk assessment program; this was consistent with the standard
15 practices of other operators.¹¹⁵ Second, starting in 2007 SoCalGas had a ~~formal~~ risk assessment
16 program, which focused on wellbore integrity management. SoCalGas implemented a “Replace
17 and Inspect” initiative, which included conducting wellbore integrity evaluations at Aliso
18 Canyon and performing remedial work, if necessary, based on the results. SoCalGas
19 implemented the initiative two years prior to Mr. Mansdorfer’s 2009 recommendation for a
20 similar initiative. The initiative included the inspection of the integrity of the production casing
21 in the storage wells. Moreover, the “Replace and Inspect” initiative included detailed evaluations

¹¹³ SED Opening Testimony at 12. Interestingly, SED testimony within Section 2 makes no further mention of this allegation.

¹¹⁴ Note that SED’s testifying expert, Margaret Felts, under oath, stated that she had never spoken or met Mr. James Mansdorfer. Ex. I-10 at 221:10-14 (Felts Depo. Tr., 221:10-14). Instead, she relied on Mansdorfer’s EUO and some produced documents from Mansdorfer or SoCalGas. *Id.* at 221:15-25.

¹¹⁵ *See, e.g.*, Ex. I-62 (Testimony of Phillip E. Baker, Southern California Gas Company, 2016 General Rate Case, A-14-11-004 at PEB-5 – PEB-8).

1 of the wellbore integrity and replacement of well hardware equipment, such as wellhead valves
2 and the well tubing and packer. As a result of this initiative, SoCalGas permanently removed six
3 wells, of approximately 30 wells inspected, from service based on their downhole condition.

4 Second, in 2014, SoCal Gas improved upon the “Replace and Inspect” initiative by
5 developing the Storage Integrity Management Program (“SIMP”). SoCalGas was in the process
6 of initiating the SIMP at the time of the SS-25 incident. For gas storage wells, SIMP includes
7 threat identification and risk assessment based on a variety of factors, remediation as necessary,
8 development of preventative and mitigative measures, and record-keeping requirements.
9 Essentially, SIMP~~is~~ combines risk management and integrity management into an aggressive
10 integrity management program that addresses risk more proactively.¹¹⁶

11 The SIMP is consistent with the API RP 1171 recommended practice for well integrity
12 evaluation. As explained above, API RP 1171 contemplates being implemented in 7-10 years
13 and was not published until September 2015, shortly before the incident.¹¹⁷ Moreover,
14 SoCalGas’ SIMP is similar to initiatives other gas storage operators were contemporaneously
15 implement~~ing~~ed. It is our experience that, historically, operators in the gas storage industry
16 performed well integrity work responsively due to technological limitations as well as general
17 success with the approach of remediating as issues arose. Recently, some operators are
18 beginning to utilize improved technology to evaluate the condition of downhole equipment
19 before failure occurs.¹¹⁸ While SoCalGas’ efforts, the “Replace and Inspect” initiative and SIMP

¹¹⁶ For example, Ravi Krishnamurthy from Blade described SoCalGas’ SIMP program as being “intense.” Ex. I-63 at 340:7-15 (Krisnamurthy Depo. Tr. 340:7-15).

¹¹⁷ Ex. I-8 (Underground Natural Gas Storage Integrity & Safe Operations 4 (July 6, 2016), available at <https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/technical-resources/pipeline/underground-natural-gas-storage/59336/aga-white-paper-ungs-integrity-and-safe-ops-20160706.pdf>).

¹¹⁸ For example, SoCalGas has already notified SED and others that part of its SIMP program involves the prioritization of wells. See Ex. I-64 (SoCalGas Response to SED Request, Question 2, Received Feb. 4, 2016, Responded Feb. 16, 2016). (Providing a list of priority wells at Aliso Canyon).

1 place them among the pioneers in the industry, moving towards a new, more proactive approach
2 to well integrity management, they are really just formalizing risk assessment processes that
3 were already in place, albeit informally.

4 Third, SED's criticisms are rooted in the benefits of hindsight. While SED faults
5 SoCalGas for relying on temperature and noise surveys, it also acknowledges that DOGGR fully
6 approved SoCalGas's casing integrity monitoring program.¹¹⁹ At the time of the SS-25 incident,
7 only two states (out of 31 with gas storage operations) required corrosion testing through vertilog
8 or similar casing inspection tools; of those two states, only one had significant gas storage
9 operations. Further, only 10 of those 31 states required *any* periodic mechanical integrity testing
10 on gas storage wells with tubing and packer completion.¹²⁰ While not controlling, because
11 California was one of the states with requirements, this statistic is indicative of the progress in
12 the industry. Therefore, SoCalGas was following DOGGR requirements and exceeding national
13 standards by conducting annual temperature surveys on all Aliso Canyon storage wells.

