SoCalGas-1

Prepared Opening Testimony of Dan Neville (November 22, 2019)

I.19-06-016

ALJs: Hecht/Poirier

Date Served: March 12, 2021

Order Instituting Investigation on the Commission's Own Motion into the Operations and Practices of Southern California Gas Company with Respect to the Aliso Canyon storage facility and the release of natural gas, and Order to Show Cause Why Southern California Gas Company Should Not Be Sanctioned for Allowing the Uncontrolled Release of Natural Gas from Its Aliso Canyon Storage Facility. (U904G).	I.19-06-016 (Filed June 27, 2019)

CHAPTER I
PREPARED OPENING TESTIMONY OF DAN NEVILLE ON BEHALF OF SOUTHERN CALIFORNIA GAS COMPANY (U 904 G)

(OPERATIONS AND MAINTENANCE PRACTICES PERTAINING TO WELL SS-25 AT ALISO CANYON)

November 22, 2019

CHAPTER I
OPERATIONS AND MAINTENANCE PRACTICES PERTAINING TO WELL SS-25 AT ALISO CANYON

The purpose of my testimony is to describe SoCalGas' operations and maintenance practices at the Aliso Canyon storage field ("Aliso Canyon") with regard to the Standard Sesnon 25 ("SS-25") well for the time preceding October 23, 2015. As detailed below, SoCalGas' well integrity monitoring and inspection activities on SS-25 were reasonable and consistent with applicable regulations. Through these activities, SoCalGas' monitoring, inspection, and testing program successfully tested and monitored wells, identified well conditions, and addressed and repaired casing leaks. SoCalGas operated and maintained SS-25 consistent with these practices and procedures, and there was no indication of a leak at SS-25 prior to October 23, 2015.

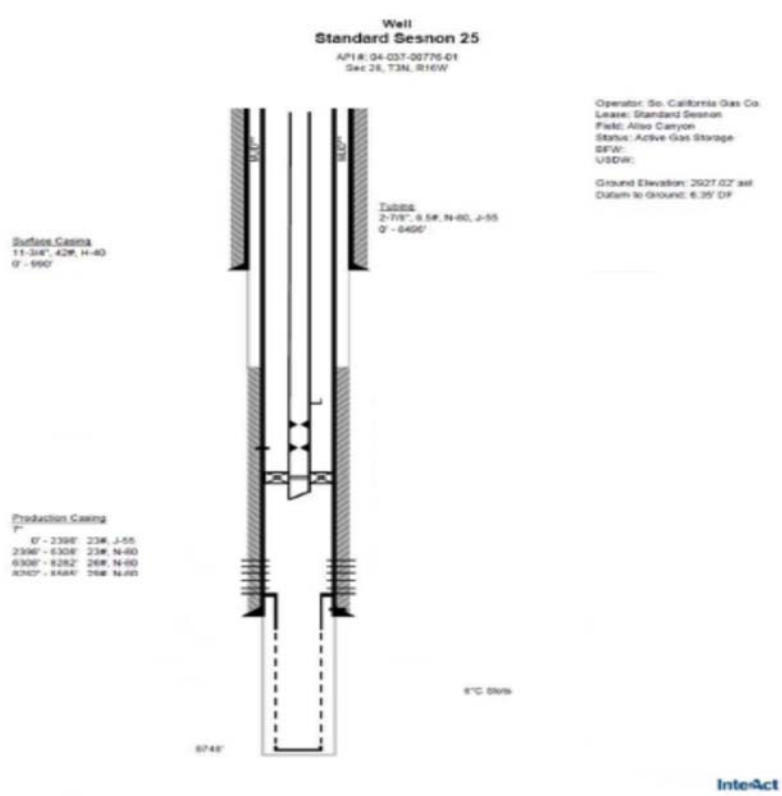
I. ALISO CANYON AND THE SS-25 WELL.

Aliso Canyon's storage reservoir is a geological zone of porous, permeable sandstone approximately 8,500 feet below the surface known as the Sesnon-Frew reservoir. Injection and withdrawal of natural gas at Aliso Canyon occurs through underground gas storage ("UGS") wells. Each of the UGS wells at Aliso Canyon reaches down from the surface to the permeable zone of the reservoir.

