

State of California
Class II UIC Program
Peer Review



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TO THE READER

This report is a snapshot of the California Class II UIC program as it existed in June, 2018. Due to factors beyond the control of the GWPC we were unable to publish this report until April, 2020. Please note that significant changes have been made to the California Class II UIC program since this review was conducted, some of which are the subject of suggestions contained in this report. Although the report does not capture the current state of Class II regulations in California, it contains useful information about the Class II UIC program and is worth reading both for its topical and historical value. The GWPC would like to thank the State of California, Department of Conservation for allowing us to perform this review and we look forward to updating the review relative to the changes that have been made since it was conducted.

Executive Summary

The California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR) received SDWA Section 1425 primary enforcement authority (primacy) for the Class II Underground Injection Control (UIC) program from USEPA on March 14, 1983. DOGGR is the agency with principal responsibility for administering the Class II UIC program for the State of California. Their main office is in Sacramento, California. The Sacramento office handles the administrative aspects of the UIC program including grants management, financial assurance, enforcement process management, and overall program oversight. Four District offices handle day to day management of permitting, inspections, well testing, compliance, field operations and enforcement.

The California Class II UIC program is managed by DOGGR under Public Resources Code § 3106 which provides the State Oil and Gas Supervisor broad authority to protect public health and safety while ensuring the wise development of the State's oil and gas resources. Article 2.5 of the Public Resources Code (§§ 3130-3132) specifically relates to the procedures for proposing aquifer exemptions to USEPA. UIC wells are generally governed under Public Resources Code 3000 et seq. and the various implementing regulations under Title 14, Division 2, of the California Code of Regulations,

The existing regulations include specific data requirements that an applicant must satisfy before the Division will approve an injection project. Project data requirements include engineering studies (including area of review determination and casing diagrams), geologic studies (including structural contour and isopach maps and reservoir characteristics), and

injection plans (including identification of the proposed maximum anticipated surface injection pressure and proposed monitoring system or methods to ensure no damage is occurring)

DOGGR issues Notice to Operators (NTOs) regarding policies and information affecting oil, gas and geothermal operations. The NTOs are a mechanism used by DOGGR to communicate actions taken under their statutory and regulatory authority. Current NTOs specific to UIC are listed in the table below. All NTOs can be found at

https://www.conservation.ca.gov/dog/for_operators/Pages/NoticetoOperator.aspx ,

Amended NTO 2018-02	June 28, 2019	Guidelines for Collection of Oilfield Water Quality Data
NTO 2017-01	February 9, 2017	Cessation of Injection
N/A	July 8, 2016	Aquifer Exemption Compliance Deadline
N/A	October 7, 2015	UIC Project Review
N/A	September 9, 2015	A strategy for produced water
N/A	May 18, 2015	AMENDED Water sampling protocols and analyses of injection and formation waters
N/A	February 11, 2014	Monthly production and injection report
N/A	January 18, 2008	Underground Injection Control Project Data

Table 2: List of California Notices to Operators 2005-2018

Additionally, the SWRCB and nine RWQCBs play a role in both project review and approval in ensuring that injection will not adversely degrade underground sources of drinking water (USDW) that may otherwise have current and future beneficial uses. The RWQCBs are the principal state agencies with primary responsibility to coordinate and control surface water and groundwater quality in the State. The Water Boards derive their authority primarily from, and must exercise their authority in accordance with, the State Porter-Cologne Water Quality Control Act (Wat. Code, § 13000 et seq.) and, where applicable, the federal Clean Water Act (33 U.S.C. § 1251 et seq.) and its implementing regulations. The Solid Waste Disposal Regulatory Reform Act of 1993 (Pub. Resources Code, § 43100 et seq.) provides additional authority for the SWRCB and the RWQCBs to regulate the disposal of solid waste for the purpose of protecting

the waters of the state.

