SoCalGas™

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Climate Adaptation Vulnerability Assessment

Executive Summary

> The natural gas system is a crucial asset to California, delivering affordable,[1] reliable,and resilient energy to residential, commercial, and industrial customers for heating and power.

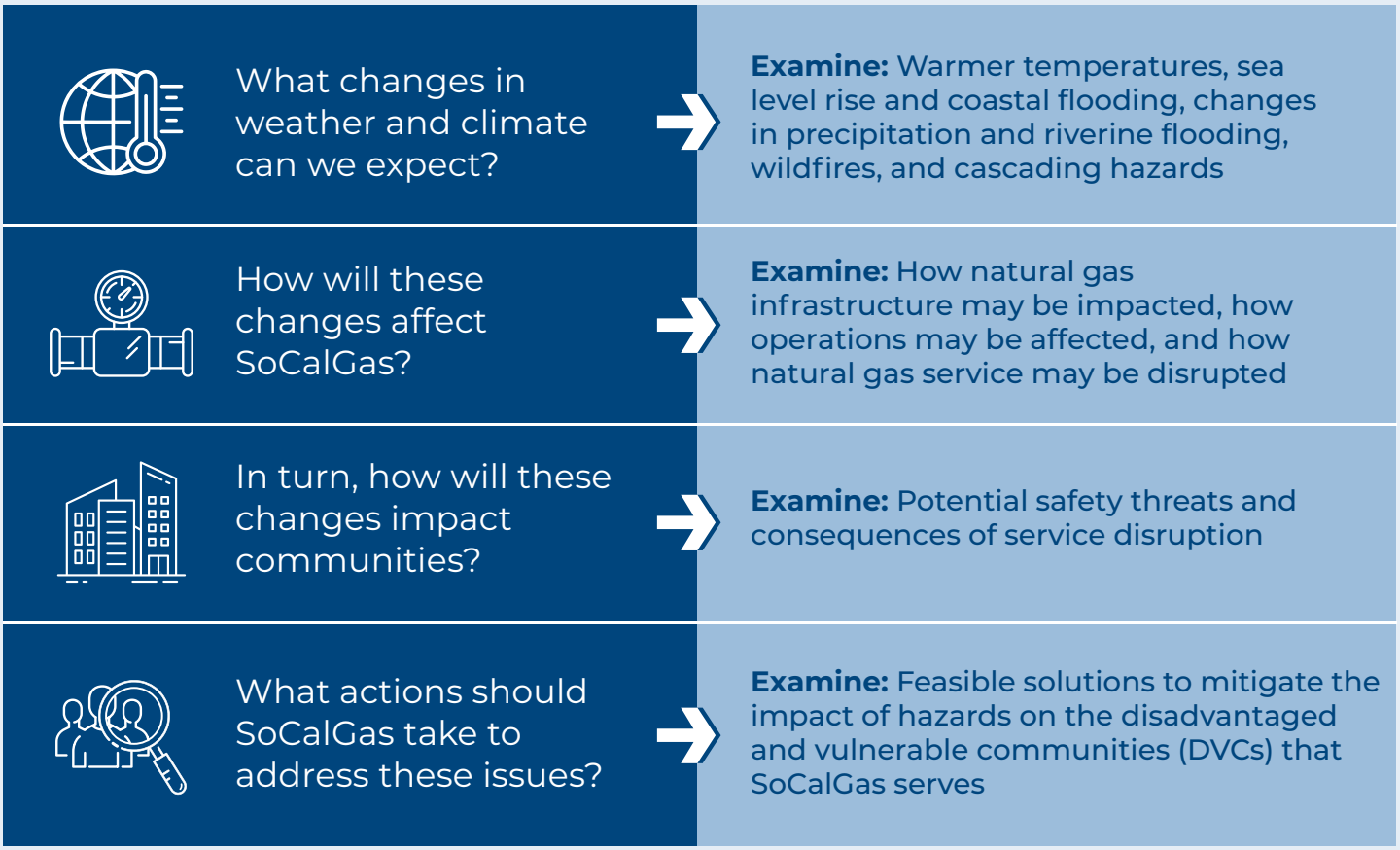
Based on statewide averages, natural gas supplies about 65 percent of household energy while only representing about 25 percent of household utility energy bills.[2] Residential and business customers depend on the natural gas system to supply energy for heating, hot water, and cooking. Commercial customers also rely on natural gas for running equipment and processes that are vital to their business operations. Industrial customers depend on natural gas for its role in high-temperature processes, such as the production of aircraft parts, as well as generating steam needed in their manufacturing processes. Additionally, the natural gas and electric systems are complementary components of California's interdependent energy system as the natural gas system plays a key role in generating electricity. In 2024, natural gas generators accounted for over 40 percent of in-state generation and the natural gas system and natural gas generation provided the single largest source of electricity in California.[3]

