

SoCalGas-175

**Incident Investigation Report (“addendum update”) regarding the gas
leak at the Aliso Canyon Natural Gas Storage Facility, prepared by
Randy Holter (March 17, 2020)**

I.19-06-016

ALJs: Hecht/Poirier

Date Served: March 18, 2022

CALIFORNIA PUBLIC UTILITIES COMMISSION
Safety and Enforcement Division
Gas Safety Branch

Incident Investigation Report

Report Date: 03/17/2020 addendum update

Investigator: Randy Holter

Incident Number: G 20151025-01.8173

Utility: Southern California Gas Company (SoCalGas)

Date and Time of the Incident: 10/23/2015, 08:30:00 AM

Location of the Incident: 12801 Tampa Ave, Northridge, CA

County: Los Angeles

Summary of Incident:

On October 23, 2015, approximately 8:30 a.m., Southern California Gas (SoCalGas) was notified of escaping gas around storage well Standard Sesnon 25 (SS-25) at Aliso Canyon Natural Gas Storage Facility (Aliso Canyon) near Porter Ranch, California. For 111 days, approximately 87,000 metric tons of methane gas escaped from the leaking well into the environment and atmosphere. Blade's best estimate is 120,000 metric tons of methane gas that was released. SoCalGas made seven unsuccessful at-tempts to plug well SS-25 from the surface during this time. On February 11, 2016, a relief well drilled into the outer casing of SS-25 at approximately 8600 feet under-ground, well SS-25 was officially declared under control, then plugged with cement and declared safe by the State on February 17, 2016. There was no ignition of the natural gas after the well failure, and no deaths or direct injuries were reported. Health concerns and health issues were reported publicly in and around the Porter Ranch community. There were reported damages to homes and nearby properties due to oil residue emitted from the flume of gas escaping from well SS-25. Approximately 5,000 community residences responded to the SoCalGas Porter Ranch Emergency Response Center for evacuation assistance. This Safety and Enforcement (SED) Gas Safety Branch Investigation Report (Report) finds that the uncontrolled release of hydrocarbon gas for 111 days from Aliso canyon well SS-25 was caused by the unreasonable, unsafe, improper, inadequate, and insufficient maintenance and operation practices of SoCal Gas. This incident event is currently under California Public Utility Commission (CPUC) formal Investigation Order I.19-06-016 to determine whether SoCalGas in in violation of State and Federal regulations. The SED is monitoring the proceedings currently underway at the time of this report.

Casualties: 0 reported

Property Damage: \$0.00

Utility Facilities involved:

Pipe Material = n/a, Pipe Size = 0.00 (inches), MAOP = 0 (psi), Operating Pressure = 0 (psi)

Gas Engineering and Compliance Section

Pressure = 0 (psi)

Witnesses:

<i>Name</i>	<i>Title</i>	<i>Phone</i>
1 Jeff Koskie	Gas Safety Liaison, SCG	909-376-7208
2 Glen LaFevers	Storage Ops Mgr, SCG	909-376-7208
3 Larry Andrews	Field Operation Mgr, SCG	(805) 443-5622
4 Jill Tracy	Environmental Progr Mgr, SCG	(619) 929-1764

Evidence:

<i>Source</i>	<i>Description</i>
1 SoCalGas, Jeff Koskie	Web Gas Incident SoCalGas No 151025-8173
2 SoCalGas, Jeff Koskie	USRB Gas Incident Report No 20151025-01
3 SoCalGas, Khoa Le	CPUC RGLI-420 Report Filing
4 Blade Energy Partners	2019.0627 Oil Filing - Att 1 -RCA Final Report

Observations and Findings:

On October 23, 2015, approximately 8:30 a.m., Southern California Gas (SoCal Gas) was notified of escaping gas around storage well Standard Sesnon 25 (SS-25) at Aliso Canyon Natural Gas Storage Facility (Aliso Canyon) near Porter Ranch, California.

On October 24, 2015, SoCalGas tested and repaired the SS-25 wellhead seals without any affect on the leak. SoCalGas crews attempted to kill the well without success using on site polymer pill pumped down the tubing. SoCalGas crews then attempted down the 7-inch production casing but gas flow appeared in cracks ground around the well site pad and the procedure was terminated.

