



Aliso Canyon Ombudsman
Response to Public Inquiry #5
Dated October 27, 2021

Response Date: February 25, 2022



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Overview

On the evening of October 27, 2021, the Safety Ombudsman email received the following question: “I am not sure if this role is still active, but if it is, can you please tell us if there is a leaking gas well at the Aliso facility right now?”

Safety Ombudsman Response

The question as stated is broad and applicable to the entire Aliso Canyon gas storage facility, so the Safety Ombudsman (“Ombudsman”) confirmed with the requestor that the Ombudsman role is active and asked the requestor, on the same day as the initial request, for clarification as to whether the requestor had something more specific in mind. The following day, October 28, 2021, the Ombudsman asked the requestor follow-up questions that might help direct the sense of the Ombudsman’s inquiry to SoCalGas:

1. Are you concerned about a particular location? Is it near where you live or work?
2. Are you concerned because you have some sense of an issue – any notice of gas odors or other environmental things that seem different?
3. Do you have a general question about the operator’s care and monitoring of its gas storage facilities, and/or how it verifies that there are no unacceptable leak issues?
4. Or, is there any other concern over the Aliso Canyon storage operation that you would like to ask about?

The requestor replied that they lived in the Porter Ranch area and were asking a general question about whether there is any well in the field that is experiencing any uncontrolled release at the time of the request.

The Ombudsman reviewed fence line methane monitoring data and notes of recent SoCalGas Well and Storage Operations Safety Committee (WSOC) meetings regarding well integrity investigations. The Ombudsman informed the requestor that review of available information could only allow that to the Ombudsman’s knowledge, nothing was “currently leaking,” but that the Ombudsman would seek additional information from SoCalGas.

The Ombudsman prepared and sent a November 5, 2021 request to SoCalGas for specific well data, covering a one month period from October 5, 2021 to November 5, 2021, inclusive, that could be reviewed for anomalies that might indicate an issue with well integrity. The request entailed the following:

1. Well annulus pressure monitoring data for all wells in the field, with identification of wells that have annulus pressure or flow exceeding designated thresholds for action or for further investigation and testing and what actions SoCal has taken or anticipates taking.
2. Wellhead pressure and flow readings for all wells in the field, with identification of any wells that have pressure or flow readings that are out of norm or out of expected and what actions SoCal has taken or anticipates taking.
3. Surface well-site monitoring information related to instrumented gas detection monitoring, with identification of any wells that have gas detection occurrences above typical levels or above levels for further action and investigation, and what actions SoCal has taken or anticipates taking.
4. Plugged well monitoring information such as pressures and fluids, with identification of any wells that have occurrences that per Company standards will require follow up actions and what SoCal has done or is planning on doing.



5. Additional activities relative to well integrity logging or well workover activities since the September 13, 2021 WSOC meeting, including blowdowns of wells and other releases of gas that might have been flared or flowed without flare.
6. Other occurrences in the gas storage, observation, or plugged wells that were discovered during the period that would be described by the Company as an Abnormal Operating Condition, an Incident as defined by PHMSA, or a Safety Related Condition as defined by the Company and PHMSA, whether reportable or not reportable to PHMSA.

SoCalGas acknowledged receipt of the request the week following November 5 and on December 1, 2021 the Ombudsman received SoCalGas' response, dated November 30, 2021, wherein SoCalGas provided the information requested. The responses are summarized below and the cited information files can be accessed by active links noted for the applicable files.

- Response 1:
 - SoCalGas interprets this request to seek pressures for the surface casing, production casing, and inner string annuli for the period October 5, 2021 through November 5, 2021. SoCalGas further interprets this request to seek information regarding wells that exceed the designated pressure limits outlined in Company Standard 224.119 for the period October 5, 2021 through November 5, 2021. See report [here](#).
- Response 2:
 - SoCalGas interprets this request to seek tubing pressure for the period October 5, 2021 through November 5, 2021. SoCalGas further interprets this request to seek information regarding wells that exceed the designated pressure limits outlined in Company Standard 224.119 for the period October 5, 2021 through November 5, 2021. At Aliso Canyon, total flow leaving the facility is measured; however, individual flow meters are not installed on individual wells. See report [here](#).
- Response 3:
 - SoCalGas interprets this request to seek information related to the LEL gas monitoring sensors installed at the wellhead. See report [here](#). SoCalGas had no gas detection occurrences above the threshold of 10,0000 ppm for 5 days or 50,000 ppm for 5 minutes during the period October 5, 2021 through November 5, 2021. Any exceedances during this period were investigated and determined to be caused by ambient humidity.
- Response 4:
 - SoCalGas interprets this request to seek pressures for isolated and out of service wells for the period October 5, 2021 through November 5, 2021. See report [here](#). SoCalGas further interprets this request to seek information regarding any isolated and out of service wells which exceed the designated pressure limits outlined in Company Standard 224.119 for the period October 5, 2021 through November 5, 2021. SoCalGas does not collect well fluids for wells that are isolated and out of service.
- Response 5:
 - SoCalGas interprets this request to seek updates on the well integrity logging or well workover activities since the September 2021 WSOC meeting that the Safety Ombudsman attended. Since September 13, 2021, SoCalGas has performed 36 mechanical integrity tests and 38 casing integrity tests on 14 active wells at Aliso Canyon. See report [here](#). SoCalGas did not perform blowdowns or releases of gas from wells during the requested period.