As the Commission and regulated utilities consider strategies to integrate climate change adaptation planning to address the increasing frequency and intensity of climate impacts, it is important to preserve the long-term safety, reliability, and affordability of infrastructure and services provided by regulated utilities, while investing in decarbonization solutions that can further reduce climate impacts. Adequate planning and investments for utility infrastructure and services will help avoid potential service interruptions, higher maintenance costs, and heightened susceptibility to extreme weather events that could disrupt the daily needs of California residents and businesses.

In compliance with the California Public Utilities Commission's (CPUC or Commission) requirements in the Order Instituting Rulemaking (OIR) to Consider Strategies and Guidance for Climate Adaptation (R.18-04-019),[4] SoCalGas's Climate Adaptation and Vulnerability Assessment (CAVA) evaluates the risks of climate hazards and extreme weather events to the company's natural gas infrastructure, and recommends strategies to increase resiliency, with an emphasis on integrating disadvantaged and vulnerable communities (DVCs)[5] into the adaptation process.

Figure 1

Climate Adaptation and Vulnerability Assessment General Process



Methodology

The methodology for the CAVA defines five climate hazards (coastal erosion, coastal flooding, inland flooding, landslides, and wildfires), and assesses how these climate hazards may impact the vulnerabilities of SoCalGas's assets (e.g., medium and high-pressure pipelines, facilities, regulators, compressors, valves, and storage fields) within expected timeframes (current, 2030, 2050, 2070). Climate projection models[6] were utilized with assumptions on various levels of emissions, population growth, economic development, climate action, and climate impacts, among other factors.

Exposure scoring along with sensitivity scoring and adaptability scoring resulted in vulnerability scoring that was assigned to each asset class based on a series of metrics to capture the potential likelihood of hazards occurring at an asset location now and in the future. The vulnerability scores are classified into five categories (low, moderate low, moderate, moderate high, and high) and asset adaptive capacity[7] was assessed qualitatively. The results and risk categories are summarized in the CAVA based on the 2050 vulnerability and adaptive capacity scores.[8]

Additionally, through the CAVA's Community Engagement Plan (CEP), SoCalGas engaged with community leaders through four regional advisory boards (RABs) to understand the adaptive capacity[9] and concerns of DVCs surrounding climate change, as over 60 percent of SoCalGas's service territory consists of DVCs.[10] The engagement efforts included workshops, tribal talking circles, community events, surveys, and online comment forms. The feedback was summarized and synthesized into key themes to consider when prioritizing investments that make energy infrastructure and communities more climate resilient.

Key Findings

Safe

Safe and reliable service is the cornerstone of the regulated utilities' obligation to provide essential service.[11] A majority of the assets studied in SoCalGas's CAVA have low to moderate low climate change vulnerability scores[12] indicating lower relative risk associated with a given hazard. SoCalGas conducts periodic risk assessments, including those associated with natural force damage, which include damage caused by climate events. System operators respond to identified threats by implementing preventative and/or mitigative measures. The vulnerability scores demonstrate the benefits of current preventative measures, risk management, and safety practices in managing climate hazards. At the same time, the CAVA forecasts areas that are vulnerable to future climate threats, which can inform proactive measures and investment needs to further improve system safety and resiliency.

Reliable

The changing climate requires an energy ecosystem that is resilient to extreme weather, wildfires, and drought, in order to deliver reliable energy. Discussions with regional advisory board members revealed that extreme heat and wildfires are some of the biggest concerns to these stakeholders, including not having energy during extreme heat events. The results of the CAVA indicate that the natural gas system is generally resilient to not only these concerns, but most current climate challenges. This favorable result is due to SoCalGas's existing mitigation programs and inherent design.