Starting November 13, 2015 to December 22, 2016, SoCalGas made seven unsuccessful attempts to plug well SS-25 from the wellhead at the surface. On December 4, 2015, after the 6th failed surface kill attempt, P-39A relief well drilling begins.

On November 13, 2015, the SED notified SoCalGas of its initiation of an investigation into the SS-25 Aliso Canyon leak and follows with request for information and cooperation.

On December 23, 2015, CPUC and California Energy Commission (CEC), enter into a joint agreement to investigate, share incident information and carry out the Governor directives for State energy and reliability obligations impacted by the incident.

In January 2016, the CPUC and DOGGR directed SoCalGas to provide a third-party root cause analysis report (RCA). Blade Energy Partners began investigating the SS-25 incident and SS-25 well kill attempts, assembled an investigation team and initiated an RCA report protocol by end of January 2016.

On February 11, 2016, an off-site relief well, P-39A drilled into the outer casing of SS-25 at approximately 8600 feet under-ground. Well SS-25 was officially declared under control, then plugged with cement and declared safe by the State on February 17, 2016.

The SED Gas Safety Branch provided investigation and oversight of the SS-25 incident site, site security, investigation protocol, site and evidence integrity, allowing the CPUC, CEC and RCA investigators to work independently from December of 2015 until the RCA completion in May 2019.

On May 16, 2019, the CPUC made public the RCA Report of Findings, "Root Cause Analysis of the Uncontrolled Hydrocarbon Release from Aliso Canyon SS-25". A summary of the RCA Report findings is as follows:

- SoCalGas lacked detailed follow-up investigation, failure analyses, or root cause analysis of casing leaks, parted casings, or other failure events in the field in the past.
- SoCalGas lacked any form of risk assessment focused on wellbore integrity management.
- SoCalGas well SS-25 lacked a dual mechanical barrier system in the wellbore.
- SoCalGas lacked internal policies in the absence of any other regulations that required production casing wall thickness inspections.
- SoCalGas lacked a well-specific well-control plan that considered transient kill modeling or well deliverability.
- SoCalGas lacked understanding of groundwater depths.
- SoCalGas lacked systematic practices of external corrosion protection for surface casing strings.

- SoCalGas lacked a real-time, continuous pressure monitoring system for well pressure and status surveillance.

Following the RCA Report release, the SED Gas Safety Investigation Team (Investigators) reviewed the RCA Report and its investigation evidence and assessed that California Public Utilities (PU) Code Section 451 requires every public utility to furnish and maintain service, instrumentalities, equipment, and facilities as a necessary to promote safety, health, comfort and convenience of its patrons, employees and the public. SED Investigators assessed each of the direct and root causes for the uncontrolled release of hydrocarbons for 111 days from SS-25 identified by the RCA Report constitutes a separate violation of PU Code Section 451 and is listed in the subheadings shown below. In addition, SED Investigators assessed SoCalGas violated PU Code Section 451 in a group of other ways: by misleading the Los Angeles Department of Public Health; by not cooperating with the CPUC SED Investigators during its pre-formal investigation; and by not having traceable, verifiable, complete and accurate records that were necessary for the safe operation and maintenance of its wells at the Aliso Canyon natural gas storage facility.

On June 27, 2019, the CPUC filed an Order Instituting Investigation, I.19-06-016, a formal investigation to determine whether SoCalGas violated any provision(s) of the California Public Utilities Code or other State or Federal law, Commission general orders or decisions, or other applicable rules or requirements pertaining to the maintenance of a gas storage facility or the release of natural gas (hydrocarbon) from the Aliso Canyon storage facility. A summary of I.19-06-016 is as follows:

- 1) SoCalGas failed to adequately operate and maintain Aliso Canyon Underground Gas Storage Facility as is necessary to promote safety, health, comfort and convenience to the public.
 - a) SoCalGas failed to conduct failure analyses, follow-up investigations or Root Cause Analyses of failed wells at Aliso Canyon. There had been over 60 casing leaks at Aliso Canyon before the SS-25 incident, but no failure investigations were ever conducted. Furthermore, external corrosion on production casing had been identified in several wells at Aliso Canyon. Based on the data, no investigation of the causes was performed, and, therefore, the extent and consequences of other corrosion in the other wells were not understood.
- 2) SoCalGas failed to adequately operate and maintain Aliso Canyon Underground Gas Storage Facility as is necessary to promote safety, health, comfort and convenience to the public.
 - a) SoCalGas Operated Aliso Canyon Without Risk Management and Well Assessment Programs. This lack of risk assessment included assessment of qualitative probability of production casing leaks or failures. By extension, the potential consequences of production casing failures or surface blowouts had not been assessed.