- Response 6:
 - SoCalGas does not have any occurrences to report for the requested period that falls under the Company's definition of Abnormal Operating Condition, PHMSA's definition of an Incident, or Safety Related Condition as defined by the Company and PHMSA.

The Ombudsman notes that the SoCalGas's responses above indicate that SoCalGas did not observe any findings in the monitoring, logging, or testing data at or near surface or downhole in wells that, in accordance with their standards, would indicate any abnormality or leak.

The Ombudsman's role must independently look at the information and ask follow-up questions the Ombudsman deems relevant. The Ombudsman's initial review of the information led to the preliminary opinion that there was not a well integrity issue during the period covered by the data request, but the Ombudsman proceeded to do more detailed review and trend analysis. The detailed review included:

1. Wellhead methane monitors reviewed for positive occurrences and trends, without respect to thresholds set by regulatory rules or internal company standards;
2. Wellhead pressure and annulus pressure reviewed for anomalies and behavior and trends, without respect to thresholds set by regulatory rules or internal company standards;
3. Well log and inspection summaries and history of risk prevention and mitigation actions by SoCalGas from 2016 to present, including monitoring, tests, inspections, and well workovers;
4. Review of past Ombudsman data requests and information received from SoCalGas;
5. Review of past public inquiry submissions to the Ombudsman email/website and the Ombudsman's responses; and
6. Review of other previous studies and information, that might have relevance to well and reservoir integrity, publicly available through State and local agencies.

The Ombudsman's analysis involved some modification of two of the data files provided by SoCalGas.

The Ombudsman created methane level vs. time graphs and performed statistical counts of non-zero methane readings, averages, and occurrences. The Ombudsman's analysis and file modifications can be seen [here](#).

The Ombudsman reviewed the casing, tubing, and annulus pressure trends and levels found in the Aliso Canyon Pressure Report file provided by SoCalGas and modified the information by positioning the individual daily reports for each well on single sheets in the file for annulus1, annulus2, tubing pressure, and casing pressure, and looking at pressure trends and pressure variability. The modified file includes flagging of wells with trends about which the Ombudsman might inquire further of SoCalGas. The Ombudsman's analysis and file modifications can be seen [here](#).

Ombudsman's Discussion of SoCalGas 11-30-21 Response Information

- Methane occurrences in wellhead and wellsite monitors and casing, tubing, and annulus pressures during the period October 5-November 5, 2021:

Even though it is normal to have background levels of methane and/or occasional pressure, etc., depending on the device or location of monitoring, the Ombudsman's experience was applied to try to discriminate between incipient or weak indications of a well integrity issue vs. threshold or limit levels. A limit set in an



internal SoCalGas procedural standard, as with all limits, can be considered arbitrary; however, if the limit conforms to known API (American Petroleum Institute) or ISO (International Standards Organization) or some other world standard, it might be acceptable provided that in addition to that conformity, good practices in monitoring of trends are in place regardless of whether a limit or a threshold has been reached or exceeded, because an increasing or adverse trend could be of concern even if the parameter's measured or detected level is below a threshold for action. Trend monitoring is important in part because macro-failures such as ruptures or large holes manifest themselves differently than small-aperture failures and/or slow leaks, and in deep wells, the point of a leak along with the failure mode could influence the appearance of the signal of such an event, or what could be called an observation of an anomaly.

Under the PHMSA Gas Storage Safety Rule, storage operators must apply API 1171 for reservoir-based gas storage, and SoCalGas also must apply California rules and regulations. The operator's standard operating procedures must address how monitoring, testing, and inspection information is assessed on a risk-informed basis, which leaves some discretion to the operator to select operating windows of pressure, temperature, flow, leak rate, stabilization rate, or other criteria that might be monitored.