14 **VI. DUAL MECHANICAL BARRIERS ARE NOT INDUSTRY STANDARD AND**
15 **SINGLE BARRIER WELL COMPLETIONS ARE INDUSTRY STANDARD.**

16 In their Opening Testimony, SED asserts that SoCalGas did not have a dual mechanical
17 barrier system in the wellbore of SS-25, instead leaving the 7-inch production casing as the
18 primary barrier to the gas.¹²¹ SED found "that SoCalGas violated Section 451 by operating well
19 SS-25 without a backup mechanical barrier to the 7-inch production casing."¹²²

20 While it is correct that SoCalGas did not have a dual mechanical barrier system in the

¹¹⁹ Ex. I-5 (DOGGR Project Approval Letter, April 18, 1989; revised July 26, 1989). SED acknowledges that DOGGR has primary jurisdiction over down hole gas storage and gas storage wells. Ex. I-10 at 235 (Felts Depo. Tr., 235).

¹²⁰ California required periodic mechanical integrity testing and approved the use of temperature logs and noise logs, as needed to meet this requirement.

¹²¹ SED Opening Testimony at 18.

¹²² SED Opening Testimony at 25.

1 wellbore of SS-25,¹²³ a dual barrier well design in underground gas storage has never, including
2 through today, been considered the industry standard practice.¹²⁴ In its opening testimony, SED
3 fails to identify an industry standard requiring a dual mechanical barrier system. As stated by a
4 JITF report, *Underground Natural Gas Storage – Integrity & Safe Operations* (“JITF Report”),
5 “Operators have designed and installed a number of different well completions depending on
6 their historical experiences, practices, and site-specific conditions. A common well completion
7 case referenced herein contains production casing without tubing.”¹²⁵ The JITF Report goes on to
8 state that “10-25 percent of natural gas storage wells have a full tubing string set into an isolation
9 packer.”¹²⁶ JITF later revised this figure to 13 percent of natural gas storage wells.¹²⁷ Thus, Aliso
10 Canyon’s single barrier well completion were consistent with the industry standard and
11 approximately 87% of all gas storage wells in operation in the U.S.¹²⁸

¹²³ At the time of conversion of the Aliso Canyon field to gas storage operations, the injection/withdrawal wells were designed with tubing on a packer and an installed subsurface safety valve (“SSSV”). The wells were operated in a single barrier configuration, utilizing annular flow to achieve the high flowrates necessary for storage operations. By flowing gas in the annulus between the tubing and production casing, effectively only a single barrier, the production casing, existed between the storage gas and the surrounding strata in those parts of the well where the production casing was not cemented.

¹²⁴ It is important to note that DOGGR’s regulations requiring dual mechanical barriers (Cal. Code Reg. § 1726.5(b)(1)) are only mandated to be in place “within seven years” of the effective date of the regulations, which is not until October 2025. Cal. Code Reg. § 1726.3(d)(1). Additionally, Margaret Felts, SED’s testifying witness, stated that she did not “know what technology is used in the wells in other storage fields around the United States” and that she had not “looked into that.” Ex. I-10 at 236:23 – 237:1 (Felts Depo. Tr., 236-37:23-1).

¹²⁵ Ex. I-8 (Underground Natural Gas Storage Integrity & Safe Operations 21 (July 6, 2016), available at <https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/technical-resources/pipeline/underground-natural-gas-storage/59336/aga-white-paper-ungs-integrity-and-safe-ops-20160706.pdf>).

¹²⁶ *Id.* at 55.

¹²⁷ Note the range was updated by JITF in September 2016 according to a poll of U.S. Underground Natural Gas Storage Operators Ex. I-68 at 13 (“Tubing and Packers in Underground Natural Gas Storage: Safety and Reliability Considerations”, AGA/API/INGAA Underground Natural Gas Storage Joint Industry Task Force, September 16, 2016, Slide 13). This estimate represents an 80% response rate (13,485 out of a total of 17,500 storage wells). *Id.* .

¹²⁸ *Id.* Ex. I-8.

1 **VII. SOCALGAS' PROGRAM FOR THE INSPECTION AND MEASUREMENT OF**
2 **WALL THICKNESS WAS COMPLIANT WITH REGULATIONS AND MET**
3 **INDUSTRY STANDARDS.**

4 SED asserts, in connection with violation 78 that, "SoCalGas did not have internal
5 policies that required inspection and measurement of the wall thickness of wellbores at Aliso.
6 Instead, SoCalGas used techniques that detected and fixed leaks only after the event
7 occurred."¹²⁹ SED testimony also notes, "SoCalGas had no internal policies on wall thickness
8 inspections because the company assumed that regulatory compliance was being adhered to by
9 running annual temperature surveys in accordance with the Aliso Canyon Monitoring Plan and
10 the project approval letter dated 1989 requiring an annual mechanical integrity test (MIT)."¹³⁰

11 First, SED is incorrect that SoCalGas "assumed that regulatory compliance was being
12 adhered to through the running of annual temperature surveys." DOGGR approved SoCalGas's
13 monitoring program as being in regulatory compliance.¹³¹ Further, as already noted, the
14 SoCalGas monitoring program met and exceeded industry standards.¹³²

15 Second, SED's testimony creates the inference that SoCalGas could have, and should
16 have, done better than simply running temperature surveys and periodic noise logs. The SED
17 testimony faults SoCalGas for not also running casing inspection logs. However, SED criticism
18 directed at SoCalGas's policies and practices is myopic and ignores the lessons learned by the
19 gas storage industry over the past 60+ years.