The basic components of a UGS well are the surface casing, production casing, tubing, and wellhead assembly. The surface casing, production casing, and tubing are vertical steel pipes of differing sizes, nested within one another, that run from the surface down to the storage reservoir. The wellhead is an assembly of steel valves, pipes, and other equipment attached by a flange to the top of the well. The wellhead assembly connects the well to SoCalGas' surface piping system within the storage facility. The surface casing has a dual purpose: to help support the wellhead, and to protect groundwater resources by isolating these groundwater resources from deeper oil/gas producing zones.

SoCalGas' wells were designed with a "tubing packer" completion. This means that the well design included steel tubing inside the producing casing (rather than a production casing alone). The tubing packer completion provides two primary benefits: 1) a means to mechanically isolate the well from the storage zone through the use of a wireline-set downhole plug, and 2) a means to hydraulically isolate the well from the storage zone by providing a conduit for kill fluid. The tubing packer completion also provides a means to inject or withdraw from the reservoir through tubing alone, the annulus alone, or through both the tubing and the casing annulus simultaneously.

SS-25's well construction consisted of surface casing run to the depth of the base of fresh water, production casing run to the top of the gas storage zone, and a tubing packer configuration that provided for various flow/injection modes. Specifically, SS-25 had 11-3/4" surface casing cemented to a depth of 990 feet, which provided the barrier between the fresh water sources and potential oil/gas zones at lower depths. SS-25 also was constructed with a 7" production casing drilled to a depth of 8585 feet, which provided the barrier between the storage zone and formations at upper depths. In addition to providing the cement barrier, the production casing also provided the mechanical conduit for the tubing to be run to the top of the gas storage zone. The tubing utilized in SS-25 was 2-7/8" tubing run to a depth of 8496 feet and set in a packer at 8486 feet. The following diagram shows the subsurface configuration of SS-25.



Subsurface Diagram of Well SS-25

SoCalGas-01.0003

SS-25's well configuration allowed for withdrawal and injection of gas through the tubing, the casing, and both the tubing and casing simultaneously. In SS-25, the flow path for tubing flow was from the storage zone perforations (8510 feet – 8748 feet), into the 7" casing below the production packer, into the tubing at 8496 feet, and through the 2-7/8" tubing to the wellhead at surface. The flow path for casing flow was from the storage zone perforations (8510 feet – 8748 feet), into the 7" casing below the production packer, into the tubing at 8496 feet, through a cross-over flow port at approximately 8451 feet, into the 2-7/8" x 7" annulus, and to the wellhead at surface. The flow path for injection was in the opposite direction through the same configuration depending on tubing or casing mode. The mode of flow was controlled at the surface by operations personnel who manually operated either a tubing operating valve or a casing operating valve depending on the desired flow mode specified by the storage field engineer in the withdrawal/injection schedule.

II. MECHANICAL INTEGRITY DESIGN, EVALUATION, TESTING, AND MONITORING.

The Aliso Canyon storage field is operated pursuant to California Public Utilities Commission ("CPUC") and Division of Oil, Gas, and Geothermal Resources ("DOGGR") regulations and is subject to the Aliso Canyon Project Approval Letter issued by DOGGR, which is similar in function to an operating permit.[1]

SoCalGas maintained mechanical integrity of active gas storage wells at Aliso Canyon, including SS-25, through design and systematic evaluation, testing, and monitoring of the various pressure barriers associated with each individual well. These pressure barriers consist of the casing cement above the storage zone, the casing body and threads, and the wellhead seals at the top of the production casing. SoCalGas initially evaluated the integrity of these barriers prior to the commencement of gas storage operations when a workover rig was employed to prepare the well for conversion to gas storage. During the conversion workover, SoCalGas evaluated the integrity of the casing cement by running a cement bond log run across the cemented area of the well above the gas storage zone from 8737 feet to 6950 feet. To evaluate the integrity of the casing body and connections, SoCalGas performed a pressure test to 3400 pounds per square