The natural gas system consists of a series of interconnected pipelines, providing multiple feeds of natural gas for most end-users. This design allows for service to be maintained both when system maintenance is required and when unplanned issues occur. SoCalGas also proactively identifies and analyzes risks and designs and implements infrastructure and programs with these risks in mind. These proactive measures enhance threat response capabilities, improving resiliency and supporting reliability when an incident occurs. The CAVA further informs what identified measures can be integrated into these existing risk-informed approaches to address future climate risks and SoCalGas plans on continuing engagements with the RABs in order to address and mitigate other threats to the most vulnerable customers.

Affordable

Currently the natural gas system is one of the most affordable suppliers of energy available,[13] even as investments in the safety, reliability, and resiliency of the system continue. A National Renewable Energy Laboratory (NREL) study demonstrates that transmitting energy through pipelines has an inherent cost advantage compared to other carriers (e.g., electric transmission).[14] As the Pipeline and Hazardous Materials Safety Administration (PHMSA) has affirmed, pipeline transportation is one of the safest and most cost-effective ways to transport natural gas, and as the U.S. [and California] continue to develop and place more demands on energy transportation, it becomes necessary to invest in upgrading infrastructure.[15] The CAVA shows that incremental investment into the system will be necessary to maintain a robust system by mid-century, but these investments can be made with a prioritization on affordability. Today, natural gas system investments are carefully evaluated to balance costs and benefits for ratepayers, using a diverse suite of tools. These tools, as well as engagement with the RABs, can help maintain both reliability and affordability of the natural gas system, while continuing to support disadvantaged and vulnerable communities.

Ready for Tomorrow

Past and ongoing investments ratepayers have made in the natural gas system have resulted in a system that is reliable, resilient, and affordable, and these investments can be leveraged to meet tomorrow's needs. SoCalGas's existing risk modeling accounts for potential natural force damage, and SoCalGas's CAVA can help inform and improve these risk models and associated investments as extreme weather events are expected to become more frequent. These modifications can also support the identification and development of additional investments and other proactive measures that enhance the resiliency and reliability of the natural gas system in the future. Other decarbonization investments can then be pursued in a way that leverages the value and service from the natural gas system, which is being enhanced through the integration of lower carbon fuels, such as renewable natural gas (RNG),[16] which can be used interchangeably with natural gas, and hydrogen (H2) blending.[17]

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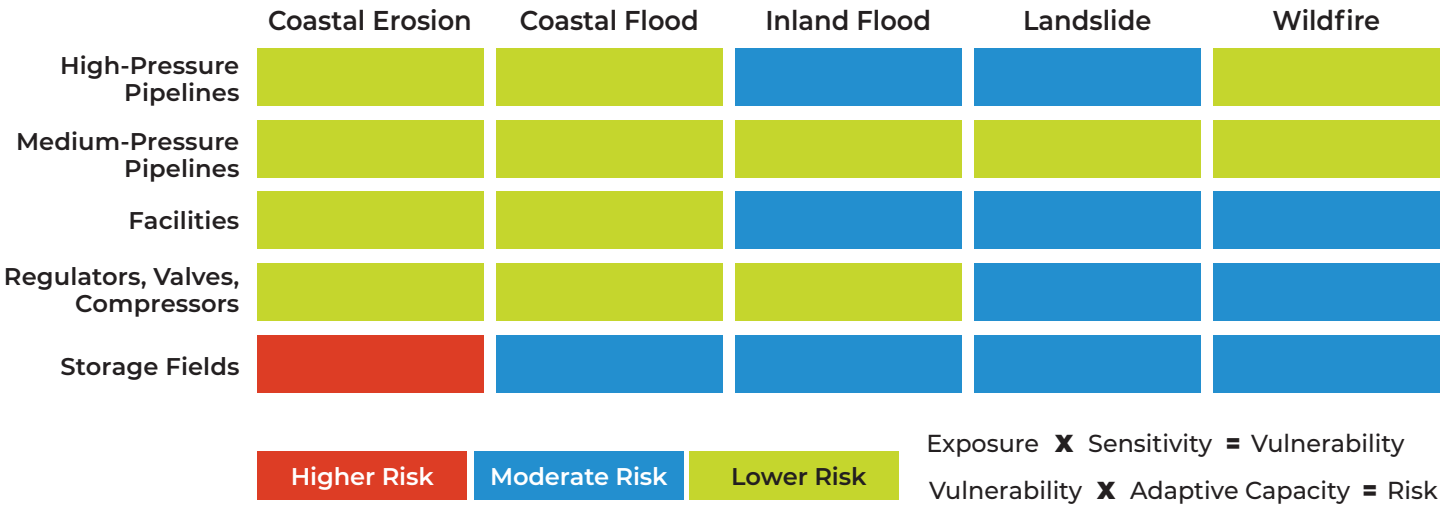
Climate Adaptation Vulnerability Assessment Summary

SoCalGas's system is well prepared to handle climate risks today, and these findings from the CAVA offer a data-driven foundation for future policy and investment decisions aimed at strengthening long-term system resilience.

