REQUIREMENTS FOR CALIFORNIA UNDERGROUND GAS STORAGE PROJECTS

INITIAL STATEMENT OF REASONS

The Department of Conservation (Department) proposes to delete section 1724.9 of the California Code of Regulations, title 14, division 2, chapter 4, subchapter 1, article 3. Concurrently, the Division proposes to add to tile 14, division 2, chapter 4, subchapter 1 of the California Code of Regulations a new article 4, entitled "Requirements for Underground Gas Storage Projects," consisting of new sections 1726, 1726.1, 1726.2, 1726.3, 1726.3.1, 1726.4, 1726.4.1, 1726.4.2, 1726.5, 1726.6, 1726.7, 1726.8, 1726.9, and 1726.10.

INTRODUCTION

The Department's Division of Oil, Gas, and Geothermal Resources (Division) supervises the drilling, operation, maintenance, and plugging and abandonment of onshore and offshore oil, gas, and geothermal wells. The Division carries out its regulatory authority to encourage the wise development of oil and gas resources while preventing damage to life, health, property, and natural resources. (Pub. Resources Code, § 3106.) The Division regulates the injection of natural gas into large underground reservoirs for storage before the gas is later withdrawn for sale to residential, commercial, and industrial customers and natural gas power plants. The Division supervises underground gas storage facilities to ensure that the original reserves are not lost, to ensure the integrity of gas storage wells, and to prevent damage to public health and the environment. (Pub. Resources Code, §§ 3106, 3180, 3181, 3220 and 3403.5.) Underground gas storage projects are subject to the requirements of the Division's existing regulations for underground injection projects (commonly referred to as the "Underground Injection Control" or "UIC" regulations). (Cal. Code Regs., tit. 14, §§ 1724.6 to 1724.10.)

The Division's staff is comprised of engineers and geologists with education and experience in the field of oil and gas exploration and production. Many of the Division's staff are licensed in their respective fields, and most have extensive regulatory and industry backgrounds. The range and depth of expertise within the Division facilitates a thorough and comprehensive approach to regulating all aspects of oil and gas production operations, including underground natural gas storage operations.

On October 23, 2015, a natural gas leak was discovered from an injection and production well in the Aliso Canyon Natural Gas Storage Facility in Los Angeles County. The leak represented a significant threat to the public peace, health, safety and general welfare. It resulted in the relocation of thousands of people from the areas proximal to the facility

and, according to the California Air Resources Board, released 109,000 metric tons of methane. On February 11, 2016, the operator temporarily controlled the leak by injecting mud from a relief well intersecting the bottom of the leaking well. A permanent seal of the well was announced by the Division on February 18, 2016.

In response to that incident, the Division promulgated emergency regulations on February 5, 2016, imposing requirements on all underground gas storage facilities in the state. The emergency regulations require at least a daily inspection of gas storage well heads using gas leak detection technology such as infrared imaging, ongoing verification of the mechanical integrity of all gas storage wells, ongoing measurement of annular gas pressure or annular gas flow within wells, regular testing of all safety valves used in wells, establishment of minimum and maximum pressure limits for each gas storage facility in the state, and development of a comprehensive risk management plan that evaluates, mitigates, and prepares for risks at each underground gas storage facility.

The Legislature also responded to the incident at Aliso Canyon, and, effective January 1, 2017, Senate Bill 887 (Pavley, Chapter 673 statutes of 2016) (SB 887) established a number of significant new statutory requirements for underground gas storage facilities. The bill mandates that the Division's regulations require that no single point of failure poses an immediate threat of loss of control of fluids, and it provides detailed specifications for ensuring well construction integrity. It requires operators to commence a stringent mechanical integrity testing regime on all gas storage wells by January 1, 2018, and it includes extensive requirements for providing risk management planning and project data to the Division. The bill also requires that operators develop and maintain employee gas storage well training and mentoring programs.

Prior to the emergency regulations with their specific underground gas storage emphasis, the Underground Injection Control regulations broadly covered underground gas storage facilities. However, underground gas storage facilities have differing and distinct concerns and practices from other types of injection projects regulated by the Division under its Underground Injection Control program. Underground gas storage facilities are generally used to store larger quantities of gas during off-peak months, while during peak summer and winter months the gas volume is lower when subject to higher demand. Therefore, the operation of gas storage wells is cyclical throughout the year, subjecting the wells to a wider range of pressures than other types of injection operations associated with oil and gas production. Gas storage wells present unique engineering challenges and warrant differing construction standards, testing, monitoring, and inspections.

Building upon the emergency regulations in place for underground gas storage facilities, the proposed regulations address a more complete regulatory scheme tailored specifically to underground gas storage facilities and gas storage wells. The proposed regulations also provide necessary clarifications and specificity to implement the statutory

requirements added by SB 887. In essence, the proposed regulations include new or revised well construction requirements for gas storage, rigorous testing and monitoring requirements for gas storage wells and underground gas storage facilities as a whole, and requirements for developing and maintaining risk management plans for underground gas storage facilities.

The Division developed these proposed regulations after significant input and discussion with stakeholders. From February 17, 2016 through March 18, 2016 the Division held an informal public comment period to outline the Division's immediate regulatory goals regarding underground gas storage, and to solicit specific input on how best to accomplish these goals. A series of four regulatory goals and associated questions were sent to stakeholders, including oil and gas operators, industry representatives, environmental groups, and members of the general public that expressed interest in previous regulatory efforts involving the Division's Underground Injection Control program, which includes rules and regulations related to underground gas storage. During the course of the public comment period, the Department received 30 letters, emails, and faxes which were considered when drafting the proposed regulations.

On July 8, 2016, the Division publicly released pre-rulemaking draft regulations for the purpose of receiving public input on the development of updates to the regulations specific to governing underground gas storage. The Division also conducted two workshops to receive verbal and oral input from interested parties, in Sacramento (August 9, 2016) and Woodland Hills (August 11, 2016). The public comment period ended on August 22, 2016 after which the comments were reviewed and considered by the Division while developing these proposed regulations. In the course of discussions of SB 887 prior to its passage between the author's office, industry representatives, environmental groups, and the Department, many of the elements of the Division's pre-rulemaking discussion draft of the underground gas storage regulations were incorporated into the legislation that was ultimately signed by the Governor.

In July of 2016, Division staff provided presentations at the U.S. Department of Energy's National Laboratories' Workshop on Well Integrity for Natural Gas Storage in Depleted Reservoirs and Aquifers workshop, held in Denver, Colorado. The workshop assembled operators, regulators, environmental advocates, and technical experts to examine the current state of natural gas storage integrity and explored risk reduction of future gas storage leak events. That workshop provided another valuable opportunity for stakeholder input and discussion.

Throughout the development of the proposed regulations, the Division received independent technical input from the U.S. Department of Energy's National Laboratories. The National Laboratories Team is comprised of scientists and engineers from Lawrence Berkeley National Laboratory, Sandia National Laboratories, and Lawrence Livermore

National Laboratory. These groups worked collaboratively to review and provide input to the Division on well integrity evaluation methods, risk reduction strategies and approaches, and other technical aspects of regulating underground gas storage activities.

SPECIFIC PURPOSE, RATIONALE AND BENEFITS

Section 1726 – Purpose, Scope, and Applicability.

The purpose of Section 1726 is to address the purpose, scope, and applicability of the proposed regulations for underground gas storage projects. Under existing regulations, underground gas storage projects are regulated as "underground injection projects" under the Underground Injection Control regulations (Sections 1724.6 through 1724.10). However, underground gas storage projects have differing and distinct concerns and practices from other types of injection projects regulated by the Division under its Underground Injection Control program. The proposed regulations create a new article, Article 4, with regulations specifically tailored to underground gas storage projects. Many of the requirements of Article 4 are new or amended requirements that are specific to underground gas storage projects, but some are existing requirements that are carried over from the Underground Injection Control regulations. Section 1726 is necessary to specify that underground gas storage projects and gas storage wells will be regulated under Article 4 and that the Underground Injection Control regulations will no longer apply to underground gas storage projects. Section 1726 is also necessary to clarify that the requirements of Article 4 apply to existing projects and wells.