20 Running a casing inspection log in a well, such as the SS-25 well at Aliso Canyon,

¹²⁹ SED Opening Testimony at 25.

¹³⁰ SED Opening Testimony at 25-26.

¹³¹ See Blade Report at 216 ("The 2015 DOGGR regulations required periodic MITs, and annual temperature surveys were approved to meet the MIT requirements."). See also *Id.* at 202 (noting that DOGGR "approved the use of static temperature surveys to satisfy compliance of the requirements for mechanical integrity.")

¹³² Moreover, Blade has stated that it did not identify any industry standards "in connection with internal policies requiring production casing wall thickness inspections." Ex. I-12 at 6 (Blade Response to the SoCalGas Data Request January 23, 2020 (Feb. 14, 2020) at 6).

1 necessarily requires conducting a workover on the well. A workover entails killing the gas
2 production from the well by filling the wellbore with fluid and then pulling all of the tubing out
3 of the wellbore. Only after all this is done may a gas storage operator run a casing inspection log
4 in the well. It was not possible to evaluate the integrity of the production casing by running the
5 logging tool down the tubing string. Therefore, to accomplish what the SED testimony suggests
6 should have been done, which is to run casing inspection logs in wellbores that had historically
7 given no indication of problems with the production casing, it would have been necessary to run
8 a workover on the well.

9 The JITF Report contains a detailed discussion of the risks of workovers in Section 2 of
10 their document titled, “Lessons Learned from Historical Underground Natural Gas Reservoir
11 Storage Well Events (API 1171 Sections 8.4 and 8.7).”¹³³ The JITF Report analyzed 61
12 unplanned storage well releases of gas in the U.S. between 1953 and 2010.¹³⁴ Their analysis
13 showed that approximately a third of the 61 incidents on record happened during well
14 interventions, including well workovers or re-works. The JITF Report further notes that the
15 industry statistics show the likelihood of such an unplanned release event occurring in a gas
16 storage well is classified as “very unlikely” to “extremely unlikely” or “remote”. Thus, it is
17 significant that approximately a third of such incidents occurred during well workovers.

18 For example, three workers recently died (and a fourth was injured) during a workover

¹³³ Ex. I-8 at 9-1124 (Underground Natural Gas Storage Integrity & Safe Operations 21 (July 6, 2016), available at <https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/technical-resources/pipeline/underground-natural-gas-storage/59336/aga-white-paper-ungs-integrity-and-safe-ops-20160706.pdf>).

¹³⁴ Ex. I-8 at 10 (Underground Natural Gas Storage Integrity & Safe Operations 10 (July 6, 2016), available at <https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/technical-resources/pipeline/underground-natural-gas-storage/59336/aga-white-paper-ungs-integrity-and-safe-ops-20160706.pdf>).

1 operation at a well in Burleson County, TX.¹³⁵ The investigation is ongoing but it is believed
2 that an “unexpected amount of natural gas entered the well and ignited. What caused the ignition
3 remains under investigation.”¹³⁶ A similar incident occurred in Watford City, North Dakota in
4 2016, where one worker was killed and three seriously injured when an amount of gas entered
5 the well during a workover and ignited.¹³⁷ A 2017 report by the Centers for Disease Control and
6 Prevention and the National Institute for Occupational Safety and Health found that 9 fatalities
7 occurred in 2014 during well workovers and that “rig or equipment repair and maintenance” was
8 one of the activities “most commonly associated with fatalities.”¹³⁸

9 U.S. gas industry experience mirrors the JITF Report’s findings that *the most likely time*
10 *to have an accident or an incident on a well is during a workover*. Anytime a gas storage
11 operator pulls a pipe out of a well, such as when removing tubing to run a casing inspection log,
12 the chance of an incident increases dramatically.

13 In their 2016 presentation, the JITF noted the following safety risks and dangers of
14 running casing inspection logs in a gas storage well:

- 15 • Advanced tools such as high resolution Vertilog cannot be used to analyze the

¹³⁵ See Ex. I-65 (Liz Hampton, *Chesapeake Energy, others sued for \$1 million in fatal Texas oil-well blast*, REUTERS U.S. LEGAL NEWS (Feb. 2, 2020), available at <https://www.reuters.com/article/us-chesapeake-ergy-blowout-lawsuit/chesapeake-energy-others-sued-for-1-million-in-fatal-texas-oil-well-blast-idUSKBN1ZZ2P1>) (noting that the blowout occurred during a workover operation); see also Ex. I-66 (Jerry Bohnen, *Federal agencies probe Chesapeake well blowout that killed 3 workers in Texas*, OK ENERGY TODAY (Feb. 5, 2020), available at <http://www.okenergytoday.com/2020/02/federal-agencies-probe-chesapeake-well-blowout-that-killed-3-workers-in-texas/>) (noting the death of the third worker).