DOGGR and the SWRCB coordinate the project approval and aquifer exemption processes through a memorandum of agreement (MOA) which was revised in July 2018 and which can be found at:

https://www.conservation.ca.gov/dog/for_operators/Documents/MOU-MOA/2018.07.31_Revised_MOA_with_the_State_Water_Board.pdf

The Class II portion of Fiscal Year 2018 USEPA UIC grant was \$528,000, for which DOGGR provided a 25% state match of \$176,000. The DOGGR budget for Fiscal Year 2018 is \$83,057,000 and includes 268 positions, of which 86 have at least some involvement with the UIC program. While DOGGR devotes substantial resources to the UIC program, at the time of our review they were not able to estimate the work years and dollars devoted to UIC activities. DOGGR is currently engaged in a planning exercise which when completed will allow them to better identify current UIC resources and future needs.

The current inventory of Class II UIC wells in California includes a total of 1775 Class IID (produced water disposal) wells, including 7 commercial wells, and 53,804 Class IIR (enhanced recovery) wells. California has the largest number of UIC Class II wells of any state in the United States as identified in the 2017 national UIC inventory published by USEPA.¹ Over the past several years DOGGR has been receiving approximately 34 project applications per year.

In 2010, the Division requested an independent audit of its programs including the UIC program. The audit, which was arranged through USEPA, was conducted in 2011 by the Horsley Witten Group. The review identified several issues especially in the administration of UIC. On November 16, 2012, the Division provided a response to the critiques raised in the audit. Following the discovery of permitting into nonexempt aquifers, the Division and the State Water Board provided an additional letter to USEPA on February 6, 2015. These letters identified a path forward to address issues that were noted in the audit as well as how to bring the program more generally into compliance with the Safe Drinking Water Act (SDWA). Subsequently, in October 2015, the Division developed a Renewal Plan with specific steps to address deficiencies noted in the audit. The Renewal Plan addressed four main issues: regulatory overhaul; new regulations for new realities; modernization of the Division's data management; and ensuring a high-quality workforce.

¹ USEPA State FY 2017 UIC Inventory Information, <https://www.epa.gov/uic/uic-injection-well-inventory>

As the Division embarked on addressing past practices of injection into USDWs, the Legislature enacted Senate Bill 83 in 2015 to formalize a process under which aquifer exemption proposals are submitted to US EPA. These provisions can be found in Public Resources Code §3131 et seq. here:

http://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?division=3.&chapter=1.&lawCode=PRC&article=2.5.

The Division, and the State Water Board, have been providing regular compliance updates to the USEPA. The compliance updates provide notification on the status of Class II injection wells which may have been completed outside the boundaries of an existing exempted area. The compliance schedule includes developing aquifer exemption proposals for aquifers with enough data to merit exemption approval by the USEPA. Currently there are 30 such proposals that are in some state of review by the State or USEPA.

The Class II UIC program implemented by DOGGR is structured to recognize and accommodate the significant geologic, geographic, demographic, petrologic, and engineering differences between various producing areas. To manage these diverse regions, the state has been divided into four administrative Districts (Figure 2):



Figure 1: Map of California Oil and Gas Districts Source: DOGGR

Because of the wide-ranging needs of each District and the overall needs of UIC program management, DOGGR utilizes a multi-faceted approach that includes:

1. Two-tiered permitting: The UIC permitting process is divided into two primary tiers. The first of these is the permitting or authorizing of the overall area of injection operation. This is referred to as a “project”. A project may contain as few as one or as many as a thousand wells or more. The project level is where the primary environmental reviews occur. These include the designation and evaluation of an AOR in the project, a determination of the maximum injection pressures and rates allowable within the overall project and an evaluation of the potential risk to groundwater posed by the project. The second level of permitting refers to the individual wells within a project. At this level each well is evaluated to assure that well drilling and construction meet the requirements of state regulation and mechanical integrity demonstration. Each of these tiers (projects and well permits) has individual application requirements including as applicable local environmental reviews required by the California Environmental Quality Act (CEQA), public notices, checks for applicant qualification, financial assurance and others.
2. Interagency review and coordination: While DOGGR has overall state Class II UIC permitting and operations authority under Article 2.5 of the Public Resources Code (§§ 3130-3132), additional authority over groundwater management is vested in the SWRCB and nine RWQCBs under the State Porter-Cologne Water Quality Control Act (Wat. Code, § 13000 et seq.) and, where applicable, the federal Clean Water Act (33 U.S.C. § 1251 et seq.) and its implementing regulations. These boards are responsible for the overall management of state water resources including groundwater and for solid waste disposal under The Solid Waste Disposal Regulatory Reform Act of 1993 (Pub. Resources Code, § 43100 et seq.). To assure that water resources are protected DOGGR, SWRCB and RWQCBs have developed a process to facilitate project and well permit reviews. This process is supported by a recently updated (July 2018) MOA which specifies the duties and responsibilities of each agency. As envisioned by the MOA, DOGGR provides the SWRCB and RWQCBs an opportunity to review project applications to assess their potential risk to groundwater resources. This opportunity for review occurs both on new projects and on modifications to existing projects. Although DOGGR has permitting authority for the issuance of UIC permits, if the agencies are unable to reach concurrence on specific water protection criteria the matter would be referred to the Governor’s office for arbitration. As of the date of this report, the arbitration process had not been used.

3. Coordinated District/central office duties: Each administrative District has unique characteristics which result in a high degree of variability between Districts. For example, UIC wells in the Inland District include enhanced recovery from shallow and deep reservoirs to recover both light and heavy oil. Waterflooding is used to enhance light oil recovery while steamflood and/or cyclic steam is used to enhance heavy oil recovery. Targeted reservoir rocks include both conventional sandstone and diatomite. Despite the extremely low permeability of diatomite (typically less than 0.1 millidarcies), and because of the very high concentration of in-place oil in terms of barrels (bbls.) per acre, this formation is being successfully developed via cold primary, waterflood, cyclic steam and/or steamflood depending on depth, thickness, and presence of heavy or light oil. Steamflood injection wells and cyclic steam diatomite wells are designed to minimize heat loss during injection, thus they are usually constructed with small casing strings (less than 3-inch diameter) and are not typically equipped with tubing and packer. Surface expression risk² is associated with high pressure cyclic steam injection into shallow diatomite. There is very little surface expression risk within conventional steamflood operations into low pressure, high permeability sandstone reservoirs containing heavy oil such as the Kern River Field. While surface expression is a health and safety issue it is not directly related to the protection of Underground Sources of Drinking Water (USDWs) which is the regulatory responsibility of the state under the federally delegated UIC program. Consequently, steam flood injection wells and cyclic steam injection wells are generally considered “low risk” with respect to potential USDW contamination. In contrast the Southern District is primarily comprised of produced water enhanced recovery (waterflood) wells which inject water with a much higher Total Dissolved Solids (TDS) content. This poses a greater risk to USDWs. As a result, many of these wells have tubing installed on a packer set within about 100 ft. above the injection zone inside of cemented casing.

The distinctions between Districts also means DOGGR uses an application review process that relies on Senior and Associate Engineers in each District to conduct technical reviews on all project and well permit applications. This allows professional staff with local geological and engineering practice experience to review applications using specific knowledge of the geology, operating needs and groundwater characteristics relative to the projects in the District. Processing and reviewing applications at the District level also allow the agency to utilize central office staff in an oversight role which provides quality assurance and quality control (QA/QC) of all applications and application processes. The District offices also work directly with

² Surface expression risk is the risk of the release of injected fluids or steam at the surface

RWQCBs. This facilitates quicker response times and increases application processing efficiency.

In addition to project and well permitting responsibility, District offices also have the lead role in compliance reviews, inspections, well testing and enforcement. The Sacramento office has administrative oversight of the program which includes hearings, enforcement notices, legal proceedings, financial assurance management, activity tracking, UIC grants and reporting, records and data management systems Water Boards coordination, budgeting and staffing. Overall program administration is the responsibility of the State Oil and Gas Supervisor, who is appointed by the Governor.