For some points of monitoring, a "zero" threshold is not helpful or useful since non-zero observations might be indicative of background or normal conditions, and if a zero threshold were set the operator would have required themselves to chase down additional tests and inspections to try to resolve a non-zero occurrence. In other points of monitoring, thresholds are set by regulatory rules. An operator could choose a lower threshold, but at a minimum the threshold is set in the regulatory rules. In yet other cases, such as testing for valve sealing capability, existing API or ISO recommended practices might advise some practical limit rate, since achieving 0% leak-by is not likely practicable in every situation. If an operator's standards are set to include and align to such recommended practices, it is a good start. Better practices can go somewhat beyond compliance and include trend monitoring, with stipulated thresholds for response and/or additional investigation.

After review of the data supplied by SoCalGas in response to the Ombudsman's request of November 5, 2021, the Ombudsman did not see evidence of an obvious, significant, or persistent issue of well integrity. However, the Ombudsman's additional review, trend analysis, and linking of methane monitoring, wellhead pressure, and annulus pressure information resulted in the Ombudsman's opinion that additional questions to SoCalGas were necessary. Therefore, on December 13, 2021, the Ombudsman sent a follow-up data request to SoCalGas; the request focused on the well monitoring information and asked for additional information regarding wells for which the Ombudsman was not able to be satisfied that there were no issues of concern based solely on the information provided in response to the November 5, 2021 data request.

The information requested on December 13, 2021, and the items of concern go beyond any issues related to regulatory- or rule-set thresholds; while the Ombudsman's review targeted, at a minimum, assurance that no regulatory thresholds or company-set thresholds were violated, the Ombudsman's review focused on occurrences, trends, and corroboration of one type of information with other types of information, to detect multiple or interacting responses to potential well integrity issues.

The data request included the following:

1. Does SoCal perform trend analysis and define any other action levels below the regulatory thresholds for methane monitoring (of 10,000 ppm for 5 days or 50,000 ppm for 5 minutes)? Are findings below thresholds combined with other information such as annulus pressures, tubing/casing pressure, or other indications that together might suggest reason for further investigation?



2. The Ombudsman's review of the October 5-November 5, 2021, data found that no location had persistent methane of 10,000 ppm or greater for 5 days but that the following well locations (wellheads or laterals) had readings exceeding 50,000 ppm for 5 minutes:
 - a. SS29 lateral (58 occurrences)
 - b. SS29 wellhead (4 occurrences)
 - c. P26 lateral (1 occurrence)
 - d. P26 wellhead (8 occurrences)
 - e. P37 wellhead (18 occurrences)
 - f. SS4A lateral (4 occurrences)
 - g. SS44B lateral (121 occurrences)

SoCalGas had indicated in their December 1, 2021 response that any exceedances during this period were investigated and determined to be caused by ambient humidity. However, the Ombudsman did not have the information concerning the stated exceedance investigations and asked SoCalGas to provide a description of the process of investigating the occurrences where the 50,000 ppm/5 minutes criterion was exceeded. Further, the initial response implies that ambient humidity is the cause of all such readings, but it is difficult for the Ombudsman to understand without additional transparency how this explanation addresses readings/exceedances that only occur at a few wells. Therefore, the Ombudsman requested SoCalGas to provide the investigations and the results thereof of each exceedance or set of exceedances.

3. The Ombudsman reviewed the well tubing, casing, annulus 1, and annulus 2 pressure data and compared the information to the wellhead and lateral methane monitoring information. The Ombudsman found that:
 - a. Well SS29 had low tubing pressure readings throughout the period and a general declining trend, coupled with high occurrences at both wellhead and lateral methane monitors plus many instances of exceeding the 50,000 ppm/5-minute criterion. The Ombudsman asked SoCalGas to explain the pressure and methane monitoring information for SS29 and why SoCalGas is or is not concerned about well integrity.
 - b. Well FF33 had low tubing pressure readings throughout the period, suggesting either a partial gas/partial liquid column in the wellbore or other reason for the wellhead pressure being much lower than typical field pressure at other wells. The Ombudsman asked SoCalGas to explain the low tubing pressure readings at FF33.
 - c. The Ombudsman asked SoCalGas what is done to clean up or note the probable spurious pressure readings that sometimes occur such as the tubing pressure reading for well P25R on November 2, 2021.
 - d. Several wells had relatively persistent methane and some annulus pressure variability, causing the Ombudsman to question what else is known about well integrity or the source of the pressure and methane readings. Wells P32B and SS4A had relatively high frequency of occurrences of non-zero methane along with casing or annulus readings that fluctuate, therefore the Ombudsman requested that SoCalGas explain its currently understood validation of well integrity for the two wells.