Figure 2

2050 Asset Risk Results by Asset Class and Hazard



This chart illustrates relative risk results for SoCalGas assets in 2050 under the CAVA scenarios.

The 2050 asset risk results underscore the value of existing safety and risk management practices and illuminate opportunities for further proactive mitigation measures and investments. These enhancements may bolster system safety and resiliency as SoCalGas prepares to meet the challenges and demands of 2050.

The CAVA methodology is designed to produce useful information for SoCalGas to consider in prioritizing its response to growing climate-related hazards as conditions change over time. While the CAVA results indicate that SoCalGas assets generally face low to moderate overall risks, it is important to understand the unique factors that apply to individual assets' relative risk rankings.

The risk categories presented in Figure 2 are assigned at the asset class rather than the asset level. An asset class being designated as high risk does not imply that all assets within that asset class are high risk. For example, storage fields have a higher relative risk ranking for coastal erosion and coastal flooding due to some of the storage field's proximity to coastal areas. For purposes of the CAVA analysis, each storage field was categorized into one designated asset category where the storage field's exposure score for a particular hazard was assigned by taking the maximum exposure across the various storage fields for that hazard, including aboveground and underground assets located in various areas of SoCalGas's service territory. This does not imply that all parts of the storage field had that level of exposure or the resulting level of vulnerability (e.g., underground assets).

Wildfires pose a lower relative risk to assets that are buried and thus protected from potential danger, compared to above-ground assets. Increased frequency and intensity of landslides can affect all types of infrastructure, whether they are above or below ground. Inland flooding generally affects assets that are outside of metropolitan areas. Understanding how assets compare to each other can help provide insight into which adaptability measures need to be prioritized to mitigate each identified hazard.

Coastal Erosion

In California, coastal erosion could pose significant threats to natural gas storage facilities.[18] As coastal areas erode, the stability of the ground supporting these facilities can be compromised, leading to potential structural damage. Erosion can expose buried pipelines and storage tanks, making them more susceptible to damage from external forces and corrosion. Additionally, the loss of protective land barriers can increase the risk of flooding, which can further impact the integrity of facilities.

Adaptability Measures

SoCalGas considers erosion impacts and uses hydroseeding on pipeline trench surfaces to reduce potential erosion. SoCalGas also maintains the original depth of cover over pipelines which helps maintain integrity of the soil around the infrastructure. Inspections of pipeline rights-of-way include verifying that erosion control blankets are intact and undamaged. To mitigate erosion effects in the future, more robust monitoring and maintenance programs can be implemented at vulnerable locations. Additionally, infrastructure can incorporate designs that can withstand the dynamic coastal environment.

Coastal Flooding

In California, coastal flooding could impact natural gas infrastructure. Floodwater and debris could damage above-ground infrastructure, such as natural gas processing plants and storage facilities. Additionally, rising sea levels and storm surges can inundate coastal areas, leading to erosion and destabilization of the ground supporting buried pipelines. This can cause pipelines to shift, bend, or even rupture, resulting in natural gas leaks.

Adaptability Measures

To mitigate coastal flooding damages, SoCalGas regulates the type of soil used to backfill projects near coastal zones, selecting soil used to backfill pipelines which is resilient against flooding damage that may occur. To help mitigate potential impacts of coastal erosion and flooding, ocean wave action can be incorporated into future design practice to help reduce damage to SoCalGas infrastructure.

Inland Flooding

Flooding can have severe impacts on natural gas infrastructure, particularly to buried pipelines. When floodwaters inundate an area, they can erode the soil surrounding pipelines, leading to exposure and potential damage. The force of the water can displace soil and rocks, exerting pressure on the pipelines and causing fractures or breaks. Additionally, floodwater can carry debris that may collide with pipelines, further increasing the risk of damage. If pipelines are compromised, it can result in natural gas leaks and loss of service, which can pose safety hazards to communities. The increased frequency and intensity of flooding events due to climate change underscore the importance of robust infrastructure design and maintenance to mitigate these risks in the future.