¹³⁶ Ex. I-67 (*Feds to Probe Fatal Chesapeake Energy Oil Well Accident*, ROUGHNECK NEWS (Feb. 4, 2020), available at <https://www.roughneckcity.com/roughneck-city/oilfieldnews/1415/feds-to-probe-fatal-chesapeake-energy-oil-well-accident>).

¹³⁷ Ex. I-68 (Amy Dalrymple, *One Killed, Three Injured in Well Site Accident*, Williston Herald (June 20, 2016), available at https://www.willistonherald.com/news/one-killed-three-injured-in-well-site-accident/article_e90d2b4c-3713-11e6-98b4-0fe09945798a.html).

¹³⁸ Ex. I-69 (SOPHIA RIDL ET AL., CENTERS FOR DISEASE CONTROL AND PREVENTION & NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH, OIL AND GAS EXTRACTION WORKER FATALITIES 2014 12-14 (Aug. 2017)).

1 condition of the casing when tubing is present. Thus, a workover is required.

- 2 • The greatest risk for an accident is during intervention or workover.
- 3 • Packer slips apply thousands of pounds of force into the casing and leave
4 indentations in the pipe wall.
- 5 • Scale and ovality allow gas to leak around the packer~~Thus, unseating the packer~~
6 ~~in order to remove the tubing during a workover can cause scale and ovality,~~
7 ~~which allows gas to leak around the packer.~~¹³⁹

8 Therefore, there is a very good reason why the gas storage industry standard for
9 monitoring casing integrity, in wells with tubing and packer completion, at the time of the SS-25
10 incident was to use temperature surveys rather than the more aggressive strategy of conducting
11 well workovers so that casing integrity logs could be run.¹⁴⁰ Given the safety risks associated
12 with well workovers JITF identified, it is often not the best course of action for a gas storage
13 operator to run a workover on their well when there is no reason to suspect there might be a
14 problem with that well, as was the case with SS-25. To do so only increases the risk and
15 likelihood of an unplanned release of storage gas.

16 **VIII. SOCALGAS' PRESSURE MONITORING SYSTEM WAS REASONABLE**
17 **AND THE CHANGES SED DEMANDS WOULD NOT HAVE MADE ANY**
18 **DIFFERENCE.**

19 SED asserts, in connection with violation 87 that “SoCalGas lacked a real-time,
20 continuous pressure monitoring system for well surveillance, which prevented an immediate
21 identification of the SS-25 leak and accurate estimation of the gas flow rate.”¹⁴¹

22 SED’s testimony regarding real time pressure monitoring (“RTPM”) is unclear. At
23 deposition, SED’s witness clarified that the reason RTPM was important was that it could have

¹³⁹ Ex. I-6 at 6 (“Tubing and Packers in Underground Natural Gas Storage: Safety and Reliability Considerations”, AGA/API/INGAA Underground Natural Gas Storage Joint Industry Task Force, September 16, 2016, Slide 6).

¹⁴⁰ It is also important to note that SED’s sole witness, Margaret Felts stated that she had “never been present when a log was run on an oil or gas well.” Ex. I-10 at 66:19-20 (Felts Depo. Tr., 66:19-20).

¹⁴¹ SED Opening Testimony at 47.

1 enabled SoCalGas to identify and remediate the leak at SS-25, which she believes had been
2 present for years, at an earlier point in time.¹⁴² The facts, however, are otherwise: the leak and
3 failure at SS-25 was a sudden event and there was no pre-existing leak. Ms. Felts testimony on
4 this issue is also inconsistent with Blade's report. As such, SED's contention here is simply
5 without any factual basis or support.

6 Ms. Felts also appears to be arguing separately that RTPM would have provided flow rate
7 data that could have been utilized in the well kill.¹⁴³ As a general matter, SED's allegations
8 regarding real time pressure monitoring, and the Blade analysis on which it appears to be based,
9 are highly speculative.

10 A. Real-Time Pressure Monitoring Systems Are Not Industry Standard in Gas
11 Storage Fields.

12 A real-time continuous pressure monitoring system, as discussed in the SED testimony, is
13 also known as Supervisory Control and Data Acquisition, or SCADA. The SED testimony in
14 this section is critical of SoCalGas for not having a SCADA system in place at Aliso Canyon at
15 the time of the SS-25 incident. However, installing SCADA on existing gas storage wells was
16 not an industry standard practice in the U.S. gas storage industry in October 2015. Notably, both
17 Blade and SED's expert witness stated that they did not identify any industry standards or
18 regulations that required real-time, continuous pressure monitoring for well operations.¹⁴⁴

19 Without a communication link to each wellhead, there was virtually no opportunity for

¹⁴² See Ex. I-10 at 267:15-25, 268:8-16, 269:22-24 (Felts Depo. Tr. 267:15-25, 268:8-16, 269:22-24).