It is necessary to clearly define the scope, purpose, and applicability of the proposed regulations in order to implement the Division's statutory mandate under Public Resources Code sections 3106, 3180, 3181, 3220, and 3403.5 to supervise underground gas storage projects to ensure that the original reserves are not lost, to ensure the integrity of gas storage wells, and to prevent damage to public health and the environment.

Section 1726.1 – Definitions.

The purpose of Section 1726.1 is to define each of these key terms used in Article 4 that require definition because they are used to convey a specific meaning, are subject to more than one interpretation, or are technical terms that are not commonly known.

- The term "area of review" is defined as a short-hand terms for the description of the area influence and concern that must be studied and monitored for any potential conduits for gas to migrate out of the gas storage reservoir.

- The term “fluid” is defined to be either a liquid or a gas, which is consistent with dictionary definition of the term. This definition is necessary because there is common confusion as to whether gas is a fluid.

- The term “caprock” is defined for the purpose of explaining this geologic term, which is used repeatedly in the proposed regulations.

- The terms “reservoir” and “zone” are defined as short-hand terms for the description of the areas where gas is stored in an underground gas storage project.

- The term “gas storage well” is defined consistent with the statutory definition in Public Resources Code section 3180, subdivision (a), which is necessary to support consistent interpretation of the regulation and statute.

- The term “underground gas storage project” is defined as a short-hand term for the description of the range and kind of operations that are subject to the requirements of Article 4.

Section 1726.1 is necessary to avoid ambiguity and ensure that those who are subject to the requirements of Article 4 are able to understand and interpret the regulation correctly. The benefit of Section 1726.1 is that clear definition of key terms in the proposed regulations will promote transparency and consistency in their application. Clear definitions of terms are necessary to effectively implement the Division’s statutory mandate under Public Resources Code sections 3106, 3180, 3181, 3220, and 3403.5 to supervise underground gas storage projects to ensure that the original reserves are not lost, to ensure the integrity of gas storage wells, and to prevent damage to public health and the environment.

Section 1726.2 – Approval of Underground Gas Storage Projects.

Existing regulation provides that injection can only be done with the Division’s approval (Section 1724.6), and that injection must stop upon written notice from the Division (1724.10, subdivision (h)). These requirements continue under the proposed regulations, but are now found in the new Article 4, Section 1726.2. In addition to carrying these requirements over to Article 4, the purpose of Section 1726.2 is to expressly articulate key aspects of the Division’s supervision of underground gas storage projects under Public Resources Code sections 3106 and 3403.5. Section 1726.2 states that operations must comply with the conditions of approval; that operations will be subject to ongoing review by the Division; that the Division’s approval may be suspended, modified, or rescinded; and that injection must stop immediately if the Division determines that the conditions of approval are not being adhered to or that injection in any way poses a threat to life, health, property, or natural resources. These provisions are necessary to ensure that operators and the general public understand that the Division’s supervision of

underground gas storage projects does not stop with Division's initial review and approval of a project, but continues throughout the life of the project.

Section 1726.3 – Risk Management Plans.

SB 887 added Public Resources Code section 3181, which requires an underground gas storage operator to submit a Risk Management Plan to Division for its approval. The risk management plan must identify and plan for mitigation of all threats and hazards and potential threats and hazards associated with gas storage well operation in order to ensure internal and external mechanical integrity of a well, including site-specific information. The risk management plan must also provide for regular review and revision, as needed, to ensure the plan appropriately reflects current conditions. The statute mandates that the risk management plan include at least the following elements:

- An assessment of the risks associated with the gas storage well and its operation.
- Planned risk mitigation efforts.
- A plan for corrosion monitoring and evaluation.
- A schedule for regular well and reservoir integrity assessments.
- A natural gas leak prevention and response program that addresses the full range of natural gas leaks possible at the facility with specific response plans that provide for immediate control of the leak.
- A regular maintenance program for the well and the portion of the facility within the division's jurisdiction. The maintenance program shall include training for site personnel and proactive replacement of equipment at risk of failure to ensure safe operation.

In addition to being a requirement in California statute, federal minimum standards established the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) require state regulation to include an effective risk management plan requirement, as risk management planning is central to the recommendation of American Petroleum Institute Recommended Practice1171.

The purpose of Section 1726.3 is to establish a framework for the operators' development, updating, and submission of their risk management plans, as well as to specify minimum contents for risk management plans. Section 1726.3 requires a risk management plan that evaluates risks associated with the underground gas storage project, identifies risk mitigation protocols, and is regularly reviewed and updated.

Consistent with Public Resources Code section 3181, Section 1726.3, subdivision (c), specifies that the risk management plan must include a plan for mechanical integrity testing of all gas storage wells, a corrosion monitoring and evaluation plan, an emergency response plan, and maintenance and training plans. Other required elements of the risk management plan based on the Divisions identification of risks generally associated with an underground gas storage project include:

- Evaluation of the construction of each gas storage well and a plan for bringing wells into compliance with the well construction requirements in these proposed regulations.
- Employment as appropriate of surface and/or subsurface automatic or remote-actuated safety valves based on consideration of factors specified in Public Resources Code section 3181, subdivision (a)(3).
- Ongoing monitoring and evaluation of gas storage wells.
- Material balance monitoring.
- Ongoing verification and demonstration of the integrity of the reservoir.
- Analysis and risk assessment of hazards associated with the formation of hydrates, and scale.
- Analysis and risk assessment of hazards associated with the potential for fire.
- Documentation of baseline conditions in observation wells.
- Consideration of potential for impacts to groundwater quality.
- Monitoring of local land use decisions that might affect risk management planning.

Section 1726.3 provides that risk management plans are subject to review and approval by the Division, and that they must describe risk assessment methodologies employed and a schedule for review and update. These provisions are necessary to ensure that the risk management plan is dynamic and current, and that it is the product of dialogue between the operator and the Division about the safe operation of the underground gas storage project. Section 1726.3 specifies that operators must have separate risk management plans specific to each underground gas storage project, which is necessary because the likelihoods and mitigations of risks are not the same at all facilities. An risk management plan will be more effective when each covers only a single underground gas storage facility.

The benefit of Section 1726.3 is that it will ensure compliance with Public Resources Code section 3181 and PHMSA's minimum standards for state regulation of underground gas storage projects. At the same time, Section 1726.3 will provide for objective, realistic, implementable, and transparent assessments of risk, and adoption of mitigation measures for those risks, associated with operation of underground gas storage projects. The benefits of the risk management plan protocols will also include reducing risks to health, safety and the environment by requiring operators to verify the mechanical integrity of their wells, reservoir, and other facility installations on an ongoing basis. The risk management plans will facilitate more effective oversight of operations and implementation of targeted prevention measures, thereby reducing risks and decreasing the overall chances of unmitigated infrastructure-related accidents.

Section 1726.3.1 – Emergency Response Plans.

Public Resources Code section 3181, subdivision (a)(1)(A), requires that operators' risk management plans include a natural gas leak prevention and response program that addresses the full range of natural gas leaks possible at the facility with specific response plans that provide for immediate control of the leak. The statute requires operators to consult with local emergency responders when developing this plan. The statute also requires that the plan include protocols for public notice of a large, uncontrollable leak; prepositioning and identification of materials, equipment, and personnel needed to respond to and stop the and protect public health; and identification of personnel responsible for notifying regulatory authorities with jurisdiction over the range of leaks possible. Section 1726.3 requires that risk management plans include an Emergency Response Plan, and the purpose of Section 1726.3.1 is to detail the requirements of an effective Emergency Response Plan that complies with Public Resources Code section 3181, subdivision (a)(1)(A). Section 1726.3.1 provides the criteria and procedures needed in Emergency Response Plans that would ensure immediate and skilled emergency responses specific to gas storage well leaks that would, first, provide safety to human health and, second, stabilize an emergency incident such as the Aliso Canyon gas leak.