Adaptability Measures

SoCalGas has thoughtfully designed the natural gas system to minimize threats from flooding today. Current company policy requires continuous assessments and engineer plans to minimize flood risk by requiring pipelines to be strategically installed away from sloping terrains or from flood prone areas. Flood mitigation is also a key component of SoCalGas's current Integrity Management Program, where continuous thorough threat assessments are conducted to address potential flood-related issues. According to the CAVA, as flooding vulnerabilities increase in the future, additional measures may be necessary, such as additional monitoring programs or burying pipelines deeper or elevating above-ground infrastructure higher than predicted flood levels, to protect against potential flood damage, which may require additional investments.

Landslide

Landslides can significantly impact natural gas pipelines, posing serious hazards to natural gas infrastructure. When a landslide occurs, ground movement can exert immense pressure on pipelines, potentially causing them to bend, rupture, or break. This can lead to natural gas leaks, which can pose safety risks to communities and the environment. Additionally, landslides can displace the soil and rocks around pipelines, leading to further instability and potential damage.

Adaptability Measures

Before performing pipeline installations, SoCalGas conducts landslide hazard analyses to assess the feasibility of the installation of the pipeline and makes necessary structural and pipeline design changes to mitigate potential hazards that are found. SoCalGas has also developed innovative safety measures that allow for quicker response. For example, in the event of a landslide, SoCalGas developed a real-time remote monitoring system that can quickly determine if facilities are located near the landslide and identify those facilities that may have been impacted. As landslides are projected to increase due to climate change, installing additional monitoring devices, such as fiber optic and strain gauges, to infrastructures that are in highly vulnerable areas may allow for increased adaptability of SoCalGas's infrastructure.

Wildfire

As climate change intensifies, wildfires in California are expected to become more frequent and severe. The increasing wildfire risk can lead to impacts such as intense heat that can melt materials and weaken the integrity of utility infrastructure. The compounded effects of climate change and wildfires necessitate proactive measures to support the resilience and reliability of California's energy systems.

Adaptability Measures

Currently, SoCalGas has proactive guidelines and requirements to minimize wildfire risks in high threat areas through continuous monitoring. In the event a wildfire does occur in a nearby area, SoCalGas's emergency management team responds by gathering information from both external and internal sources, assessing the location, and identifying any SoCalGas infrastructure that may be affected by the threat. If infrastructure is present, notifications are sent internally to relevant departments, and close coordination with SoCalGas operators promotes effective monitoring and quick response in the field. In the future, it may also be crucial to check for adequate water supply and fire systems for fire departments to quickly and effectively combat wildfires. This can be addressed during the planning and design phase of projects in higher vulnerability areas which may require continuous investments to improve nearby water systems at facilities, compressor stations and storage fields.

SoCalGas looks forward to further developing its CAVA to account for changing climate risks, while continuing to provide safe, reliable, and affordable services to its customers.

Conclusion

Continued investment in the existing natural gas system is needed to provide natural gas and electric reliability under increasingly complex conditions

- Today, the fuel delivered through SoCalGas's system supplies a safe, reliable and affordable source of energy.
- The existing network has been built through thoughtful investments in system operations and programs and has historically provided value for ratepayers.
- SoCalGas's traditional investments not only aim to safeguard the natural gas system but also help increase energy resilience in the communities we serve, especially in the DVCs.

The CAVA highlights necessary adaptations and investments required to mitigate future climate hazards

- By proactively addressing climate change with continued investments in the natural gas and electric systems and robust system management practices, California can realize the reliability and resiliency benefits of natural gas infrastructure.
- The evaluation and findings from the CAVA will be used as one important measure in SoCalGas's risk assessments and infrastructure investment processes. SoCalGas's investments will be essential for California to continue having access to safe, reliable, and affordable energy, today and tomorrow.

Continuing engagement with DVCs is important when considering investments to make communities more climate resilient

- SoCalGas plans to support community leaders and partners by keeping the lines of communication and feedback open to new ideas, suggestions, and recommendations for engaging with DVCs and creating more resilient communities.
- Funding to provide compensation to community partners for their expertise and participation is important for maintaining strong engagement.
- Providing grants to communities can also support climate adaptation and resilience.