¹⁴³ See, e.g., Ex. I-10 at 270:15-272:1 (Felts Depo. Tr. 270:15-272:1).

¹⁴⁴ SED's expert testified that she was unaware of and had not looked into industry standard practice regarding continuous pressure monitoring in gas storage fields. Ex. I-10 at 266:1-5 (Felts Depo. Tr. 266:1-5). See also Ex. I-12 at 7-8 (Blade Response to SoCalGas Data Request, Feb. 14, 2020, Response to Questions 2a and 2b (pp. 7-8)) (Blade states that it "did not identify any INDUSTRY STANDARD(S) 'related to real-time, continuous pressure monitoring systems for well surveillance.'" Blade similarly did not identify any laws or regulations requiring real-time, continuous pressure monitoring).

1 remote control, much less data monitoring. The Interagency Task Force on Natural Gas Storage
2
3 Safety notes that 80% of all storage wells within the industry were drilled prior to 1980 and thus
4 did not have a communication link.¹⁴⁵ Thus, in order to have remote control or data monitoring,
5 storage operators would have to retrofit old wellheads with expensive electronic data recorders.
6 It wasn't until gas storage compressor stations became more automated and had fully functional
7 computer networks and SCADA systems, that operators began to extend communications
8 capabilities to individual wells. It wasn't until the early 2000's that remote data capture
9 equipment started to be installed on wellheads so the operators could download pressure and
10 temperature data periodically, typically weekly, to their laptops. Our experience indicates that
11 even today less than half of all gas storage operators have full SCADA capability. New
12 regulations issued after the SS-25 incident will likely accelerate installations, but they have been
13 slow coming.¹⁴⁶

14 Most gas storage operators now have SCADA systems for their compressor station(s) and
15 central control facility operation, but as of 2015 very few gas storage fields that were developed
16 in depleted oil or gas fields had retrofitted their storage wells with this capability.¹⁴⁷ SoCalGas
17 was in this same position at Aliso Canyon having a SCADA system for their central facilities,
18 but not for monitoring individual well data. At the time of the SS-25 incident, SoCalGas had
19 purchased and was in the process of installing SCADA for their wells at each of their gas storage
20 facilities, but the system at Aliso Canyon had not yet been installed.

¹⁴⁵ Ex. I-70 (Ensuring Safe and Reliable Underground Natural Gas Storage – Final Report of the Interagency Task Force on Natural Gas Storage Safety, October 2016).

¹⁴⁶ Ex. I-71 (See <https://inductiveautomation.com/resources/article/what-is-scada>).

¹⁴⁷ Notably, SED's witness testified that she had not looked at industry standards for continuous pressure monitoring in gas storage operations *at all*. See Ex. I-10 at 266:1-5 (Felts Depo. Tr. at 266:1-5).

1
2 B. Real-Time Pressure Monitoring Would Neither Have Provided a Meaningfully
3 More Immediate Identification of the Leak, Nor Would It Have Provided Insight
4 into the Extent of the Leak.

5 The SED testimony states the following:

6 “The lack of real-time pressure measurements prevented the immediate identification of
7 the SS-25 7-inch casing failure.”¹⁴⁸ SED further states that “[i]f this type of system had been
8 installed on SS-25, it would have provided insight into the time of the leak, the opportunity to
9 shut in the well immediately, size of the leak, and the extent of the problem.”¹⁴⁹

10 The above SED statements, which are copied directly from the Blade report with no
11 further comment, analysis or insights, are incorrect and irrelevant. SED alleges that if a SCADA
12 system were installed, it would have provided insight into the time of the leak and the
13 opportunity to shut-in the well immediately.¹⁵⁰ That SoCalGas could have somehow stopped the
14 failure mid-rupture is pure speculation, lacks factual support, and belies credulity.¹⁵¹ Blade
15 estimates the time of the leak at between 7am and 8am on October 23, 2015.¹⁵² SoCalGas
16 discovered the leak at 3:15pm that same day, and shut-in the well by 3:30pm that same day. For
17 all intents and purposes, SoCalGas, through their regular well monitoring, discovered the leak
18 and shut-in the well almost immediately. A few hours difference in the initial identification of

¹⁴⁸ SED Opening Testimony at 48.

¹⁴⁹ *Id.*

¹⁵⁰ SED’s witness says the same in her deposition, where she stated that “[SoCalGas] would be able to see exactly what was going on in the well and because they didn’t have that, they were somewhat hampered in being able to detect the leak before it actually broke out the surface . . .” Ex. I-10 at 267:15-21 (Felts Depo. Tr. 267:15-21). However, she appears to be relying solely on the Blade Report when giving this testimony. *See Id.* at 266:24 – 267:2.