[1] DOGGR has authority to approve, reject, or suspend underground gas storage ("UGS") operations at Aliso Canyon and has primary downhole jurisdiction over SS-25. SoCalGas works with DOGGR to provide information about the wells, the reservoir, and other aspects of storage operations during DOGGR's annual review and upon request.

inch (psi), above the maximum operating pressure of 3150 psi. The wellhead seals barrier was addressed through the installation and testing of a new high-pressure gas wellhead system. The wellhead system is rated for 5000 psi and has three sets of seals around the outside top of the production casing. Pressure test ports are available between each set of seals so that each seal can be pressure tested independently.

As of October 22, 2015, active UGS wells at Aliso Canyon, including SS-25, were subject to a systematic well integrity monitoring and inspection program that included: (1) daily site inspections; (2) weekly pressure readings; (3) monthly well site inspections; (4) annual leakage surveys; (5) annual temperature surveys and, if needed, noise and/or tracer surveys; and (6) additional casing integrity inspections if tubing was removed in the course of a workover. Separate and apart from the scheduled inspections and tests, if a well exhibited abnormal conditions, additional testing was conducted, including unscheduled pressure readings, temperature surveys, noise surveys, gas sampling, and/or other investigative work.

A. <u>Daily Site Inspections</u>.

Each day, SoCalGas field operators visited and inspected every gas storage well at the field. These inspections were conducted by operators trained to identify signs of abnormal operating conditions, which may manifest as odors, sounds (e.g., unusual hissing or the sound of gas moving even when valves are closed), and/or visual cues (e.g., wellhead shaking or ice on the wellhead). An abnormal operating condition may be attributed to a leak in the well lateral piping, a leak from the wellhead, a leak through the wellhead seals into the surface casing, or potentially a shallow leak in the production casing. An abnormal operating condition triggers further investigation to determine the cause of the abnormality. Further investigation would typically consist of checking the wellhead seals, and/or running temperature/noise surveys, and/or gas sampling.

B. <u>Weekly Pressure Readings</u>.

Once each week, SoCalGas field operators connected a pressure gauge to instrumentation tubing at the well site to check the pressure in each tubular space within the well: (1) the interior of the tubing (tubing pressure), (2) the annular space between the tubing and the production casing (casing pressure), and (3) the annular space between the production casing and the surface casing (surface casing pressure). In a well such as SS-25 that allows for casing flow, the tubing and casing are exposed to the storage zone pressure and, as a result, the tubing, casing, and storage zone pressures are nearly equal.

Because the surface casing generally extends from approximately 800 feet to 1000 feet below the ground, a shallow leak in the production casing would cause gas to enter the annular space between the production casing and surface casing. Even a very minor "pinhole" leak would, over time, cause the surface casing pressure to gradually increase. Accordingly, the surface casing pressure should be at 0 psi or at a stable, very low pressure; and if it was not, further investigation was conducted to determine the cause of the anomaly. Further investigation would typically consist of checking the wellhead seals, and/or running temperature/noise surveys, and/or gas sampling.

C. Monthly Well Site Inspections.

Well site inspections performed monthly included thorough inspections of the structural components of the wellhead, the cellar floor, access roads, and the general condition of the well site. Issues identified from the inspection that warranted corrective maintenance or further investigation would be recorded and addressed.

D. Annual Leak Surveys.

Once per year, SoCalGas performed surface area leak inspections of wells using methane gas detection equipment around the well site area for the purpose of detecting any gas migration through the soil.

E. Annual Temperature Surveys and Investigative Noise and Tracer Surveys.

Once per year (and sometimes more frequently), SoCalGas performed a temperature survey by lowering a specialized thermometer probe down the full length of each UGS well, continuously recording temperatures down to the depth of the reservoir. Temperature surveys can identify leaks because gas moving through a small opening creates a pronounced, localized temperature drop by virtue of a natural phenomenon known as the Joule-Thomson effect. A temperature survey is recorded on a graph consisting of a plot of temperature on the X-axis and depth on the Y-axis. The temperature survey for a typical well having pressure containment (i.e., no leaks) will be a relatively straight diagonal line, representing a gradual increase in temperature as the probe is lowered into the earth (the increase is caused by geothermal heat). By contrast, the temperature survey for a well with a leak from the casing, a casing component, or the casing cement shoe will show a gradient shift toward the left (i.e., cold) side of the graph at the point of the leak.