4. USDW protection methodology: The USEPA approved California Class II UIC program does not contain a specific requirement for casing and cementing across USDWs.³ However, a large portion of California's wells are cemented across USDWs because their injection casings are cemented to surface. USDW's are not mapped on a statewide basis and over 46,000 of the approximately 55,000 existing injection wells in California are in steam or cyclic steam injection projects. These wells have unique construction based on engineering and production needs and are encompassed within large, densely packed, shallow well fields; thus, equipping these wells with tubing and packer is not practical. Instead, the California program utilizes a strategy of injection zone containment as the primary means of USDW protection. This is accomplished via restrictions on injection pressures, rates and total volumes based on an evaluation of the overall project, potential fluid conduits in the AOR, routine injectate flow testing, and where necessary well monitoring within the AOR. Additionally, each injection well is required to have at least 100 ft. of cement placed above the injection zone behind the injection casing and at least 100 ft. above the base of freshwater. These steps are designed to assure that injectate is isolated from zones that may contain a USDW.

Aquifer exemption resolution: The Safe Drinking Water Act allows USEPA to exempt aquifers from protections afforded to USDWs if the aquifers do not currently serve as a source of drinking water and will not serve as a source of drinking water in the future, based on certain criteria. Aquifer exemption allows these underground sources of water to be used for oil or mineral extraction or disposal purposes in compliance with USEPA's UIC requirements. The 1982 UIC Program Memorandum of Agreement (MOA) between USEPA and DOGGR specifies which aquifers were granted exemption and which were not. However, in late 2011, a Senior Engineer at DOGGR made the discovery that the Memorandum of Agreement displayed on

³ Proposed changes to UIC regulations would require tubing and packer on all new Class II injection wells including steam and cyclic steam injection wells.

DOGGR's website (MOA1) was inconsistent with the agreement that appeared in the internal manual of instruction (MOA2). DOGGR informed USEPA of the discrepancy between the two versions of the agreement in 2012. DOGGR and USEPA agreed that DOGGR would identify all the wells injecting into non-exempt zones and urge oil operators in those zones to begin the process of applying for an aquifer exemption.

DOGGR also implemented strict aquifer exemption criteria that requires operators to submit an aquifer exemption request with substantial supporting documentation. Further, DOGGR is working with the Water Boards, and the USEPA to assure that exemptions are issued appropriately and in a manner that is protective of water as determined by the RWQCBs. These actions are part of an on-going effort by DOGGR to update and strengthen their UIC program. The effort also includes the development and implementation of substantial changes to the UIC regulations which can be found at:

[https://www.conservation.ca.gov/dog/general_information/Pages/UndergroundInjectionControl\(UIC\).aspx](https://www.conservation.ca.gov/dog/general_information/Pages/UndergroundInjectionControl(UIC).aspx)

Although they are not the only elements of the program, the five items listed above are significant in that they describe the overall framework under which DOGGR implements the UIC program.

Program Elements

Permitting and File Review

California utilizes a "two tiered" permitting system that includes an initial evaluation of what are referred to as "projects", which includes the overall area of operations and can include a single well or multiple wells, and "well permits" which entail a review of the aspects of an individual well within a project. These two tiers differ in their basic focus. Project reviews include the primary environmental review and the designation and evaluation of an AOR, determinations of maximum injection pressures and rates allowed and an evaluation of the potential risk to groundwater posed by the project. Individual well permit reviews evaluate the specific well drilling and construction of wells and evaluation of mechanical integrity demonstrations. Each tier has application requirements including as applicable local environmental reviews required by the California Environmental Quality Act (CEQA), public notices, checks for applicant qualification, financial assurance and others.

In addition to the application reviews conducted by DOGGR, SWRCB and RWQCBs also are given the opportunity to review applications in accordance with the recently revised MOA between

DOGGR and the SWRCB. In the case of project applications, the Water Boards almost always participates. Permit applications for individual wells are submitted to the DOGGR District offices and reviews are performed at that level, in addition to issuance of the permit. Water Board reviews are performed by the RWQCBs, and initial discussion occurs between the DOGGR Districts and the RWQCBs. Final Project Approval Letters (PALs) are issued by the Sacramento central office of DOGGR after receiving concurrence from the SWRCB based on consultation with the RWQCB. Under the newly revised regulations, each injection well has its own individual approval to inject, and each injection well is also associated with an overarching approved injection project. Individual injection wells may gain or lose approval to inject without directly affecting the approval status of the injection project with which they are associated. Currently, PALs contain an automatic expiration date.