¹⁵¹ SED’s expert appears to believe that continuous monitoring would have allowed SoCalGas to identify the leak at an earlier stage when it was a “smaller leak,” which would have made dealing with it easier. Ex. I-10 at 268:21 – 267:1 (Felts Depo. Tr. 268:21 – 267:1); *see also Id.* at 271:19 – 272:1. There is no evidence to support this, especially given how rapidly Blade explained the crack in the casing propagating. *See Blade Report* at ~~6552~~.

¹⁵² Blade Report at 158.

1 the gas leak and the closing of the well would have made absolutely no difference to the actions
2 and outcome at the SS-25 well.

3 SED further alleges that if a SCADA system were installed, it would have provided
4 insight into the size of the leak. Presumably, by the “size of the leak”, SED (and Blade) mean
5 the gas flow rate of the leak. But this is impossible. A SCADA system would have provided no
6 information at all as to the magnitude of the gas leak. A SCADA system measures surface
7 tubing and casing pressures and, if equipped with a well flow meter, the injection or production
8 rate at the wellhead. At the time of the leak, the SS-25 well was injecting gas at a rate of
9 approximately 70 MMscf per day. That is the rate that the SCADA system would have
10 measured, and that rate has absolutely nothing to do with the magnitude of the downhole gas
11 leak. Once the well was shut-in, the gas injection rate would now be zero, but the SCADA
12 system would still not be measuring any flow rate associated with the gas leak because the
13 SCADA system measures data at the wellhead. As the Blade report states, most of the gas from
14 the leak would have “flowed through the heavily weathered and vertically fractured top 200-300
15 ft. of formation, however, some would have flowed horizontally through permeable or fractured
16 layers away from the SS-25 well site, and some would have remained in the subsurface.” It is
17 not possible for a real-time measurement system at the wellhead to detect and measure the gas
18 flow rate outside the wellhead flowing through the geologic strata.

19 Finally, SED alleges that if a SCADA system were installed, it would have provided
20 insight into the extent of the problem. Once again, this could not be possible. Real-time
21 measurement of surface tubing and casing pressures, as well as gas injection rates, would have
22 yielded no information whatsoever as to the location of the leak in the production casing, the
23 type or size of the rupture in the casing, or as was stated earlier the magnitude of the gas flow

1 rate. SCADA would have yielded no information at all as to the extent of the “problem.”

2 The SED allegations in respect of SCADA are unfounded. SCADA on individual wells
3 was not an industry standard in 2015 in gas storage fields developed in depleted oil and gas
4 fields (80% of the U.S. gas storage fields). SCADA would not have yielded any useful
5 information as to the location or extent of the gas leak in the SS-25 well. And, most importantly,
6 a SCADA system would have made absolutely no difference in the events that transpired at the
7 SS-25 well on October 23, 2015 and thereafter.

8 **IX. SOCALGAS HAD ORGANIZED WELL FILES THAT CONTAINED THE**
9 **APPROPRIATE AND NECESSARY INFORMATION.**

10 In support of violations 327-329, SED asserts that “SoCalGas did not keep complete,
11 accurate, or accessible records that were necessary for the safe operation and maintenance of its
12 wells at Aliso Canyon Natural Gas Storage Facility.”¹⁵³

13 The SED allegation is incorrect. We note that there are no regulations or documented
14 industry standards prescribing what sorts of documents should go into a well file or how they
15 should be organized. Based on our experience at numerous gas storage fields and with gas
16 storage operators, we believe that the Aliso Canyon well files are in fact well organized and
17 contain the appropriate and necessary information. Each well has four separate files; one for the
18 drilling programs, wellbore schematic, rework history and permits; a second file for downhole
19 logs; a third file for well surveys that includes subsurface pressure data and temperature surveys;
20 and a fourth file for wireline invoices. As noted by SED, they do not include data related to
21 operations or maintenance of related and supporting facilities, which is consistent within the
22 industry. These data would normally be kept in separate files appropriate for that purpose. For
23 example, the Maximo system stores maintenance data related to storage facilities such as

¹⁵³ SED Opening Testimony at 67.

1 wellhead valves, leakage surveys, etc.

2 We have reviewed many of the well files for the Aliso Canyon gas storage field and,
3 based on our experience, it is our opinion that these records were maintained in a manner
4 exceeding the industry standard for U.S. gas storage operating companies.¹⁵⁴ SED's testimony,
5 provided by Ms. Margaret Felts, indicates that she never reviewed the actual physical Aliso
6 Canyon well files.¹⁵⁵ Ms. Felts acknowledges that she only reviewed an electronic production
7 of records from SoCalGas' well files in response to a data request, not a physical well file.¹⁵⁶
8 Therefore, we believe that without properly reviewing the actual well files, SED cannot
9 appreciate the accuracy or completeness of the SoCalGas well files at Aliso Canyon.