- i) SoCalGas imprudently operated Aliso Canyon while SoCalGas knew or should have known environmental threats to underground metal well casings.
 - ii) The lack of asset baseline assessment and assessment of asset changes over time is an unreasonable well maintenance practice.
 - iii) SoCalGas failed to assess subsurface threats of groundwater to shallow casings.
- 3) SoCalGas failed to operate Aliso Canyon wells with adequate redundant safety barriers as is necessary to promote safety, health, comfort and convenience to the public.
 - a) Operating Aliso Canyon wellbores as single mechanical barrier systems is an inadequate SoCalGas Well Operation Policy. The SS-25 well 7-inch production casing was the primary barrier to the gas reaching adjacent borehole strata and intermediate reservoirs and shallow aquifers.
- 4) SoCalGas failed to adequately operate and maintain Aliso Canyon Underground Gas Storage Facility as is necessary to promote safety, health, comfort and convenience to the public. SoCalGas lacked necessary methodologies such as periodic wall thickness measurements because existing regulations were inadequate at the time. Annual SoCalGas temperature logging and weekly pressure measurements are adequate to detect leaks and fix them only after an event has occurred. In SS-25, the corrosion patch was large (around 9.25 in. in length), and due to the microbial nature, there were grooves within the corrosion patch that acted as stress concentration locations. The microbial corrosion occurred over many years. Consequently, when the corrosion region failed, it resulted in a rupture that was about 2 ft long. The trailing indicators of these failures were not adequate to manage the failures.
 - a) SoCalGas internal operation policies were inadequate in the absence of regulations requiring production and surface casing wall thickness inspections.
 - b) SoCalGas failed to Implement Company Gas Standards to Inspect Well Casing Wall Thicknesses.
- 5) SoCalGas was imprudent in their attempts to kill well SS-25, putting the health, safety and comfort and convenience of the public at risk. There was no quantitative understanding by SoCalGas of well deliverability, although data were available, and well-established industry practices existed for such analysis. A range of industry-standard well flow and well injection modeling applications were readily available to SoCalGas before Aliso well SS-25 failed. Investigation of the SoCalGas SS-25 well second kill attempt through to the sixth kill attempt found that SoCalGas used insufficiently dense fluid along with insufficient pump rates in its attempts to kill the well. SoCalGas also performed no modeling of the kill attempts prior to kill attempts one through six even though well kill modeling software is available. Modeling the kill attempts would have resulted in stopping the leak earlier than February

11, 2016.

- a) SoCalGas took unreasonable and inefficient measures to control and kill well SS-25.
 - b) SoCalGas attempted to kill well SS-25 without a well-control plan specific to the conditions of SS-25.
 - c) SoCalGas SS-25 well kill attempts 2 - 6 were imprudent well kill attempts.
 - d) SoCalGas failed to utilize industry standard computer modeling tools in the first six SS-25 well kill attempts.
- 6) SoCalGas failed to adequately identify and address threats to Aliso Canyon Underground Gas Storage facilities as is necessary to promote safety, health, comfort and convenience to the public.
- a) SoCalGas operated Aliso Canyon without risk management and well assessment programs.
 - b) SoCalGas failed to assess subsurface threats of groundwater to shallow casings. SoCalGas lacked understanding of groundwater depths relative to the surface casing shoe and production casing until after the SS-25 failure when the two groundwater wells were drilled at SS-9 in 2018.
- 7) SoCalGas failed to adequately furnish and maintain external corrosion protection systems at Aliso Canyon Underground Gas Storage facilities as is necessary to promote safety, health, comfort and convenience to the public.
- a) SoCalGas knew and had means to mitigate environmental threats to underground facilities by using cathodic protection (CP).
 - b) SoCalGas did not furnish exterior corrosion protection systems for SS-25 and other wells identified with external corrosion. Without systematic external corrosion protection monitoring on surface casing and no installed corrosion monitoring equipment the consequences of corroded surface casing and uncemented production casing were not understood by SoCalGas.
- 8) SoCalGas failed to furnish Aliso Canyon wells with adequate safety and monitoring systems necessary to protect the health and comfort of the public.
- a) SoCalGas Did Not Furnish Efficient Instrumentalities Necessary for Immediate Identification of the SS-25 Leak. The lack of real-time, continuous pressure monitoring system well surveillance prevented an immediate identification of the SS-25 leak and accurate estimation of the gas flow rate.
- 9) SoCalGas failed to furnish Aliso Canyon wells with adequate safety and monitoring systems necessary to protect the health and comfort of the public
- a) SoCalGas failed to furnish Aliso Canyon with real-time well surveillance. Had SoCalGas been monitoring well pressures in real-time and stopped injection before the temperature drop caused that parting, appropriate actions were available to storage field operations. Root cause analysis of