Applications for projects or well permits may be submitted either electronically or in paper. Paper text applications are submitted to the respective District offices, where they are date stamped by the front office receiving clerk. During fiscal years 2015 through 2017, DOGGR received 103 project applications, and 60 projects. During fiscal years 2015 through 2017, DOGGR issued the following number of well permits:

- Drill –8862, Supplemental Drill – 2163
- Rework –9765, Supplemental Rework – 778
- Abandon –8606, Supplemental Abandon - 311

With respect to file reviews, in 2014 the Division also launched a project-by-project review of all underground injection projects. This review is a Division-wide effort to bring more uniformity to UIC program management and recordkeeping and will ensure that all projects have the appropriate data on file for effective regulatory oversight.

An extensive checklist has been developed to help guide DOGGR staff and operators through the review process. The main purpose of the checklist is to ensure that all District office project data is complete and to request from the operator any missing data. DOGGR staff may also meet with operators to ensure projects are operating in accordance with the project parameters. After the project-by-project review has been completed, subsequent reviews will take place periodically, but not less than once every three years.

All data collected during the initial review and subsequent periodic reviews is recorded in WellSTAR and made available for review by other DOGGR staff, the Water Boards, and operators. (See Part V Data Management for further details on WellSTAR)

Financial Assurance

Financial assurance requirements apply to individual wells. In the 2011 audit of the DOGGR program some potential shortcomings were identified. At that time, individual bonds were normally released after a noncommercial injection well had injected fluids for a six-month continuous period if DOGGR was satisfied that the well was mechanically sound. Blanket bonds were not normally released until all the operator's wells were abandoned or until the operator specifically requested the release of a well from bond coverage. The 2011 audit also indicated that the amount of bonds required for individual wells was potentially inadequate to cover all plugging and abandonment costs.

New statutes effective on January 1, 2018 improved bond coverage by changing the bond release requirements and increasing the bond amounts. Bonds are now not released until a well is properly plugged and abandoned. For individual wells, a bond of \$25,000 applies if the well is less than 10,000 feet deep. The bond increases to \$40,000 if the well is greater than 10,000 feet deep. Commercial wastewater disposal wells require a bond of \$100,000. If 20 or more wells are applied for at one time, an operator may choose to use a blanket bond instead. Required amounts for blanket bonds are as follows:

- \$200,000 for 50 or fewer wells in the state
- \$400,000 for 51 to 500 wells in the state
- \$2,000,000 for 501 to 10,000 wells in the state
- \$3,000,000 for more than 10,000 wells in the state

These new laws apply not only to newly drilled wells, but also to existing wells whenever any sort of re-work action occurs. Wells also become subject to the new requirements if a change in ownership occurs. It is estimated that 99% of all UIC wells will now be subject to these new requirements. A further strong point of the bonding program is the ability, which is included in statute, to increase the required bond amount for operators who have shown a pattern of non-compliance.

Public Involvement

In California, most public involvement in the UIC permitting process occurs during the project phase. The California Environmental Quality Act (CEQA) is a statute that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. DOGGR's CEQA unit works to ensure compliance with the CEQA and to conduct CEQA reviews in the most effective and efficient manner possible. The

CEQA unit coordinates with DOGGR programs, local jurisdictions, state and federal agencies, and the public.

DOGGR routinely solicits input from all interested members of the public, and particularly welcomes comments from the residents of communities situated near oil and gas operations. It is DOGGR policy and practice to publish notices in a regionally available newspaper inviting public comment regarding each request for approval of a new underground injection project or for approval of substantial changes to an existing underground injection project.