In the event a temperature survey identified an anomaly indicative of a possible leak, SoCalGas conducted additional surveys such as noise or tracer surveys to further investigate the anomaly. Noise surveys involve lowering a sensitive microphone down the wellbore to detect the sound of gas (if any) moving through an opening in the casing or around the base of the casing. The data are displayed on a log showing the sound frequencies detected at various depths from the surface to the reservoir. In a tracer survey, a small amount of gas is injected through the well, and a small radioactive tracer is added to the injection gas. A tool follows the tracer down the well, reading the location of the radioactive element as it descends the well. If the radioactive element disappears into the reservoir zone as expected, there is no leak. If the radioactive element begins ascending after reaching the end of the well, that is in an indication of gas ascending on the outside of the production casing and could indicate the presence of a casing shoe cement leak.

F. <u>Mechanical Integrity Inspections During Workovers.</u>

Generally, a workover would be conducted on a well if the well required maintenance, repair, or upgrades. A well workover includes removal of the wellhead assembly and the well tubing, which requires the well to be "killed," or hydrostatically isolated from the storage zone by pumping fluid into the well to prevent gas from rising. Well control is managed throughout the workover by maintaining a column of fluid in the wellbore that over-balances the pressure of the gas storage zone.

SoCalGas used the removal of the tubing during a workover as an opportunity to perform certain kinds of integrity tests on the well's production casing that are not possible when the tubing is in place, such as running an ultrasonic inspection tool ("USIT"), which uses ultrasonic sound waves to circumferentially measure the internal radius and thickness of the casing as well as cement quality.

III. <u>LEAK REMEDIATION PRACTICES WERE EFFECTIVE</u>.

Prior to October 23, 2015, SoCalGas successfully addressed and repaired infrequent casing leaks as they arose. SoCalGas' monitoring, inspection, and testing program successfully identified and stopped leaks.

As stated above, UGS wells at Aliso Canyon were designed with a tubing packer completion, which provides two primary leak mitigation benefits: 1) a means to mechanically isolate the well downhole from the storage zone through the use of a wireline-set downhole plug, and 2) a means to hydraulically isolate the well from the storage zone by providing a conduit for kill fluid. A leak could involve a breach of the wellhead seal barrier, a breach of the casing body/thread barrier, or a breach of the casing shoe cement barrier; or, in some wells, a leak could involve a breach of certain components such as stage collars, casing patches, or packers. In most cases, leak remediation was accomplished through mechanical isolation by setting a downhole plug in the tubing's downhole profile. In some cases, depending on the type of leak, remediation was accomplished through a well kill by rigging up pumping equipment and directly pumping into the tubing through an access flange at the top of the well.

As an additional safety measure, SoCalGas had in place a remote well kill system so that SoCalGas could kill the well in the event the well site was inaccessible. The system consisted of valves and piping connected to the wellhead, separate from the flow side of the wellhead, specifically to allow remote well kill. The piping ran to a remote area from the wellhead so that pumping equipment could be staged away from the immediate wellhead area, if necessary. Additionally, each well was connected to a kill network of piping so that an individual well could be killed from a nearby well. Company procedures dictated that the well kill valves on the wellhead remain in the open position at all times during operations, thus maintaining remote kill ability at all times.

Once a UGS well leak was remediated through isolation of the storage zone, a workover program was prepared detailing the repair method and further investigative work, if required. The workover program was submitted to DOGGR on a "Notice of Intention to Rework / Redrill Well" form. DOGGR then prepared a "Permit to Conduct Well Operations" detailing additional regulatory requirements, including a list of required inspections. Prior to moving the workover rig on the well, operators would remove any plugs that were set for mechanical isolation and would isolate the well hydrostatically through a well kill. Repair methods could include remedial cementing, installation of a casing patch, installation of an innerstring, or permanent plugging of the well. As the work progressed, DOGGR would issue a "Report on Operations" that documents any inspections conducted by DOGGR in the course of the workover. Following the workover, SoCalGas prepared a "History of Oil or Gas Well" report that described the daily work conducted, including detailing changes in the downhole configuration. In addition to this report, following the workover, SoCalGas submitted required workover records, including casing inspection logs, to DOGGR.