- e. Eleven wells - P44, FF35C, FF35E, FF38B, P26A, P26C, P42A, P69H, P72B, SS4O, and SS9 - had relatively persistent, relatively high methane readings, so the Ombudsman requested that SoCalGas explain its currently understood validation of well integrity for those wells.

On January 26, 2022, the Ombudsman received SoCalGas' responses dated January 26, 2022. The SoCalGas response was complete in providing the information requested. The responses are summarized below.

1. Response 1:

Q: Does SoCal perform trend analysis and define any other action levels below the regulatory thresholds? Are findings below thresholds combined with other information such as annulus pressures, tubing/casing pressure, or other indications that together might suggest reason for further investigation?

SoCalGas takes the following actions when regulatory threshold occurrences are detected: The operator responds to the site with a handheld methane detection instrument to verify no leaks are present or to determine the source of a leak. If a leak is detected, corrective action is taken immediately to stop emissions. SoCalGas reviewed the occurrences identified in this question and concluded the occurrences were not caused by methane but were caused by rain and high humidity.

SoCalGas generally does not perform trend analysis or define any other action levels below the regulatory thresholds. Methane concentrations are not typically correlated with well pressures. However, if two coinciding anomalous events did occur, SoCalGas would further investigate to determine if the events were related. SoCalGas did investigate the above-mentioned occurrences in Question 1a and found no relation between the methane readings and well pressures.

Q: Please provide a description of the process of investigating the occurrences where the 50,000 ppm/5 minutes criterion was exceeded.

Operators respond to the site with a handheld methane detection instrument to verify no leaks are present or to determine the source of a leak. The results of these inspections are documented in the Maximo Records provided. See folder Maximo Records. Weather conditions are analyzed to determine if the elevated methane readings were caused by rain or high humidity.

Q: Please provide the investigations and the results thereof of each exceedance or set of exceedances (as when there are multiple/consecutive readings in excess of 50,000 ppm) for the five wells listed in 1.a above.

No methane exceedances were detected in these cases. SoCalGas confirmed that the exceedances during this period were caused by ambient humidity, except for the occurrences of P26's wellhead sensor which was triggered by an unusual instrument malfunction. The manufacturer witnessed and verified that the sensor was malfunctioning. The P26 wellhead sensor was replaced.

The elevated methane readings listed in Question 1a all occurred on Oct 25th and Oct 26th and were determined to be caused by ambient humidity. Furthermore, because all instances occurred during the same 24-hour period, it is unlikely they were related to individual annular well pressures.



2. Response 2:

Q: Please explain the pressure and methane monitoring information for SS29 and why SoCal is or is not concerned about well integrity.

The pressure drop in the well tubing and methane monitoring occurrences are not related. SoCalGas investigated the drop in tubing pressure in well SS29 and determined it was due to reservoir fluid loading, which was confirmed by a recent pressure gradient survey. SoCalGas also confirmed there were no methane leaks in that area. Detection exceedances were caused by high humidity from heavy rain during the identified time period. Please refer to the SS29 Work Orders in the folder Maximo Records.

Q: Please explain the low tubing pressure readings at FF33.

This well is equipped with a shallow surface controlled subsurface safety valve (SCSSV). To accurately check the functionality of the SCSSV, the well needs to be able to flow to confirm SCSSV position. FF33 has developed a fluid level with reservoir fluids and would not flow, hence the SCSSV could not be tested accurately. As a result, the well was removed from service and a tubing plug was installed to isolate the well from the reservoir.

Q: What is done to clean up or note the probable spurious pressure readings that sometimes occur such as the tubing pressure reading for well P25R on November 2, 2021?

The pressure readings referenced reflect an operator performing a transmitter functionality test using high pressure nitrogen. The transmitters are rated for 0-10,000 psi.

3. Response 3:

Q: Please explain SoCalGas' currently understood validation of well integrity for the above two wells.

P32B underwent a full SIMP well integrity casing inspection/casing pressure tests and assessment in July 2021 and passed its annual compliance noise-temperature survey in August 2021. The well integrity test results do not suggest any well integrity issue. The well integrity test results have been reviewed and approved by CalGEM. Annuli pressures are continuously monitored and managed by operations to not exceed the 100 psi threshold.