Once DOGGR's technical review of the project has been completed, this public comment period is initiated. This includes a three-day notification posting in a local newspaper by the operator, followed by a waiting period for public comments of 15 days. At the same time, the operator is required to notify offset operators of the proposed action. However, there is no requirement to notify nearby landowners or to provide any other form of public notification, such as posting the proposed action on the DOGGR website. WellSTAR will be accessible to the public via DOGGR's website, although links to projects at a specific location have not yet been established. If there is a significant change to the project after the comment period, or a significant error in the notice, then a re-posting of the notice would be required. This could include an item like a change in the township/range/section location.

If significant public comments are received during the 15-day comment period, a decision is made on whether to hold a public hearing, which would be held at an appropriate location within the local District. This decision would normally be made the State Oil and Gas Supervisor or the local District Deputy. A key factor in making that decision would be whether the commenter is likely to be directly affected by the proposed project.

If a public hearing is held, it is a formal hearing with transcripts. Attendees are invited to make oral comments at a lectern and/or provide written comments within the public comment period. Transcripts of oral comments are combined with all written comments, and then are reviewed and summarized by the Office of Legislative and Regulatory Affairs (OLRA). They are then forwarded to District staff to prepare written responses which are reviewed by the Department of Conservation (DOC) Legal office.

Depending on the interest shown in the project, DOGGR could post the summary of comments of a public hearing on their website, however, there is no specific policy on that subject, and it would be a case-by-case decision. For hearings on a proposed aquifer exemption, relevant documents and the application are posted throughout the process. In addition to the formal

portion of the public hearing, DOGGR staff may also make themselves available to answer citizen's questions informally in conjunction with the hearing.

DOGGR seldom receives comments on proposed projects and it is very rare for a public hearing to be requested. This is considered to be a result of the extensive CEQA process which occurs prior to an application being filed. Accordingly, DOGGR has no current plans to extend the public comment period, or to place notices on the DOGGR's website. While there is a complaint process established by PRC § 3235, no specific procedures have been established because there have been very few complaints related to proposed projects.

Although DOGGR receives a limited number of reported emergencies and citizen complaints related to field activities, when received they are considered a high priority and are addressed immediately upon receipt. The field inspector can often resolve a minor complaint at his or her level, usually by meeting with the complainant and reviewing and discussing the situation. Resolution often occurs within a few days, and rarely takes longer than about 30 days. If this is not successful, the matter will be escalated, and the Senior Engineer may need to become involved. Both the operator and the complainant are kept informed of the situation. All communication records regarding the complaint and investigation are stored in WellSTAR, and a report is written and filed as appropriate. All formal communication normally takes place at the Senior Engineer level.

Well Construction

In California, CCR 1722.2 requires that each well shall have casing designed to provide anchorage for blowout prevention equipment and to seal off fluids and segregate them for the protection of all oil, gas, and freshwater zones. All casing strings shall be designed to withstand anticipated collapse, burst, and tension forces with the appropriate design factor provided to obtain a safe operation. Casing setting depths shall be based upon geological and engineering factors, including but not limited to the presence or absence of hydrocarbons, formation pressures, fracture gradients, lost circulation intervals, and the degree of formation compaction or consolidation.

CCR 1722.4 is the applicable regulation for cementing of casing operations. It requires the surface casing annulus to be filled from the casing shoe to the surface in all wells almost without exception. For intermediate casing or production strings, cementing in the annulus is required to be at least 500' above oil and gas zones and anomalous pressure intervals. A minimum of 100' feet of cement is required to be set in the annular space above the base of a freshwater zone either by lifting cement around the casing shoe or cementing through

perforations or use of a cementing device placed at or below the base of the freshwater zone. All casing is required to be cemented in a manner that ensures the proper distribution and bonding of cement in the annular spaces. . The appropriate Division District Deputy may require a cement bond log, temperature survey, or other survey to determine cement fill behind casing.

Although additional requirements for cementing are not within the current proposed UIC regulations, new well construction standards and new cementing standards may be included in the future. As of this review, well construction regulations related to casing and cementing requirements were still in "pre-rulemaking" development.