UGS wells were additionally equipped with safety systems designed to shut-in wells in order to prevent or mitigate leaks in the wellhead or surface piping. The surface safety system consisted of fail-close pneumatic operated valves located on the wellhead and designed to close by any of the following methods:

- Low pressure pilot – shuts in well if a break in the surface piping causes the wellhead pressure to drop below a threshold value;
- High pressure pilot – shuts in well if pressure in the surface withdrawal line exceeds a threshold value;
- Sacrificial sand erosion probe – shuts in well upon excessive erosive sand production;
- Fusible plug – shuts in well if a fire occurs in the well cellar; and
- Remote shut down station – allows for wells to be shut-in manually from a remote distance from the wellhead.

The foregoing practices allowed SoCalGas effectively to mitigate leaks in the wellhead and surface piping of UGS wells.

WITNESS QUALIFICATIONS

I, Daniel Neville, am the Reservoir Engineering Manager in Integrity Management and Strategic Planning for Southern California Gas Company ("SoCalGas"). I have held this position since June 2012. My roles as Reservoir Engineering Manager included the following.

Beginning in January 2018, I worked in Integrity Management and Strategic Planning. My responsibilities include assisting SoCalGas in implementing both the California Division of Oil, Gas and Geothermal Resources ("DOGGR") regulations and the federal Pipeline and Hazardous Material Safety Administration ("PHMSA") regulations at all of SoCalGas' natural gas storage facilities.

Beginning in April 2016 and continuing into January 2018, my role was in Storage Engineering, where I was responsible for overseeing a team of six Storage Field Engineers and one geologist that provided engineering support to operations and maintenance at all of the SoCalGas natural gas storage facilities

Beginning in June 2014 and continuing into April 2016, my role was in Storage Asset Management, where I managed the drilling, completion, and testing program for native gas wells drilled as part of the Goleta native gas project at SoCalGas' La Goleta natural gas storage facility in Goleta, California. Beginning in November 2015, I also began providing assistance concerning various tasks related to the October 23, 2015 leak at SS-25.

Beginning in June 2012 and continuing into June 2014, my role was in Storage Engineering, where I was responsible for overseeing the six Storage Field Engineers that provided engineering support to operations and maintenance at all of the SoCalGas natural gas storage facilities.

Prior to my position as Reservoir Engineering Manager at SoCalGas, beginning in 1991 and continuing into June 2012, I worked in various other positions at SoCalGas, including Storage Field Engineer; Storage Operations Manager; Drilling and Workover Engineer; and Staff Engineer.

Prior to my employment at SoCalGas, beginning in 1987 and continuing into 1991, I co-owned Reservoir Data Services, Inc., a well servicing business that provided well testing services to major and independent oil companies operating in, and offshore of, California, including wells at Aliso Canyon. Beginning in 1983 and continuing into 1987, I worked as a field engineer at

Schlumberger Limited, a leading provider of technology for reservoir characterization, drilling, and production to the oil and gas industry worldwide.

I am a member of the Society of Petroleum Engineers, a professional society involved with knowledge transfer and technology. I have been a member of the board of the local chapter of the Society since the late 1990s.

I also am a member of the Pipeline Research Council International – Underground Storage Committee, a community of pipeline companies seeking to research and improve global energy pipeline systems.

I am a technical advisor on two ongoing research programs, including (1) Pipeline & Hazardous Materials Safety Administration (PHMSA) - "*Guidelines On Assessing Risk of UGS Well Entry"* and (2) California Energy Commission - "*Risk Assessment and Treatment of Wells."*

I have a bachelor's degree in petroleum engineering from Texas A&M University.

I have not previously testified before the Commission.