Criteria in Section 1726.3.1 require operators to identify activities and qualified persons for initiating effective emergency response and control; provide requirements conducive to maximize efficiency and effectiveness when responding; and specify a schedule for conducting drills to validate and test the effectiveness of the plan. In addition, the emergency response plan requires operators to develop a drill schedule to test the validity of the plan and to ensure the readiness of personnel, their interaction with equipment including third party service providers, and update current contact information. Local first responders must have an opportunity to review and respond to the operators' emergency response plan and to themselves periodically conduct drills with the operator.

Section 1726.3.1 requires that Emergency Response Plans, at a minimum, address the following risk-based scenarios: collisions involving well heads, well fires and blowouts, hazardous material spills, equipment failures, natural disasters, leaks and well failures, medical emergencies, and explosions. To address such scenarios, the proposed regulation requires that the plans include all of the following:

- Written action plans establishing assigned authority to the appropriate qualified person for initiating effective emergency response.
- Accident-response measures that outline response activities, leakage mitigation approaches, and well control processes for well failure and full blowout scenarios.
- Positioning and identification of materials and personnel necessary to respond to leaks, including materials and equipment needed to respond to the leak and protect human health.
- A schedule for regular drills, providing for an opportunity for involvement of the Division and local first responders, and providing an opportunity for surprise drills initiated by the first responders.
- A schedule for regular evaluation and update of the emergency response plan.
- Protocols for emergency reporting and response to appropriate government agencies.
- Specification of personnel roles and responsibilities.
- Internal and external communication protocol.
- Emergency contact information including area codes.
- A protocol for public notice of a large, uncontrollable leak to any potentially impacted community, as defined in the risk management plan, if the leak cannot be controlled within 48 hours of discovery by the operator.

The catastrophic leak at the Aliso Canyon Storage Facility demonstrated the need for detailed and comprehensive protocol and risk-based response measures to be included in emergency response plans at underground gas storage facilities. These requirements would ensure thorough preparedness for a rapid, efficient and effective response to potential emergency scenarios at a gas storage facility. Rehearsals of the emergency procedures would ensure the plan is viable, efficient and comprehensive in scope and operation. Section 1726.3.1 provides a comprehensive assessment of procedures necessary to implement an emergency response plan immediately. Implementing the

steps and procedures outlined by the minimum risk-based scenarios and the steps shown above will prepare operators to respond rapidly and reduce, if not avoid, harm to the public health and environment.

The emergency response plan requirements of Section 1726.3.1 further the Division's statutory mandate under Public Resources Code Section 3181, subdivision (a)(2)(A), to address the full range of natural gas leaks possible at a gas storage facility with specific response plans that provide for safety to human health and the rapid control of a leak. By implementing recommended practices from industry standards, an emergency response plan will provide benefits such as the protection of public health and safety, worker safety, and the environment.

Section 1726.4 – Underground Gas Storage Project Data Requirements.

Under existing regulations, operators of an underground gas storage project are required to provide the Division with all of the injection project data specified in Section 1724.7. These proposed regulations carry those same Underground Injection Control data requirements over to the new requirements specific to underground gas storage projects, with some modifications and additions to create a standard specific to underground gas storage projects. This is necessary because underground gas storage projects are different in many ways from other types of Underground Injection Control projects and need regulation that will be directly applicable to underground gas storage operations. The purpose of Section 1726.4 is to establish the minimum data requirements to support an underground gas storage project.

Section 1726.4, subdivision (a), articulates the performance standard for approval of underground gas storage projects and that supporting project data must demonstrate that this performance standard is met. Consistent with Public Resources Code sections 3106, 3180, 3181, 3220 and 3403.5, the performance standard is that stored gas will be confined to the approved zone(s) of injection and that the underground gas storage project will not cause damage to life, health, property, or natural resources. Subdivision (a) details the required project data. Subdivision (d) provides that where it is infeasible to supply the data specified in subdivision (a), the Division may accept alternative data, provided that the alternative data demonstrates that the performance standard is met. These provisions are necessary to make clear the Division's expectation for data supporting an underground gas storage project and they provide the benefit of a clearly defined, but flexible, path to compliance.

There are many overarching geologic and engineering principles that remain consistent when reviewing underground gas storage as compared to other underground injection projects covered by the Underground Injection Control regulations, and for that reason several of the existing Underground Injection Control data requirements are unchanged

in the context of underground gas storage-specific requirements. The following currently required project data is still required for underground gas storage projects:

- Statement of primary purpose of the project.

- Reservoir characteristics of each injection zone, such as porosity, permeability, average thickness, areal extent, fracture gradient, original and present temperature and pressure, and original and residual oil, gas, and water saturations.

- Isopach map of each gas storage reservoir or subzone in the project area.

- Maximum anticipated surface injection pressure and maximum anticipated daily rate of injection, by well.

- Monitoring system or method acceptable to the Division to be utilized to ensure the gas injected is confined to the intended approved zone(s) of injection.

- A list of proposed cathodic protection measures for plant, lines, and wells, where employed.

These requirements are simply renumbered, reordered, and relocated, and these changes are without regulatory effect.

Some of the existing Underground Injection Control data requirements have been modified to better meet underground gas storage data needs. These requirements fall under the modified category. Underground gas storage is different from other underground injection operations in many ways, and these modifications to the data requirements reflect those differences. Underground gas storage is a more specific activity that has much less variability than the range of other underground injection operations covered by the Underground Injection Control regulations. This difference allows underground gas storage data requirements to be more specific to the type of injection and withdrawal than Underground Injection Control regulations might be capable of. Some of the new data requirements reflect a change in available information due to technology improvements. The following Underground Injection Control project data requirements have been modified in the context of the underground gas storage-specific requirements:

- An engineering and geological study demonstrating that injected gas will not migrate out of the approved zone or zones, such as through another well, geologic structure, faults, fractures or fissures, or holes in casing. This modification combines the engineering and geologic studies that are already required and sets

clear expectations for creation and review of those studies by stating the primary concern, which is zonal isolation.

- Structure contour maps drawn on a geologic marker at or near the top of each gas storage zone in the project area, indicating faults and other lateral containment features. This requirement is modified to include faults and other lateral containment features. This is vital to the evaluation of zonal isolation and should be included on structure maps.

- At least two geologic cross sections through at least four gas storage wells in the project area and the areas immediately adjacent. The requirement has been made more robust, including an additional cross section and more wells as data points and includes adjacent areas. The cross sections are used to verify the geologic interpretation of the field and more cross sections and wells included means there can be more confidence in the geologic interpretation of the field and injection zone.

- Representative electric log to a depth below the deepest producing zone identifying all geologic units, formations, aquifers with groundwater that has 10,000 or less milligrams per liter of total dissolved solids content, aquifers with groundwater that has 3,000 or less milligrams per liter of total dissolved solids content, oil or gas zones, and gas storage reservoirs. This was modified to define the fresh waters referred to in the existing Underground Injection Control requirement. Protection of both base of underground sources of drinking water and the base of fresher water is a vital part of the Divisions' statutory mandates. Clarifying that the electric log should identify both bases of fresh water insures that those waters can be protected.

- Additional information may be requested by the Division, and may include, but is not limited to: isopach, isoGOR, isoBAR,structure-contour, 3-D three-dimensional modeling, oil-water, gas-water, or oil-gas contact maps of the project, or and other information which will would delineate all known features such as faults and fractures within the area of influence of review for the underground gas storage project. California is a very geologically diverse state and there is no way to create a complete list of all data that may be needed to evaluate a project, and adding some additional requirements may be inappropriate in other areas, and just add to cost without adding to our understanding of an area.

- Reservoir fluid data for each gas storage zone, such as oil gravity and viscosity, water quality, presence and concentrations of non-hydrocarbon components in the associated gas (e.g. hydrogen sulfide, helium, etc.), and specific gravity of gas. The reservoir fluid data requirement is modified to include non-hydrocarbon components associated with the gas. This helps fingerprint the gas if there is ever

a leak. The presence of helium is generally an indicator of pipeline grade thermogenic gas verses biogenic gas. As methane has many natural biogenic sources, knowing the non-hydrocarbon components can be critical to gas identification.