SS4A also underwent a full SIMP well integrity casing inspection/casing pressure tests and assessment in September 2020 and passed its annual compliance noise-temperature survey in March 2021. The well integrity test results do not suggest any well integrity issue. The well integrity test results have been reviewed and approved by CalGEM. Annuli pressures are continuously monitored and managed by operations to not exceed the 100 psi threshold.

4. Response 4:

Q: Please explain SoCalGas' currently understood validation of well integrity for the above eleven wells.

Each of these storage wells listed have recently undergone a full SIMP well integrity casing inspection/casing pressure tests and assessment as well as a recent compliance noise-temperature survey. The current data from these well integrity tests do not suggest any well integrity issues. P26C has been abandoned at the zone and is scheduled for a complete abandonment in 2022. All the wells listed have been approved by CalGEM.



Ombudsman's Discussion of SoCalGas 01-26-22 Response Information

In regard to the methane readings in exceedance of 50,000 ppm for 5 minutes, SoCalGas provided work ticket records showing that for each instance, a technician had been dispatched to the site, checked for gas levels, and finding nothing out of norm, closed the ticket and the concern. SoCalGas provided the work records showing their follow-up for each well, but since all records provided are similar, the Ombudsman is attaching only one as an example: [Click Here](#).

While the documentation provided by SoCalGas was partially satisfactory, it did not specifically address the alleged link of methane reads to humidity, nor why the elevated methane reads occurred only at a few locations. The Ombudsman subsequently reviewed National Weather Service records for the period under review and correlated rainfall events to most of the elevated methane readings. Elevated methane readings occurred on October 7, October 8, October 9, October 18, October 23, October 24, and October 25, and there were some slightly elevated methane readings on October 31-November 1. The most elevated levels of methane were observed on October 25. The Ombudsman's review of weather data focused on the National Weather Service station reports for Burbank, Camarillo, Van Nuys, and Santa Monica and spot checks of other reporting stations in the greater area of downtown Los Angeles and northward. Widespread rainfall events were noted on October 4-5, October 7-8, October 18, October 23, and October 25. The heaviest rainfall occurred on October 25 and corresponds to the highest elevated methane readings.

Natural gas in near-surface soil and sediment is common in this and many areas, with seepage more or less continually at low or non-detectable rates. However, instances occur, and are documented in places in the world, when near-surface soil or sediment becomes frozen or water-saturated, impeding the normal seepage of the shallow natural gas. When the build-up of gas creates enough pressure to overcome the impediment to flow created by the water saturation, the release of the gas is more detectable because it has concentrated as a temporary collection rather than continually seeped. After review of the weather data and the rainfall events recorded at weather stations in the area, the Ombudsman is mostly satisfied that the instances of elevated methane readings for short periods of time might likely have been the result of such changes in the water saturation of the near surface soils or sediments.

Some prior studies of soil gas vapor and near-surface gas in the Aliso Canyon area lend characterization to the various sources for such gas – see, for example the Catch Basin 3 summary found [here](#).

Natural gas is found in much of the sedimentary stack of rock overlying the Aliso Canyon storage zones. Some sedimentary rocks overlying the gas storage zone are naturally hydrocarbon-containing and known to be a potential source of gas in near-surface sediments or mixing with other natural gas in near-surface sediments.

The Ombudsman remains questioning as to why the elevated methane levels occurred only at a minority of locations, spread throughout the field: this could be indicative of the wells being situated at points of greater natural methane seeps, or it could be indicative of residual sources of methane located in or near these wells. The Ombudsman will have further discussion with SoCalGas as to their efforts to identify the sources of the seeping methane, or whether it could do so in the future, to reduce the uncertainty as to the source of the low-grade seeping. SoCalGas continues to monitor the area around the SS25 well (the source of the October 2015 incident) and the shallower sources of gas.

The Ombudsman also refers the reader to responses to previous submissions on this site – in particular, readers can review 1) the response to Submission #1 (July 26, 2019), which addresses geologic



characterization of the Aliso Canyon area, the geologic complexity, and its influence on natural hydrocarbons occurrences, and 2) parts of the response to Submission #4 (July 29, 2020). The information and analysis included in those previous Submission #1 and #4 responses will not be repeated here but do serve to provide significant background information to understand the various methane occurrences in the monitoring data.