Next Steps

The next SoCalGas CAVA filing will be in 2028, followed by every four years thereafter. SoCalGas looks forward to further developing its CAVA to account for changing climate risks, while continuing to provide safe, reliable, and affordable services to its customers.

For more information, visit
socalgas.com/ClimateAdaptation

Safe, Reliable & Affordable energy delivery today. Ready for tomorrow.

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References

1. Refer to data regarding top 50 investor owned utilities (IOUs) by total customers, e.g., American Gas Association (AGA), 2023 Ranking of Companies By Total Sales Customers AGA, 2022 Ranking of Companies By Total Sales Customers; see also WalletHub, Energy Costs by State (2025) (July 1, 2024).
2. Calculated based on California Energy Commission (CEC) 2019 California Residential Appliance Saturation Study average household energy consumption; Statewide average residential electricity rates from the CEC Demand Forms and CEC provided spreadsheet on average residential natural gas rates.
3. 2023 Total System Electric Generation.
4. Decision (D.)19-10-054 (at pg 21) defines climate change adaptation as "adjustment(s) in natural and human systems to a new or changing environment. Adaptation to climate change for energy utilities…refers to adjustment in utility systems using strategic and data-driven consideration of actual or expected climatic impacts and stimuli or their effects on utility planning, facilities maintenance and construction, and communications, to maintain safe, reliable, affordable and resilient operations."
5. Defined in D20-08-046.
6. Refer to CAVA at ES-3 for a discussion of the Coupled Model Intercomparison Project Phase 6 (CMIP6) and shared socioeconomic pathways (SSPs).
7. The term "adaptive capacity" in this assessment evaluates SoCalGas's capacity to handle disruption to its system (i.e., SoCalGas adaptive capacity or asset adaptive capacity) and DVC's capacity to adapt to the disruptions (i.e., community adaptive capacity, which is what is defined in D. 20-08-046).
8. Refer to CAVA Table ES-1 at ES-6 for summarized Asset Risk Result.
9. Adaptive capacity is "the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences." See PCC, Climate Change 2014: Impacts, Adaptation, and Vulnerability (2014), Annex II, Glossary at 1758.
10. According to the California Communities Environmental Health Screening Tool's criteria on income and pollution burden. Refer to CAVA at 2-2.
11. Public Utilities Code – PUC § 963
12. CAVA at p. 4-4.
13. Federal Register Vol 89, No 201 at pg 2.
14. NREL, DeSantis et al., iScience 24, 103495, December 17, 2021.
15. U.S. Department of Transportation PHMSA Pipeline Replacement Background.
16. Prompted by SB1440, the CPUC has set a procurement target that the gas utilities should procure RNG equivalent to about 12 percent of their residential and small business 2020 load by 2030.
17. H2 blending has been identified in the California Air Resources Board's Scoping Plan as a key component of its efforts to achieve net-zero greenhouse gas emissions by 2045. In March 2024, as directed by the CPUC in D.22-12-057, SoCalGas and three other California gas utilities submitted an application requesting approval for a series of demonstration projects designed to inform a standard for blending clean, renewable hydrogen into the natural gas system.
18. To be conservative, a storage field's exposure score for a particular hazard was assigned by taking the maximum exposure across the entire storage field area for that hazard, including aboveground and underground assets. This does not imply that all parts of the storage field had that level of exposure or the resulting level of vulnerability (e.g., underground assets).

Cautionary Statement Regarding Forward-Looking Information

This report contains forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. Forward-looking statements are based on assumptions about the future, involve risks and uncertainties, and are not guarantees. Future results may differ materially from those expressed or implied in any forward-looking statement. These forward-looking statements represent our estimates and assumptions only as of the date of this report. We assume no obligation to update or revise any forward-looking statement as a result of new information, future events or otherwise.

In this report, forward-looking statements can be identified by words such as "believe," "expect," "intend," "anticipate," "contemplate," "plan," "estimate," "project," "forecast," "envision," "should," "could," "would," "will," "confident," "may," "can," "potential," "possible," "proposed," "in process," "construct," "develop," "opportunity," "preliminary," "initiative," "target," "outlook," "optimistic," "poised," "positioned," "maintain," "continue," "progress," "advance," "goal," "aim," "commit," or similar expressions, or when we discuss our guidance, priorities, strategies, goals, vision, mission, projections, intentions or expectations.

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