- Casing diagrams for all wells that are within the area of review and that are in the same or a deeper zone as the gas storage project, including directionally drilled wells that intersect the area of review in the same or deeper zone. The casing diagrams must demonstrate that the wells in the area will not be a potential conduit for gas to migrate outside of the approved zone of gas storage or otherwise have an adverse effect on the project or cause damage to life, health, property, or natural resources. At a minimum, the casing diagrams must demonstrate that plugged and abandoned wells have cement across all perforations and extending at least 100 feet above the highest of the top of a landed liner, the uppermost perforations, the casing cementing point, the water shutoff holes, or the intended zone of injection. This requirement has been modified to include all wells in the area of review and is clearer about what would be considered a negative impact from a bad casing. It is vital that all wells in the area of review are considered in order to ensure zonal isolation issue that needs to be addressed.

- The planned or estimated well drilling and plugging and abandonment program to complete the project, showing all gas storage wells, plugged and abandoned wells, other wells related to the project, and unit boundaries. This requirement is modified to not include flood pattern in the map. This is not needed as underground gas storage projects do not use enhanced oil recovery techniques like steam or water flooding.

- A summary of the source and analysis of the gas injected, submitted to the Division on an annual basis. This requirement has been modified to be an annual submittal by the operator. As the source and composition of the gas may change over time it is important that up to date information is provided to the Division. This data can also be used to fingerprint any leaks as thermogenic.

- Any data that, in the judgment of the Division, are pertinent and necessary for the proper evaluation of the underground gas storage project. California is a very geologically diverse state and there is no way to create a complete list of all data that may be needed to evaluate a project, and adding some additional requirements may be inappropriate in other areas, and just add to cost without adding to our understanding of an area. Flexibility in the data requirements allows the Division to ensure they have whatever data is needed to evaluate a project and prevents projects from being denied due to lack of information rather than merit.

Section 1726.4, subdivision (a), also includes new project data requirements that are not found in the more general Underground Injection Control project data requirements, but that are necessary for effective evaluation of underground gas storage projects. The following underground gas storage project data requirements are new:

- Oil and gas reserves of all proposed storage zones prior to start of injection, including calculations, to indicate the storage capacity of the reservoir being considered for gas storage. The storage capacity and reserves are important factors in validating the injection pressures required, reservoir pressure maximums and minimums, and the gas, oil, and water contacts that effect appropriate drilling and completion locations.

- Description of existing or proposed surface and subsurface safety devices, tests, and precautions to be taken to ensure safety of the project. Identification of risk mitigations employed is necessary for effective evaluation of the project.

- Proposed produced water disposal method. This is necessary to evaluate and ensure appropriate handling of produced water from the underground gas storage project.

- Maximum and minimum reservoir pressure for the underground gas storage project and the data and calculations supporting the bases for the pressure limits. If the reservoir pressure is decreased too much there can be water encroachment or porosity collapse, if the reservoir pressure is too high the formation or caprock could fracture and unintended portions of the well could be experiencing higher pressures as the injection pressure attempts to exceed the reservoir pressure.

- A comprehensive geologic characterization of the gas storage project including lithology of the storage zone or zones and sealing mechanisms as well as all formations encountered from surface to the deepest well in the project. The geologic characterization shall include any information that may be required to ensure injected or withdrawn gas does not have an adverse effect on the project or pose a threat to life, health, property or natural resources. The geologic characterization shall include potential pathways for gas migration and areas or formations where potential entrapment of migrated gas could occur. The geologic characterization is an important tool for evaluating the reservoir, as the lithology of the reservoir is critical in validating safe operational limitations for factors like injection pressure, drill and completion locations, and withdrawal limitations.

- A map of the area of review showing the location and status of all wells within and adjacent to the boundary of the area of review. The wellbore path of directionally drilled wells shall be shown, with indication of the interval penetrating the gas storage zone(s) of the underground gas storage project. Validating zonal isolation

is one of the primary concerns of evaluating a underground gas storage project. This map clearly shows all wells that may be a consideration when evaluating zonal isolation.

- Identification of all wells within the area of review that are not in the same or a deeper zone as the underground gas storage project, including description of the total depth of the well and the estimated top of the gas storage reservoir below the well. Validating zonal isolation is necessary to ensure safe operation of a underground gas storage project. This list of wells will contain wells that are not likely to present zonal isolation problems, but the list will streamline the evaluation and help to verify that the listed wells are not connected to the reservoir.

- Wells completed in or penetrating through the intended gas storage reservoir shall be identified and evaluated for containment assurance for the design of gas storage operation volumes, pressure, and flow rates. The operator should identify, and the Division confirm, wells which may require integrity testing or well logging in order to meet the integrity demonstration. The Division may select plugged and abandoned wells to be re-entered, examined, re-plugged and abandoned, or monitored to manage identified containment assurance issues prior to approval of gas storage operations. This requirement solicits the operator's evaluation of whether wells in the area of review have possible integrity or containment issues, which would be a good starting point for the Division's own evaluation. If integrity issues are found that could be a threat to zonal isolation this requirement provides for necessary further inquiry as to the condition of the well.

- Maps of the locations of underground disposal horizons, mining, and other subsurface industrial activities not associated with oil and gas production or gas storage operations within the area of review, to the extent it is publicly available. When evaluating many tests, such as noise and temperature logs, activities in other zones may be seen as anomalies in the test and cause confusion. Having information on all other activities surrounding the project allows Division staff to more quickly and accurately interpret data.

- A wellhead monitoring system acceptable to the Division for the detection of leaks. Surface equipment leaks are the most common form of leaks and should be detected quickly to limit emissions from all facilities. A wellhead monitoring system is a necessary component for detecting leaks from surface equipment in a reliable and timely manner.

- The name and API number of all gas storage wells and other wells that are part of the underground gas storage project. This book keeping list ensures that observation wells that do not penetrate the storage zone, but that are part of the

underground gas storage project, are accounted for alongside all other gas storage wells in the underground gas storage project.

Section 1726.4, subdivision (b), specifies that data supporting an underground gas storage project must be updated if conditions change or if more accurate data becomes available. This requirement is necessary to ensure that project data is up-to-date with the current operating conditions of the project.

Section 1726.4, subdivision (c), requires digital submission of data and clear labeling and organization of the data. Given the amount of essential information associated with an underground gas storage project, utilization of modern communication technology and thoughtful presentation of data and analysis are necessary for efficient and effective evaluation of the project.

Section 1726.4, subdivision (e), instructs operators to address concerns about any possible basis for confidential treatment of project data so that such can be given due consideration as data is received by the Division.

Section 1726.4, subdivision (f), describes information sharing between the Division and the California Public Utilities Commission, which also has regulatory oversight responsibilities for underground gas storage projects.

The requirements of Section 1726.4 are each necessary to the creation of a standalone underground gas storage oversight program. Having regulations specific to underground gas storage will have the benefit of allowing thorough evaluation of proposed underground gas storage projects and will in turn better protect life, health, property, and natural resources. Section 1726.4 benefits the Division, operators, and the public by providing clear descriptions of the data required and the expectations for that data, as well as the flexibility to modify the data requirements to better fit the complex geology of California and technological improvements over time. This same flexibility will allow the Division to stay in step with technology in fulfilling its statutory mandate to oversee underground gas storage projects.

It is necessary to define the data and analysis that will demonstrate the safety and efficacy of an underground gas storage project in order to implement the Division's statutory mandate under Public Resources Code sections 3106, 3180, 3181, 3220, and 3403.5 to supervise underground gas storage projects to ensure that the original reserves are not lost, to ensure the integrity of gas storage wells, and to prevent damage to public health and the environment. Section 1726.4 is also necessary to implement the requirement of Public Resources Code section 3181, subdivision (a)(1) that data describing an underground gas storage project and gas storage wells demonstrate that stored gas will

be confined to the approved zone or zones, and that updated data shall be provided to the Division if conditions change or if more accurate data become available.