The Ombudsman's questions in regard to the annulus pressure and wellhead pressure and methane readings at all 20 wells identified in the December 13, 2021, data request were satisfied by SoCalGas' explanations of the data as well as the summaries of well integrity inspections it has performed on those wells, wherein no findings were of concern. The Ombudsman is aware of the types of downhole logs and tests run in the Aliso Canyon storage field wells and the results of information obtained from such logs and tests. The Ombudsman agrees that the point-in-time test and inspection information do not indicate an integrity concern for the wells in question. The Ombudsman notes that an example of the diligence performed by SoCalGas is evident in the response to the question about the FF33 well: the pressure trend issue was a result of a safety device malfunction, and so the well was isolated from pressure and removed from service until the equipment issue could be resolved. The Ombudsman notes that SoCalGas has performed a significant amount of work from 2016 to present to reduce risk in the Aliso Canyon storage field, a point that will be discussed a bit further below.

Nevertheless, SoCalGas responded that they do not perform trend analysis of certain data, such as annulus pressure trends, but, rather, the SoCalGas procedures require response when pressure thresholds, methane thresholds, or other such set-points for response are met or exceeded. The Ombudsman requested selected internal procedural standards by which SoCalGas governs and manages well integrity. A review of SoCalGas' pressure monitoring standard finds that the standard speaks to "trends" but no review is compelled until a parameter defined as a threshold is exceeded. The standard does not specify how trends are to be analyzed.

The Ombudsman recommends that SoCalGas revise their applicable pressure monitoring procedure to include trend monitoring for parameters such as well casing and tubing pressure, annulus pressure, and methane readings. The procedure should provide some detail on how to analyze trends of each type of pressure or volume information, with the thresholds of normal operation only serving to define required actions under the abnormal operating condition procedural standard but that unexpected trends occurring at levels below thresholds also should be analyzed. Further, the procedure should specify that the pressure and methane monitoring data should be integrated to identify occurrences when multiple types of information might point to an issue that should be further investigated.

- Ombudsman Statement on SoCalGas risk-informed integrity management of the Aliso Canyon storage field

SoCalGas, as required by PHMSA and CalGEM, maintains a storage integrity management program (SIMP), composed of various directives and procedures, underpinned by a Risk Management Plan (RMP). While the original inquiry of October 27, 2021, spoke to any concern about well integrity, the Ombudsman believes it is worthwhile to provide a summary to show that through applied effort and focus on storage integrity management, the likelihood of an unwanted event might be decreased and the consequences of an unwanted event, should it occur, might be well-managed to control the effects and duration of an unwanted event.

It is not the Ombudsman's intent here to review all the detail of the SoCalGas SIMP as applied to Aliso Canyon, because there is information in prior postings to regulatory agencies and on the Aliso



Canyon websites, including the Ombudsman website. However, here in this response the Ombudsman provides a high-level summary, focusing the response on how risk is controlled and, in general, reduced.

- Well inspections

From 2016 onward, SoCalGas monitors well pressures, methane presence, and well site conditions. SoCalGas has reviewed the safety and security of site conditions and taken measures to improve safety and security of the surface facilities at each well site. Such actions reduce the chance of an unwanted event and prepare the company to respond to an unwanted event should it occur. For example, SoCalGas has studied landslide potential and identified certain wells and well sites for mitigation treatments. Additionally, SoCalGas has performed wellhead remediation, replacement, or repair on over three and a half dozen wells, which reduces risk by repairing or replacing degraded or compromised equipment; when new materials are installed, risk is reduced by allowing verification of the material design as fit for the pressure, temperature, and flow service intended, with a designed factor of safety over and above those anticipated conditions.

SoCalGas has reduced risk by reducing overall footprint – plugging dozens of wells in the past 5 years. There were 114 wells in the Aliso Canyon field subject to well integrity assessment at the start of 2016, but that number has been reduced by more than 40% by plugging of wells in accordance with current rules, regulations, methods, and verification of effectiveness. Plugging of a well does not eliminate risk but substantially and significantly reduces risk by creating barriers to pressurization of any point of the well and inserting additional solid and fluid barriers to fluid flow.