SS-25 failure estimates 1 to 2 hours elapsed between the axial rupture and the circumferential rupture. The axial rupture caused a decrease in the surrounding temperature which, in turn, led to the circumferential parting.

- 10) SoCalGas failed to maintain accurate and complete Aliso Canyon well records as is necessary to protect the health and comfort of the public.
 - a) Inadequate SoCalGas record keeping prohibited efficient and accurate assessment of well SS-25 condition when it failed. SoCalGas lacked accurate and complete records that show data necessary for operations and maintenance related decisions of SS-25, and the rest of Aliso Canyon.
- 11) SoCalGas failed to implement and maintain a Risk Assessment Program or Wellbore Integrity Management Plan at Aliso Canyon Storage Facility as was necessary to protect the safety, health, comfort and convenience of the public from the SS-25 well failure of October 23, 2015.
 - a) SoCalGas knew of threats to Aliso Canyon well casings and failed to implement Risk Assessment Programs and Wellbore Integrity Management Plans. SoCalGas knew about the well integrity problems at Aliso Canyon, specifically the presence of corrosion and the lack of a dual mechanical barrier system in the wellbore, which is what caused the leak failure in SS-25 at the Aliso Canyon.
 - b) SoCalGas knew of threats to Aliso Canyon well casings and failed to implement a formal plan to detect corrosion on the Well SS-25 seven-inch casing. Known casing corrosion and other related well events should have initiated development of a formal plan for incidents with more severe consequences.
 - c) SoCalGas failed to implement a Storage Integrity Management Program in 2009, despite recommendation from Gas Storage Engineering Managers at that time.
- 12) SoCalGas failed to integrate assessment methodologies and mitigation practices utilized elsewhere in the company as is necessary to promote safety, health, comfort and convenience to the public. SoCalGas did not integrate internal Company operation and maintenance policies and apply them to Aliso Canyon to address metal loss in well casings. SoCalGas had Integrity Management Programs for their Transmission (TIMP) assets and Distribution (DIMP) assets since 2006. These SoCalGas programs proactively identify potential problems, determine associated risks, and then implement actions to prevent the problem from occurring or procedures to mitigate the list.
 - a) SoCalGas did not integrate internal Company operation and maintenance policies and apply them to Aliso Canyon to address metal loss in well casings. SoCalGas failed to implement an equivalent program that proactively addressed storage field well integrity, and the response to casing leaks and well failures was reactive to each occurrence.

November 22, 2019 - the CPUC appeared before the Commissions assigned Administrative Law Judge to provide testimony for its June 27, 2019 Order Instituting Investigation, I.19-06-016.

As of March 16, 2020, this incident event is currently under CPUC formal Investigation Order I.19-06-016 to determine whether SoCalGas is in violation of the above. The SED is monitoring the proceedings currently underway at the time of this report.

Preliminary Statement of Pertinent General Order, Public Utilities Code Requirements, and/or Federal Requirements:

<i>General Order</i>	<i>GO Rule</i>
1 GO112F	CPU Code Section 451

Conclusion:

Conclusion Addendum

This SED Gas Safety investigation report finds that the uncontrolled release of hydrocarbon gas for 111 days from Aliso canyon well SS-25 was caused by the unreasonable, unsafe, improper, inadequate, and insufficient maintenance and operation practices of SoCal Gas. Therefore, SED finds SoCalGas is in probable violation of General Order (GO-112F) and CPU Code Section 451.

As of March 23, 2020, this incident event is currently under CPUC formal Investigation Order I.19-06-016 to determine whether SoCalGas is in violation of the above. The SED is monitoring the proceedings currently underway at the time of this report.

APPENDIX A

GAS INCIDENT REPORT FIELD EVIDENCE – Photos