Section 1726.4.1 – Casing Diagrams.

Section 1726.4, subdivision (a)(5)(F), requires casing diagrams of all wells that are within the area of review and that are in the same or a deeper zone as the gas storage project, including directionally drilled wells that intersect the area of review in the same or deeper zone. The purpose Section 1726.4.1 is to specify the data elements that must be diagramed in those casing diagrams. This regulation is necessary to ensure that casing diagrams include the data necessary for the Division's evaluation of wells within the area of review and it will provide the benefit a high level of clarity as to the requirements of Section 1726.4, subdivision (a)(5)(F).

Section 1726.4.2 – Records Management.

The purpose of Section 1726.4.2 is to require operators to establish a Records Management Program for underground gas storage projects that will enable the Division and the operator to properly monitor wells and facilities, readily access pertinent information in the event of an emergency, and ensure the records reflect evidence of conformity to regulation requirements for underground gas storage facilities.

The industry best practices identified in API RP 1171 call for accurate and comprehensive records for a underground gas storage project to be maintained for the life of the facility. Section 1726.4.2 will establish a records management process whereby records relevant to conformity to the proposed regulations will be available for review, will be updated, and will be managed in a manner that tracks record changes, modifications, location, and history throughout their entire information life cycle. The result will be an efficient system ensuring safety that is in alignment with industry standards. A Records Management System specifically maintaining underground gas storage records will demonstrate regulatory compliance, historical knowledge, and ensure vital information is available in the event of an emergency situation such as the catastrophic leak at Aliso Canyon.

The Division is committed to ensuring safety in underground gas storage operations and Section 1726.4.2 requires operators to establish a Records Management System to achieve that end. A Records Management Program will facilitate safe operation and rigorous oversight of underground gas storage projects, thereby enhancing protection of health, safety, and the environment.

Section 1726.5 – Well Construction Requirements.

Well construction is the primary focal point for ensuring gas storage wells are safe and that they will maintain integrity over time. The operation of gas storage wells is unique and very different from other types of oil and gas production activity, and a gas storage well that is not effectively designed and constructed for gas storage operations can pose a significant threat to health and safety. Gas storage wells need to be constructed according to the anticipated activity and conditions the well will be exposed to. Gas storage wells are operated in cycles throughout the year and are therefore exposed to a wide range of reservoir pressures. Not only are these wells exposed to high injection pressures, they are exposed to withdrawal rates that are typically higher than the injection rates during peak energy demands. Given the operating conditions, gas storage wells should include multiple layers of protection, and not rely upon any single construction element to ensure well integrity.

Effective January 1, 2017, SB 887 added Public Resources Code section 3180, which, in subdivision (d), mandates that the Division promulgate regulations that establish standards for the design, construction, and maintenance of all gas storage wells to ensure that integrity concerns are identified and addressed before they can become a threat to life, health, property, the climate, or natural resources. The statute mandates that the regulations establish a performance standard that gas storage wells be designed, constructed, and maintained to ensure that a single point of failure does not pose an immediate threat of loss of control of fluids, as determined by the Division. The statute also includes a list of well construction features to be considered by the Division in establishing these well construction requirements. Consequently, under the proposed regulations, operators would be required to ensure this standard is met for anticipated operating conditions for all underground gas storage projects.

The purpose of Section 1726.5 is to establish in regulation the performance standard specified in Public Resources Code section 3180 and to provide specifications and a framework for meeting the performance standard and ensuring effective construction of gas storage wells. The proposed regulations provide operators with detailed specifications for meeting this performance standard, but the proposed regulations also provide operators with the option of developing alternative means of meeting the standard upon approval by the Division. If an operator can demonstrate to the Division's satisfaction that alternative mechanisms or well construction design will ensure that a single point of failure does not pose an immediate threat of loss of fluids, the operator may employ those methods.

Consistent with the statutory mandate, Section 1726.5, subdivision (a), states that operators shall design, construct, and maintain gas storage wells so as to ensure that a single point of failure does not pose an immediate threat of loss of control of fluids and

make certain that integrity concerns with a gas storage well are identified and addressed before they can become a threat to life, health, property, or natural resources. Section 1726.5, subdivision (b), is a checklist of well construction specifications, which are provided as a clear roadmap for compliance with the performance standard in subdivision (a). This is an exemplary list of well construction features that would clearly demonstrate compliance with the performance standard, but adherence to this checklist is not the exclusive means of achieving the standard. Subdivision (c) provides that operator may utilize alternative well construction methods if the Division is satisfied that the alternative will achieve the overarching performance standard for gas storage well construction.

A central feature of the exemplary specifications in subdivision (b) is that the well is completed with two separate mechanical barriers, each comprised of specified elements. The primary mechanical barrier is comprised of production tubing and packer, tubing hanger with seals, and a Christmas tree master valve, all able to withstand full operating pressure. The secondary mechanical barrier is comprised of the production casing and the wellhead component, also all able to withstand full operating pressure. Because both mechanical barriers are able to withstand full operating pressure, the statutory performance standard is met that no single point of failure should pose an immediate threat of loss of control of fluids. Adhering to this standard means that the risk of total well failure is substantially lower as compared to only having one mechanical barrier because, should one barrier fail, the second mechanical barrier will allow the operator to maintain fluid control while the well is being remediated. The exemplary specifications in subdivision (b) also include a number of key indicators of a competent and well-constructed gas storage well. These include such things as appropriate casing size, quality, and condition for the depth and operating conditions of the well; appropriate casing connections; and competent cement and cement plugs that ensure isolation of the gas storage reservoir.

The specifications in subdivision (b) were developed by Division engineers with reference to API Recommended Practice 1171, the International Organization for Standards' ISO/TS 16530 (Well Integrity, February 2014), and the construction measures listed for consideration in Public Resources Code section 3180, subdivision (d)(3). In addition, the Division consulted with subject matter experts at Lawrence Berkley National Laboratory, Lawrence Livermore National Laboratory, and Sandia National Laboratory.

As discussed above, the technical specifications in Section 1726.5, subdivision (b), are an example of how an operator can meet the statutory performance standard for construction of gas storage wells, but it is not prescriptive set of requirements. Section 1726.5, subdivision (c), provides that for wells that do not conform to the exemplary specifications in subdivision (b) the operator may present an alternative well construction and the Division will determine on a case-by-case basis whether the alternative well construction meets the performance standard articulated in Public Resources Code

section 3180, subdivision (d), and restated in Section 1726.5, subdivision (a). In this way, Section 1726.5 ensures that the statutory mandate of Public Resources Code section 3180, subdivision (d), is met, it provides clarity to the regulated operators as to how to meet the performance standard, and at the same time it allows flexibility to develop efficient case-specific methods to meet the performance standard.

Section 1726.5, subdivision (d), specifies that these well construction requirements are in addition to generally applicable well construction requirements already in effect and do not repeal or amend other existing regulations.

Effective well construction requirements for gas storage wells are necessary to implement the Division's statutory mandate under Public Resources Code sections 3106, 3180, 3181, 3220, and 3403.5 to supervise underground gas storage projects to ensure that the original reserves are not lost, to ensure the integrity of gas storage wells, and to prevent damage to public health and the environment.

Section 1726.6 – Mechanical Integrity Testing.

The incident at Aliso Canyon demonstrated the necessity of an effective mechanical testing regime to not only identify the existence of a leak in a gas storage well, but also to identify the potential for a leak to occur before it happens. SB 887 added Public Resources Code section 3180, subdivision (b), which requires underground gas storage operators to conduct a mechanical integrity testing regime on all gas storage wells that includes regular leak testing, casing wall thickness inspection, pressure testing of the production casing, and any other testing deemed necessary by the Division to demonstrate the integrity of the well. The purpose of Section 1726.6 is to establish a mechanical integrity testing regime for gas storage wells that, consistent with the requirements of Public Resources Code section 3180, subdivision (b), will be predictive in nature and will identify potential well integrity issues so that they are remediated before a leak occurs.