SoCalGas has performed downhole well integrity inspections of the well casing condition, casing cement condition, and detection of fluid flow behind or between well casings. SoCalGas has run over twelve dozen casing inspection logs. As of December 9, 2021, there were 62 active wells in the Aliso Canyon storage field; every well has had an inspection, although 57 of those wells have already had 2nd-round inspections and 20 have had 3rd-round inspections. SoCalGas has run over twelve dozen other types of mechanical integrity tests and inspections and several hundred fluid flow monitoring logs. The casing inspection program allows for knowledge of the actual state of casing that has been in the well for many years, and the 2nd- and 3rd-round surveys begin to allow SoCalGas to infer something about the rate, if any, of time-dependent mechanisms of degradation and the location and potential causation of defects, which could be due to as-built or incidental mechanical action or due to some time-dependent mechanism. The inspections of the casing cement and fluid flow detection provide information about the quality of the isolation afforded to prevent migration of stored fluids as well as the flow of fluids from non-storage zones along the well bore. The knowledge derived from the well integrity downhole inspections reduces risk by removing sources of uncertainty with respect to actual state and pressure containing capability of the casing, the hydraulic isolation afforded by the casing/cement in combination, and the time-dependent aspects of degradation mechanisms, such as corrosion. The effect of this continual improvement in knowledge through a sustained casing inspection program also could allow SoCalGas to optimize its risk management effort, in the future focusing time and money on other sources of uncertainty, should, for example, the understanding of casing degradation mechanisms become well established such that frequent inspections are no longer necessary to monitor and study time-dependent degradation mechanisms.

SoCalGas has performed repairs, upgrades, and replacements to well tubing and casing in the last five years, with over three dozen new inner casing strings installed and many instances of tubing



replacement. The repair, upgrade, and replacement actions reduce risk by first allowing confirmation of the actual materials installed downhole, and second by replacing an older and possibly degraded or compromised piece of equipment with something new and verifiably fit for the storage service, with a known design factor of safety over and above the pressure, temperature, and flow conditions expected.

- Human and Organizational Reliability

The quality and effectiveness of the SoCalGas SIMP depends on human and organizational reliability. Integrity management program artefacts such as specifications and procedures can be well-formed, but operational discipline is necessary to make them living processes that govern and manage the actions of people throughout the organization. To that end, the Ombudsman has reviewed and continues to review the SoCalGas SIMP procedures, and as noted in responses to public inquiries and in the Ombudsman's annual reports, the Ombudsman maintains an active role in recommending opportunities for improvement of the SoCalGas SIMP.

The Ombudsman selected specific SoCalGas procedures relevant to storage field integrity and safety and related to the October 27, 2021 public inquiry to the Ombudsman. The Ombudsman sent a second data request to SoCalGas on December 13, 2021, asking for:

- a. Nine procedural standards that identify roles, responsibilities, hazards and threats, and actions taken to monitor well integrity information, identify items of concern and respond to those items of concern;
- b. Two documents related to threat identification and preventive and mitigation measures;
- c. Documentation demonstrating that SoCalGas periodically reviews and documents hazards and threats, keeps current on integrity risks at its storage fields, and how it assesses the need for certain types of prevention and/or mitigation measures;
- d. Documentation demonstrating that SoCalGas works to continually improve its risk-informed integrity management through goal setting and performance monitoring of its SIMP; and
- e. Documentation of the status and inclusion of any findings from additional studies that relate to safety and integrity management in general, such as improvements in understanding human factors and their role in adequacy of operating and maintenance procedures.

SoCalGas provided the requested information to the Ombudsman on February 3, 2022.

- Procedural Standard Adequacy

Two procedural standards in the request relevant to the October 27, 2021, public inquiry are those covering pressure monitoring and abnormal operating conditions.

SoCalGas responded to Ombudsman inquiries that SoCalGas does not perform trend analysis of certain data, such as annulus pressure trends, but, rather, the SoCalGas procedures require response when pressure thresholds, methane thresholds, or other such set-points for response are met or exceeded.

The Ombudsman's review of SoCalGas' pressure monitoring standard finds that the standard does speak to trend analysis as an investigative analytical method after a reading exceeding a threshold defining normal operating range is observed. The procedure does not specify how the trends are to be analyzed, nor does the procedure specify trend monitoring for observations within or below normal thresholds. The standard identifies the "normal operating condition" thresholds for well



pressure and annulus pressure in Aliso Canyon wells. The exceedance of the normal operating condition thresholds links the pressure monitoring observations to abnormal operating conditions; the SoCalGas procedural standard on abnormal operating conditions identifies a “pressure anomaly on a storage injection, withdrawal, or observation well” as an example of a possible abnormal condition. The pressure monitoring procedural standard requires that monitoring must allow for the discovery and correction of abnormal operating conditions relative to the normal operating thresholds.