10 **X. CONCLUSION.**

11 This concludes our prepared testimony.

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¹⁵⁴ Notably, SED does not state what it believes industry standards for record organization are. In response to questions about what record *retention* policies it believes were relevant to the industry, SED provided a record retention policy from PG&E. *See* Ex. I-9 (SED Supplemental Data Response to SoCalGas Data Request 3 (as supplemented Jan. 23, 2020)), SED response to question 25(a). However, this PG&E policy, Ex. I-72 ("PG&E.P2-2-Guide.to.Record.Retention-2003"), did not provide any standards or practices for record organization and is therefore irrelevant.

¹⁵⁵ Ex. I-10 at 135:22 – 136:1 (Felts Depo. Tr. 135:22 – 136:1. Further, Ms. Felts testified that she has never looked at recordkeeping practices at other gas storage fields). *Id.* at 312:14-19.

¹⁵⁶ Ex. I-10 at 135:22-136:1 (Felts Depo. Tr. 135:22 – 136:1).

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WITNESS QUALIFICATIONS

My name is Timothy L. Hower, P.E. My business address is MHA Petroleum Consultants, 730 17th St., Suite 410, Denver, Colorado 80202.

Credentials and Qualifications

1. I am a Senior Technical Advisor at MHA Petroleum Consultants (“MHA”). I hold an M.S. degree and a B.S. degree in Petroleum Engineering from the Pennsylvania State University. I am a Registered Professional Engineer in the states of Colorado and Wyoming. My qualifications are described in greater detail below and summarized in my curriculum vitae¹⁵⁷

2. I am a Distinguished Member of the Society of Petroleum Engineers (“SPE”), having been elected so in 2015. Additionally, I have received the C. Drew Stahl Distinguished Alumni Achievement Award from Pennsylvania State University and the Henry Matson Technical Service Award from the SPE for innovative contributions in the field of engineering in gas reservoirs.

3. I have sat on many industry groups including as Chairman of the Denver Section of the SPE from 2001 – 2002, as Chairman of the SPE’s Reprint Series on Layered Reservoirs, as Program Chairman of the SPE’s Low Permeability Reservoirs Symposium in 1995, 1998, and 2000, and as General Chairman of the 1993 SPE Low Permeability Reservoirs Symposium and the 2005 SPE Rocky Mountain Technical Conference.

4. I have over thirty-six years of petroleum engineering experience, including evaluation and optimization of underground gas storage projects, including Compressed Air Energy Storage (CAES) projects located in the U.S., Europe and Australia. I have conducted industry training courses on reservoir engineering of underground gas storage reservoirs, and co-authored an industry textbook covering gas storage reservoir management.

5. From June 1983 through September 1988, I was the Senior Reservoir Engineer at Tenneco Oil Exploration and Production in Denver, CO. While at Tenneco, I was responsible for managing oil and gas properties in the Rocky Mountain Region. I participated in unitization studies for several enhanced recovery projects in North Dakota and was the lead engineer for Tenneco’s interests in the San Juan Basin in New Mexico.

6. From October 1988 through September 1990 I was a Staff Engineer at CNG Development Company in Pittsburgh, PA. I managed oil and gas properties in conventional and unconventional (tight sands, shales, and coalbed) reservoirs. I worked on production forecasting, field optimization, reserve estimation, formulation evaluation, depletion, and drainage studies.

7. From October 1990 through September 1995, I was the Senior Manager of Exploration and Production and a Consulting Engineer for Intera Petroleum in Denver, CO. I

¹⁵⁷ Ex. I-73 (T. Hower CV).

1 provided engineering, simulation and software support for oil and gas clients throughout the
2 globe and managed a staff of more than 30 geologists, geophysicists, petrophysicists and
3 engineers.

4 8. From October 1995 through June 1997, I was the Engineering Manager for Enron
5 Oil and Gas Company in Denver, CO and Houston, TX. I was in charge of property evaluations,
6 exploration and exploration drilling programs, secondary recovery design and implementation,
7 reservoir simulation studies, reserve and acquisition evaluations and annual budgeting and
8 forecasting for Enron Oil Company's largest division.

9 9. From July 1997 through July 2019, I was the President and CEO of MHA
10 Petroleum Consultants. I was responsible for the day-to-day operations of the company with
11 active engineering projects around the world. During this time I worked as a project manager for
12 numerous engineering consulting projects worldwide. In July 2019, I stepped down as President
13 and CEO but remain a senior technical advisor to the company, continuing to consult in projects
14 worldwide and instruct and develop industry-training courses.

15 10. I have testified as an expert witness in over 100 matters before various state oil
16 and gas regulatory commissions, before numerous district and circuit courts, and before the
17 London High Courts, the London Court of International Arbitration, the High Court of New
18 Zealand and the Supreme Court of South Australia. I have not testified before the California
19 Public Utilities Commission before.