Section 1726.6, subdivision (a)(1), requires operators to conduct temperature and noise logs at least annually and to report and explain any anomalies identified to the Division. This testing would fulfill the requirement for regular leak detection under Public Resources Code section 3180, subdivision (b)(1). It is also consistent with the existing mechanical integrity testing requirements for injection wells under Section 1724.10, subdivision (j).

Section 1726.6, subdivision (a)(2), requires operators to conduct a casing wall thickness inspection on each gas storage well, employing such methods as magnetic flux and ultrasonic technologies. Although magnetic flux and ultrasonic technologies are provided as examples of effective technologies for casing wall thickness inspection, operators would be encouraged to propose other equally effective methods. Compliance with the

requirements of Section 1726.6, subdivision (a)(2), would satisfy the requirements of Public Resources Code section 3180, subdivision (b)(2).

If the operator is able to demonstrate the corrosion rate, then the Division will work with the operator to establish an appropriate timeframe for the next casing wall thickness inspection based on the rate of corrosion. In the absence of a demonstrated corrosion rate, thickness testing would be repeated every 24 months. The Division believes that for a well that does not have a demonstrated corrosion rate, a 24-month testing cycle would be sufficiently frequent for the thickness testing to have predictive value.

Section 1726.6, subdivision (a)(3), requires operators to pressure test the production casing of each gas storage well, and specifies the parameters for conducting a pressure test and for determining whether a well passes a pressure test. The purpose of the pressure test is twofold: first, to determine if the well can hold the pressure at which the well will operate; and second, to ensure the well casing will retain integrity in case of an upset, i.e. a failure of the tubing or packer. To accomplish this, the well must tested at a pressure that is higher than maximum operating pressure in order to account for variations and unexpected conditions. Many industry standards for pressure testing pipelines call for pressure testing at 125 percent of the anticipated operating pressure. Industry standards for pressure testing of gas storage wells are more general and suggestive, but the Division has determined that 115 percent of maximum operating pressure is appropriate, as well casing is set in the ground where formation pressure is constantly applying pressure to the exterior of the well.

In addition to specifying the required pressure used for the test, subdivision (a)(3) includes testing parameters designed to ensure that the well has integrity and that small leaks that would indicate a lack of well integrity are identified. This is accomplished by dictating in regulation what constitutes a stable pressure. This includes specification of no more than 10 percent overall decline in pressure over 30 minutes, and a rate of pressure decline in the last five minutes of the test that is no more than .05 percent per minute. This criterion was developed after hundreds of tests in the Aliso Canyon field through the Division's safety review. Effective parameters for pressure testing may vary based on the specific circumstances of a well, such as the age of the well, casing thickness, and corrosion factors, and the proposed regulation provides that the Division may vary the parameters as necessary to ensure an effective pressure test. By default, Section 1726.6, subdivision (a)(3), establishes a 24-month cycle for pressure testing. However, as with the casing wall thickness testing, a more appropriate timeframe can be set by the Division on a case-by-case basis.

These parameters are based on industry standards and practices and the Division's experience and expertise in supervising the pressure testing of wells. The Division has overseen the countless pressure tests of injection wells under its Underground Injection

Control regulations, including dozens of pressure tests of gas storage wells at the Aliso Canyon field as part of the recent well testing safety review. Compliance with the requirements of Section 1726.6, subdivision (a)(3), would satisfy the pressure testing requirement of Public Resources Code section 3180, subdivision (b)(3).

Each of these testing requirements include a requirement that if testing indicates a possible well integrity issue, then the Division must be informed and the well cannot be used without subsequent approval from the Division. In those circumstances, the Division will work with the operator to determine the best approach to ensuring the integrity of the well before allowing the operator to return the well to service.

A newly constructed or reworked gas storage well would be subject to the entire testing regime of subdivision (a), and Division may also require additional testing for any gas storage well as needed to demonstrate well integrity. Before conducting any of the mechanical integrity testing required under Section 1726.6, the operator is required to provide advance notice to the Division so that Division staff may witness the testing. The operator is required to provide documentation of the testing to the Division in a digital format within 30 days of completion.

The testing regime in Section 1726.6 is in accordance with the requirements of Public Resources Code section 3180, subdivision (b), and was developed by Division engineers in consultation with experts from the Sandia, Lawrence Livermore, and Lawrence Berkeley National Laboratories. No single type of mechanical integrity test provides complete information about the condition of a well, but the combination of required tests will provide the Division and the operator multiple sets of data about the well, which will allow for detection of current and potential well integrity concerns. Effective mechanical integrity testing requirements for gas storage wells are necessary to implement the Division's statutory mandate under Public Resources Code sections 3106, 3180, 3181, 3220, and 3403.5 to supervise underground gas storage projects to ensure that the original reserves are not lost, to ensure the integrity of gas storage wells, and to prevent damage to public health and the environment.

Section 1726.7 – Monitoring Requirements.

Section 1726.7 includes various requirements for the purpose of ongoing verification of the integrity of the underground gas storage project and prompt detection of any form of leak. The catastrophic leak at Aliso Canyon demonstrated the need to take all reasonable steps to identify a leak from a gas storage well as soon as possible. Early detection enables operators and regulators to take appropriate responsive action before potential risks develop into a larger danger to health, safety and the environment.

Section 1726.7, subdivision (a), requires operators to monitor gas storage wells for the presence of gas in all annuli of the well by monitoring annular pressure and annular gas flow in the well at least once a day. Because fluctuations in annular pressure or annular gas flow can signify a defect in the well casing or other subsurface well installation, compliance with this performance standard would help ensure early detection and appropriate responses to potential leaks in a gas storage well.

Section 1726.7, subdivision (b), requires operators to develop and implement a plan for performing regular material balance calculations. The regulation provides four examples of effective material balancing methodologies, but provides that the operator may propose an equally effective alternative, subject to approval by the Division. Material balance calculations are an industry-accepted practice ensuring all gas injected and production into and out of an underground gas storage project is accounted for at all times. Material balance calculations also provide a warning, as do other monitoring methods, that a leak from the intended zone of injection may be present and that further analysis and mitigating actions may be required by gas storage operators to eliminate leaks.

Section 1726.7, subdivision (c), requires operators to immediately report surface or cellar gas releases to the Division, because the presence of such gas may be an indication of a leak from a gas storage well. The operator would require to fingerprint the gas within 48 hours and provide the results to the Division as soon as they are available. This is necessary because the gas fingerprint is essential information for determining the source of the gas.

Section 1726.7, subdivision (d), requires operators to employ a real-time data gathering system, such as Supervisory Control and Data Acquisition (SCADA), in each underground gas storage project by January 1, 2020. SCADA systems, or other similar real-time data gathering system, are widely accepted as the most effective means for identifying concerns with gas storage wells and the underground gas storage project as a whole. At this time, most underground gas storage projects in the state already employ a real-time data gathering system, or are in the process of implementing such a system. Section 1726.7, subdivision (d), also includes performance standards for alarm set points in a SCADA system, and a framework for responding when pressure on the well is detected. Alarm set points must be aligned with anticipated pressure in the monitored annuli, but for annuli where no pressure would be anticipated, the framework allows that alarm set points may be set as high as 100 psi. Pressure below 100 psi would be consistent with pressure from naturally occurring gas and do not threaten the integrity of the well. If there is sustained pressure above 100 psi in an annulus where no pressure would be anticipated, then the operator may adjust the alarm set point to the equilibrium if the operator demonstrates to the Division's satisfaction that the source of the pressure is not migrating storage gas and that the pressure does not threaten the integrity of the well.

Section 1726.7, subdivision (e), requires operators to run a test using Neutron Gamma Ray or equivalent technology on each gas storage well annually, to do a year-to-year comparison of the results, and identify any changes. This requirement will help operators identify accumulation of gas behind the casing of the well, which could be an indicator of a leak in the well.