For pressure readings which fall outside of normal operating ranges, the procedure requires that the Storage Operations Group investigate by performing certain actions, and if the deviation is confirmed as possibly related to well integrity, the well must be removed from service and further investigations conducted and evaluated. The pressure monitoring standard assigns the investigation to a group rather than to a specific role, although one could assume the Storage Operations Manager owns that specific responsibility: “Aboveground Storage Operations Group shall make an initial assessment based on the observed pressure trends and determine whether company personnel can safely visit the wellsite and inspect the well to confirm actual pressure conditions. Assessment for safe conditions should be ongoing throughout the investigation process.” The standard assigns responsibility to the “storage field engineer” to “monitor injection/withdrawal well pressures and well pressure trends.” and “oversee and direct remedial action resulting from identified pressure anomalies as required.”

- SIMP

SoCalGas conducts an annual review of the SIMP to confirm adequate controls are in place to demonstrate compliance with regulatory requirements and identify areas of improvement. The reviews include risk assessment process, awareness of abnormalities and communicating and managing change, actions taken to verify reservoir and well integrity and to control threats to integrity, regulatory audit findings and corrective actions, and other recommendations made during the year.

Each year, SoCalGas sets goals and metrics to measure progress in storage integrity management. Performance measures include number of wells assessed and assessment type, number of actionable condition findings resulting from the assessments, number of internal audits and regulatory audits, and the resulting number of corrective actions identified and corrective actions completed.

The framework for the SoCalGas SIMP performance monitoring and continual improvement is in place and being lived. Additional improvement can be expected. For example, SoCalGas responded to the Ombudsman’s request that the assessment of human factors in operating and maintenance procedures is ongoing and has not yet been completed.

Organizational culture affects performance and effectiveness of integrity management programs. The Ombudsman participated in the January 26, 2022, public workshop presented by the authors of the California Public Utilities Commission (CPUC)-sponsored report by 2EC, “Independent Safety Culture Assessment of SoCalGas and Sempra Energy” (December 10, 2021). The Ombudsman read the entire report, which is available [here](#). CPUC states that the report is “part of the CPUC’s investigation to determine whether SoCalGas and Sempra have an organizational culture and governance that prioritizes safety, adequately directs resources to promote



accountability and achieve safety goals and standards, and how SoCalGas reacts as an organization when a significant safety event occurs.”

The SoCalGas SIMP exists within the context of the organizational culture of the company. The improvements identified in the 2EC “Safety Culture Assessment...” report for the CPUC should be brought into the SIMP. Even so, strong processes within an integrity management program such as the SIMP can be living examples within a company of a particular center of excellence in safety culture. The role of the Ombudsman is in part designed to assist in the safety culture transformation discussed in the 2EC report, through the Ombudsman’s functioning within the role as prescribed, which allows insight into the way the SoCalGas storage integrity management processes and procedures are worked, the robustness of those processes and procedures, the information obtained, the way information is used in risk-informed decisions, and the way performance is managed and improved.

The Ombudsman’s function to listen to the public, receive public questions and ask questions of SoCalGas, persist in the questioning to a point of reasonable satisfaction, and make further recommendations for improvement, is a way to assist SoCalGas in both safety culture transformation and SIMP effectiveness.

- Conclusion

The Ombudsman did not observe in the data provided by SoCalGas any safety-threatening well integrity issue in the Aliso Canyon storage field during the period October 5, 2021, to November 5, 2021. SoCalGas, in their responses to the Ombudsman’s requests, stated that they did not observe any findings in the monitoring, logging, or testing data at or near surface or downhole in wells that, in accordance with their standards, would indicate any abnormality or leak.

The Ombudsman recommends that SoCalGas revise their applicable pressure monitoring procedural standard to include:

- Trend monitoring for parameters such as well casing pressure, well tubing pressure, annulus pressure from all applicable annular spaces, and methane readings, for conditions under which adverse trends might occur within specified “normal operating levels”;
- Detail on how to identify deviations from normally-expected pressures and methane levels and how to analyze trends of pressure, volume, rate, or methane concentration;
- Detail on how to analyze trends of each type of pressure or volume information, with the thresholds of normal operation only serving to define required actions under the abnormal operating condition procedural standard but that unexpected trends occurring at levels below thresholds also should be analyzed;
- That the pressure and methane monitoring data should be integrated to identify occurrences when multiple types of information might point to an issue requiring further investigation;
- Requirements for frequency of monitoring and reviews of the monitoring practices;
- requirements for more frequent monitoring in areas where anomalous behaviors occur and evaluation of the benefits of additional sample collection and analysis to identify soil and annular space gases;
- Clarity of role responsibility for trend monitoring, internal reporting, and investigation; and
- Implementation within the SIMP of applicable recommendations from the CPUC-sponsored report by 2EC “Independent Safety Culture Assessment of SoCalGas and Sempra Energy”.