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1 **WITNESS QUALIFICATIONS**

2 My name is Charles E. Stinson, PE. My business address is 1892 N Birch St, Canby, OR,
3 97013.

4 **Credentials and Qualifications**

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6 1. I am a Petroleum Engineer at CS Energy Ventures. I hold a B.S. in Applied
7 Mathematics from the University of Colorado. I am a registered Petroleum Engineer in the State
8 of Oregon. My qualification are described in greater detailed below and summarized in my
9 curriculum vitae.¹⁵⁸

10 2. I have over 40 years of broad experience in the natural gas industry, upstream and
11 downstream, involving ventures both regulated and non-regulated, domestic and Canadian. This
12 includes extensive experience in the permitting, development and operations of underground
13 storage facilities in Oregon and California, both as an employee of the operating companies
14 (1978 to 2011) as well as a professional engineering consultant (2011 to present).

15 3. I have 25 years in management and executive roles with operational and fiscal
16 responsibility for activities including Underground Storage Development & Ops, Natural Gas
17 Marketing, Natural Gas Gathering & Processing, Producing Property Acquisitions, Distribution
18 Facilities Design, Supply Resource Management, Gas & Oil Exploration & Production, Gas
19 Facility Operations & Maintenance, Transmission Pipeline Construction, and Regulatory
20 Compliance.

21 4. I have held the following senior management positions with multiple technical
22 staff working under my direction. I was Vice President of Engineering & Operations at NW
23 Natural Gas Storage LLC, Vice President of Engineering & Operations at Gill Ranch Storage
24 LLC, Managing Director & Chief Engineer at NW Natural, a local gas distribution company in
25 Oregon, President of Canor Energy Ltd, a Canadian oil & gas exploration company, Vice
26 President & General Manager of Oregon Natural Gas Development Company, and President of
27 Westar Marketing Company, a gas marketing subsidiary of NW Natural.

28 5. At a 20 Bcf underground gas storage project located in Central California, jointly
29 owned by Gill Ranch Storage LLC and PG&E, I had overall accountability for the project
30 development, including all aspects of the project screening & selection, design, permitting, and
31 construction. The project sought and received a mitigated negative environmental declaration
32 from the California Public Utility Commission and completed the certificate of convenience and
33 necessity in a period of 16 months allowing the construction to proceed and achieve the target
34 startup date in October 2010.

35 6. I have managed and directed the development of the Mist Gas Storage Field over
36 the past 35 years. Development initially kicked off in 1985, and its first underground gas storage

¹⁵⁸ Ex. I-74 (C. Stinson CV).

1 operation commenced in 1989. Since that time, it has undergone multiple expansions and
2 currently has 8 reservoirs accounting for over 20 Bcf of working gas capacity.

3 7. As Director of Project Development at Mist Gas Storage Field, I had overall
4 management responsibility for the design, permitting and construction of two projects
5 comprising 97 miles of 24" gas transmission pipeline, built to expand the takeaway capacity of
6 the Mist Gas Storage Field described above. The permitting was very contentious, and ultimately
7 the approved permit was challenged to the Oregon Supreme Court. It was upheld by virtue of the
8 project team's diligence and strict compliance with the intent of the law. The last phase of these
9 projects went operational in 2004. Together they have operated continuously without issue.

10 8. Additionally, I have performed an assessment of the underground storage
11 potential of a nearly depleted natural gas reservoir. The property owner commissioned this study
12 of a gas field located wholly on their property in Northern California. This study included not
13 only an analysis of the physical attributes of the gas reservoir, but also the current market
14 conditions for storage development and the need for additional storage capacity in California.

15 9. As a member of the Compressed Air Energy Storage (CAES) project team, I
16 headed up the subsurface team in providing expertise and guidance in the selection of suitable
17 reservoirs for testing and potential development. I was designated as the Compression Test
18 Manager for the reservoir testing program performed in early 2015. The CAES project was
19 designed to test the feasibility of storing sufficient volumes of air in an underground depleted
20 natural gas reservoir to provide 300 MW of electric power during periods of peak demand. The
21 project is available for commercial development.

22 10. Additionally, I headed up teams of gas storage professionals to perform risk
23 assessments for two gas storage facilities in the western U.S. in compliance with new regulations
24 for underground gas storage.

25 11. I am a member of the Society of Petroleum Engineers. Additionally, I was
26 previously the chairman of the Northwest Energy Association (also a director), the American
27 Gas Association Underground Storage Committee, and the Western Energy Institute.

28 12. I served on the American Gas Association Underground Storage Committee for
29 20 years, including one year as the chairman. This committee included operators of the majority
30 of gas storage fields in the U.S. and served as a platform for them to share emerging
31 technologies, current best practices, development and operating challenges, regulatory changes,
32 and a host of other issues facing their companies. As a result of committee meetings held at
33 various operating company sites, I have toured over 30 gas storage fields in 13 states.

34 13. I have provided expert witness services in two litigations involving underground
35 gas storage facilities, one in California and the other in the Midwest. I have testified in front of
36 the California Public Utilities Commission during the permitting process for Gill Ranch Gas
37 Storage Project.

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