Section 1726.7, subdivision (f), requires operators to develop and implement an inspection and leak detection protocol for inspection of the wellhead assembly and attached pipelines for each gas storage well, and the surrounding area within a 100-foot radius of each gas storage well. The inspection protocol must provide for inspection at least once a day, employing effective gas leak detection technology such as infrared imaging. This requirement was developed in consultation with the California Air Resources Board (CARB) and was adopted by emergency regulation in response to one of the mandates of Governor Brown's January 1, 2016 Emergency Proclamation. This requirement ensures early discovery of leaks or other irregularities in the wellhead assembly and attached pipelines. CARB is in the process of adopting equivalent requirements for underground gas storage facilities, and the proposed regulation provides that the Division's requirements under subdivision (e) will no longer apply once CARB has adopted and implemented its requirements.

The monitoring methods required under Section 1726.7 are consistent with standards set by industry sources including API RP 1171 and ISO 16530-2, and also recommendations set forth by the Federal Interagency Task Force on Natural Gas Storage Safety, in their document Ensuring Safe & Reliable Underground Natural Gas Storage, October 2016. Each of these requirements will help to ensure early detection and appropriate prevention or remediation of leaks in an underground gas storage project.

These requirements for monitoring for indications of gas leaks are necessary to implement the Division's statutory mandate under Public Resources Code sections 3106, 3180, 3181, 3220, and 3403.5 to supervise underground gas storage projects to ensure that the original reserves are not lost, to ensure the integrity of gas storage wells, and to prevent damage to public health and the environment.

Section 1726.8 – Inspection, Testing, and Maintenance of Wellheads and Valves.

Section 1726.8 requires operators to periodically test all installed surface and subsurface safety valves to ensure that they are functional and able to hold anticipated pressures. The section specifies the timeframe and manner of testing, including required notice to the Division to provide opportunity to witness. The section specifies a default timeframe for addressing any issues with the valves about allows for modification by the Division on a case-by-case basis. The section also includes some design specifications for surface

valves, which are intended to ensure that the well can be isolated from the pipeline system.

The purpose of this regulation is to ensure that underground gas storage wells, and the associated equipment, are installed, operated, and maintained in a leak free condition. A malfunctioning valve means that a well is not operating as designed, which might prevent the safe operation, testing, and maintenance of the well. Requiring regular testing of valves in accordance with prevailing industry standards is necessary to verify the working status of the wells and associated equipment. In the absence of these express requirements, such testing does not always occur on a regular basis.

It is necessary to require operators to provide Division staff with an opportunity to witness valve testing so that the Division can verify that testing is done in accordance with industry standards and that testing is accurately documented.

The benefit of these requirements is that potential issues can be identified before they become a serious problem, thereby reducing the risks associated with a gas release and the potential impact to the environment. Effective valve testing and maintenance requirements for gas storage wells are necessary to implement the Division's statutory mandate under Public Resources Code sections 3106, 3180, 3181, 3220, and 3403.5 to supervise underground gas storage projects to ensure that the original reserves are not lost, to ensure the integrity of gas storage wells, and to prevent damage to public health and the environment.

Section 1726.9 – Well Leak Reporting.

Public Resources Code section 3183, subdivision (c), requires that for a "reportable leak" that is not controlled within 48 hours, the Division must post information about the leak on its Internet website and provide regular updates to the public until the leak is stopped. Public Resources Code section 3184 further requires that within 72 hours of being notified of a "reportable leak," the Division shall make a determination as to whether the leak poses a significant present or potential hazard to public health and safety, property, or to the environment such that a relief well is necessary. If the supervisor makes that determination, the operator shall immediately begin preparation for, and, as soon as practicable at the determination of the Supervisor, commence the drilling of, a relief well.

Public Resources Code section 3183, subdivision (a), requires the Division, in consultation with CARB, to adopt regulations defining a "reportable leak" and establish the timeframe for reporting such leaks to the Division. The purpose of Section 1726.9 is to implement the requirements of Public Resources Code sections 3183 and 3184. In consultation with CARB, the Division identified two key gas-leak thresholds in CARB's proposed Oil and Gas Regulation: a leak from a gas storage well is a "reportable leak" if

it exceeds 50,000 parts per million by volume total hydrocarbons, or if it exceeds 10,000 parts per million by volume total hydrocarbons for more than five days. Consistent with the framework in CARB's proposed regulations, leaks at the higher-volume threshold must be reported immediately, but leaks at the lower-volume threshold are only reportable if the operator is unable to stop it within five days. In addition, any leak that poses a significant present or potential hazard to public health and safety, property, or to the environment is a "reportable leak." This general requirement is consistent with the statutory mandate in Public Resources Code section 3183, subdivision (a), and it ensures that any well that is cause for concern is reportable, even if it does not exceed the specified thresholds. As these thresholds are the same as the gas-leak thresholds in CARB's proposed rules, conflict among comparable State rules will be avoided.

The regulation references US EPA Reference Method 21 as a source of effective guidance on how to measure gas leaks. Other measurement methodologies could be employed, if the operator is able to demonstrate that a methodology will provide consistent and reliable results.

Section 1726.9, subdivision (c), specifies that the requirements of this section are in addition to, and do not supersede, any other requirements for reporting or responding to leaks from a gas storage well. These proposed regulations and other existing regulations include various requirements for responding to indications of leaks from a well, and it is necessary to be clear that the requirements of Public Resources Code sections 3183 and 3184 are in addition to those requirements and that the defining terms of Section 1726.9 do not affect the application of those requirements.

Section 1726.10 – Requirements for Decommissioning.

The purpose of Section 1726.10 is to require an operator that intends to bring a underground gas storage project to an end to provide a clear plan for decommissioning the facility. Existing regulations address approval of a new project, yet there are no regulations to provide for a safe and comprehensive closure of an existing storage project. These requirements will ensure that there is a transparent and appropriate plan for the subsequent use or decommissioning of the wells and facilities of the underground gas storage project. These requirements will also address a systematic approach to the removal or continued storage of gas within the underground gas storage project.

To ensure that the plan is appropriate, the plan is subject to Division approval and the final work must be certified by the Division that all the steps of the decommissioning were completed to the Division's satisfaction. To ensure comprehensive oversight of the decommissioning, the operator must also consult with the California Public Utilities Commission.

The benefits of this proposed regulation include oversight of closure of gas storage operations to ensure that the project area is restored and that if any injected gas that is to remain in the reservoir, it is stored and monitored properly. This will reduce the risk of damage to the environment, and the risks of health and safety concerns for nearby receptors. Requirements for decommissioning an underground gas storage facility at the end of its life cycle are necessary to implement the Division's statutory mandate under Public Resources Code sections 3106, 3180, 3181, 3220, and 3403.5 to supervise underground gas storage projects to ensure that the original reserves are not lost, to ensure the integrity of gas storage wells, and to prevent damage to public health and the environment.

STANDARDIZED REGULATORY IMPACT ASSESSMENT

The Division has determined that this rulemaking action is a major regulation and has completed a Standardized Regulatory Impact Assessment (SRIA) for this rulemaking, which has been provided to the Department of Finance (DOF) for review and comment. The SRIA, DOF's comments on the SRIA, and the Division's response to DOF's comments are attached. Please see "Attachment A."

ALTENATIVES CONSIDERED

From February 17, 2016 through March 18, 2016 the Division held an informal public comment period to outline the Division's immediate regulatory goals regarding underground gas storage, and to solicit specific input on how best to accomplish these goals. A series of four regulatory goals and associated questions were sent to stakeholders, including oil and gas operators, industry representatives, environmental groups, and members of the general public that expressed interest in previous regulatory efforts involving the Division's Underground Injection Control program, which includes rules and regulations related to underground gas storage. During the course of the public comment period, the Department received 30 letters, emails, and faxes which were considered when drafting the proposed regulations.

On July 8, 2016, the Division publicly released pre-rulemaking draft regulations for the purpose of receiving public input on the development of updates to the regulations specific to governing underground gas storage. The Division also conducted two workshops to receive verbal and oral input from interested parties, in Sacramento (August 9, 2016) and Woodland Hills (August 11, 2016). The public comment period ended on August 22, 2016 after which the comments were reviewed and considered by the Division while developing these proposed regulations.

With the passage of SB 887, various approaches to the regulation of underground gas storage projects became required by statute, and the Division adapted the proposed

regulations to ensure that they accomplish each of the rulemaking mandates of the new legislation.

In the course of developing the proposed regulations, the Division considered various alternative approaches and suggestions included in the stakeholder comments. No alternative considered by the Division would be more effective in carrying out the purposes of the proposed regulations, or would be equally effective but less burdensome to affected private persons and small businesses than the proposed regulations. The alternatives considered include the following:

- The Division considered but rejected requiring surface controlled subsurface safety valves (SCSSV) in every gas storage well. In general, the goal of SCSSVs is to provide protection against uncontrolled leaks from a well in the case of catastrophic damage to the well. However, SCSSVs have drawbacks including reduction in well reliability associated with malfunctioning valves, risk to facility employees and contractors due to increased need to enter the well for maintenance purposes, and other potential risks that would have to be evaluated carefully. Requiring SCSSVs across the board without consideration to the specific circumstances of a gas storage well could be counterproductive from a risk-based perspective and would therefore not be as effective in carrying out the purposes of the proposed regulations.

- The Division considered but rejected both a less frequent and a more frequent default timeframe for repeating pressuring testing and casing wall thickness inspection. The proposed regulations provide that the timeframe for repeating these mechanical integrity tests can be established on a well-by-well basis based on the demonstrated corrosion rate of the well and other measures taken by the operator to ensure the integrity of the well. In the absence of such well-specific data and analysis, a mechanical integrity testing cycle that extends beyond two years would not provide adequate assurance of early detection of integrity concerns. At the same time, mechanical integrity testing can be a source of wear on a well and potentially impact storage operations. As a result, more frequent testing cycle may result in undue additional risk compared to the benefits derived by more frequent testing. Extending or shortening the two-year timeframe would therefore not be as effective in carrying out the purposes of the proposed regulations.

- The Division considered but rejected modifying the gas storage well construction requirements to allow a single point of failure to pose a threat of loss of control of fluids, provided that it is not an *immediate* threat. With this alternative approach, gas storage wells would be allowed to have just a single mechanical barrier, as long the design, construction, and ongoing testing of the mechanical barrier demonstrate that there is no immediate risk of its failure. Completing wells with multiple mechanical barriers exponentially decreases the risk of well failure and the alternative approach of allowing single mechanical barriers would not be as effective in carrying out the

purposes of the proposed regulations. The Division understands that bringing existing wells into compliance with the new well construction requirement will create significant impacts for operators, and Section 1726.3(c)(1) of the proposed regulations provides that compliance will be phased in over time in accordance with a risk-based work plan.

- The Division considered but rejected the alternative of continuing to require operators to implement their inspection and leak detection protocols, even after CARB has implemented its requirements under its proposed Oil and Gas Regulations. The Division consulted with CARB on the subject and determined that the Division's requirements would be duplicative and unnecessary at that point. Accordingly, that alternative would be more burdensome for operators and would not be more effective in carrying out the purposes of the proposed regulations.

CONSISTENCY WITH COMPARABLE FEDERAL REGULATION OR STATUTE

In June 2016, Congress enacted the "Securing America's Future Energy: Protecting our Infrastructure of Pipelines and Enhancing Safety Act of 2016" or "Safe Pipes Act." The Safe Pipes Act amended an existing body of pipeline safety laws set forth in sections 49 U.S.C. §§ 60101—60503, including adding a new section entitled "Standards for Underground Natural Gas Storage Facilities." (49 U.S.C. § 60141.) The new section directs the federal Pipeline and Hazardous Materials Safety Administration ("PHMSA"), within the Department of Transportation, to issue "minimum safety standards" for underground natural gas storage facilities within two years of the Safe Pipes Act's enactment. (49 U.S.C. § 60141(a).) On December 19, 2016, PHMSA issued an "Interim Final Rule" establishing standards for wells and downhole aspects of underground gas storage facilities. (See 81 Fed. Reg. 91,860 (Dec. 19, 2016).) The Interim Final Rule incorporates and makes mandatory two sets of industry "best practices" issued by the American Petroleum Institute ("API") (specifically, API Recommended Practice 1170, Design and Operation of Solution-mined Salt Caverns used for Natural Gas Storage; and API Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs). The Interim Final Rule took effect on January 18, 2017.

The proposed regulations are consistent with and are more stringent and comprehensive than the minimum federal standards. The Division consulted API RP 1171 as a starting point in developing the proposed regulations. (Recommended Practice 1170 was not consulted because there are no solution-mined salt caverns used for natural gas storage in California). The Division's proposed regulations would include additional detail and definition as to requirements in comparison to API RP 1171, which tends to apply requirements based on more open-ended case-by-case assessments. Examples of greater definition and stringency in the Division's proposed regulations include more stringent and defined well construction standards, a clear regulatory framework for risk

management planning, more detailed requirements for mechanical integrity testing and monitoring, more frequent testing of safety valves, and stronger Division oversight through project data requirements.

PHMSA's January 18, 2017 Interim Final Rule establishing minimum standards for underground natural gas storage facilities addresses many of the same issues as the Division's proposed regulations. Both sets of regulations are intended to minimize the environmental and public health risks associated with such facilities. However, PHMSA minimum standard only provide a floor for regulation of underground gas storage projects, and the Division's proposed regulations are necessary to achieve greater protection of health and safety and to meet statutory requirements for the regulations of underground gas storage projects under state law.

SB 887 directs the Division to promulgate standards for the design, construction, and maintenance of all gas storage wells in California to ensure that any integrity concerns with a gas storage well are identified and addressed before they can become a threat to life, health, property, the climate, or natural resources. (Pub. Resources Code, § 3180; see also Pub. Resources Code, § 3403.5 [charging the Division with responsibility to ensure that no damage occurs to the environment by reason of injection and withdrawal of gas at underground storage facilities].) The federal Safe Pipes Act of 2016 authorizes states to adopt additional or more stringent safety standards for intrastate underground natural gas storage facilities if such standards are "compatible" with PHMSA's minimum standards. (49 U.S.C. § 60141, subd. (e).) The Division's proposed regulations are compatible with the newly adopted federal standards, and nothing in the Division's proposed regulations would prevent compliance with the federal standards.

DOCUMENTS RELIED UPON

The Department relied upon the following documents in proposing this rulemaking action:

- The Department's Standardized Regulatory Impact Assessment (SRIA) and STD 399 for the proposed regulations.

- A Practical Guide for SMEs, ISO 31000 Risk Management, ISO/ITC/UNIDO, ISO 2015, ISBN 978-92-67-10645-8, ISO copyright office, Geneva.

- Figure 4 - Component Failure Rate as a Function of Time, ISO/TS 16530-2:2014(E), p. 18. ISO 2014.

- Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, API Recommended Practice 1171, First Edition, September 2015. American Petroleum Institute.

- Risk Management – Principles and Guidelines, International Standard, ISO 31000, First edition, 2009-11-15, ISO copyright office, Geneva.

- Risk Management – Risk Management Techniques, IEC/ISO 31010, Edition 1.0, 2009-11.

- Risk Management – Vocabulary, ISO Guide 73, First edition 2009, ISO copyright office, Geneva.

- Underground Gas Storage Regulatory Considerations, States First, An Initiative of the IOGCC & GWPC, States First Gas Storage Workgroup, 9/30/2016.

- Underground Natural Gas Storage Safety, Integrity & Safe Operations, API, AGA, INGAA, 7/6/2016.

- Well Integrity – Part 2: Well integrity for the operational phase, Technical Specification, ISO/TS 16530-2, First edition 2014-08-15.

- Emergency Proclamation of Governor Edmund G. Brown, January 1, 2016, available at, https://www.gov.ca.gov/news.php?id=19263.