DOGGR has indicated that proposed draft regulations would require cemented casing from the base of the lower-most USDW/beneficial water to one hundred feet above the waters to be protected. However, if an enhanced oil recovery (EOR) injection well proposes two strings of casing cemented from the base of the lower-most USDW and 100 feet above the USDW, DOGGR will not require tubing and packer set in the well during active injection operation. DOGGR indicated that the double layer of cemented casing is considered adequate to protect the USDWs. On behalf of DOGGR, research is being conducted at various national laboratories on well construction and cementing standards, and recommendations will be forthcoming for consideration.

The tubing and packer arrangements for Class II injection wells are required by CCR 1724.10 (g). All injection wells except steam, air, and pipeline-quality gas injection wells must be equipped with a tubing and packer. The packer is required to be set immediately above the approved zone of injection. New proposed regulations include the provision that the location of the packer shall be no more than 100 feet above the approved zone of injection and may only be set within the approved injection zone if there are no open perforations above the packer.

Exceptions to the tubing and packer requirement may be made when: there is no evidence of freshwater-bearing strata; there is more than one string of casing cemented below the base of freshwater; or other justification, as determined by the District deputy, based on documented evidence that freshwater and oil zones can be protected without the use of tubing and packer. DOGGR staff indicated that an accurate inventory of injection wells (not including cyclic steam or steam flood wells) without a tubing-packer arrangement is needed and is being compiled.

Mechanical Integrity Testing

Mechanical integrity testing (MIT) is currently required by CCR 1724.10 (i) and requires two-part (internal and external) tests to ensure injected fluids are confined to an approved zone.

The first part consists of pressure testing the casing-tubing annulus by a standard annular pressure test (SAPT) and the second part consists of the testing necessary to demonstrate the absence of fluid migration behind the casing, tubing, and packer. The new UIC regulations also extend mechanical integrity testing requirements to injection wells that do not have tubing and packer, such as steam flood wells, and the requirement is thereby applied to the casing in tubingless wells. Such wells will be allowed 5 years from the date of implementation of the new regulations, April 1, 2019, to meet the mechanical integrity demonstration requirements.

Current regulations do not provide actual specifications for SAPT satisfactory test requirements, however the proposed UIC regulations under CCR 1724.10 do include such specifications. These include allowing the operator to select the initial test pressure of the pressure test, provided that the pressure test is conducted at an initial test pressure of at least 200 psi above surface pressure, and the maximum allowable surface injection pressure for the injection well, as determined under Section 1724.10.3, does not exceed the initial test pressure used during the most recent successful pressure test.

The new regulations will allow continuous pressure monitoring of the annulus as an alternative to running a SAPT for wells equipped with tubing and packer, subject to DOGGR's approval. An initial pressure test will be required at a minimum of 500 psi, and a pressure of at least 100 psi must always be maintained on the annulus. In addition, there will need to be an observable pressure differential of +/- 10 % of the tubing pressure or at least +/- 50 psi between the annular pressure and the tubing pressure.

The new regulations will also provide the option of using an alternate mechanical integrity testing method to satisfy the requirement to pressure test the casing of an injection well. This is intended primarily for wells which do not have tubing and packer and requires that the alternate testing method be approved by DOGGR on a case-by-case basis as being at least as effective as pressure testing in demonstrating the integrity of the well at the calculated pressure value under Section 1724.10.3(a)(1).

External testing requirements are listed under the new UIC regulations at CCR 1724.10.2 (a)-(g). They include conducting radioactive tracer surveys, noise logs, and temperature surveys. Within three months after commencement of injection, an external integrity test must be performed. Each type of well is subject to testing frequencies based on risk as identified in the following schedule: disposal injection wells are tested at least once per year; enhanced recovery injection wells and non- low-use cyclic steam wells every two years; and steamflood injection wells equipped with tubing and packer and low-use cyclic steam injection wells once every five years. The specifications for external integrity requirements under the new regulations are well

detailed. These specifications essentially codify current practices in order to ensure consistency throughout the state. Exceptions, modifications, or alternative testing measures to either standard annular tests or external testing requirements may be allowed upon written approval of the Division.

Inspections

The DOGGR field inspectors work out of the District Offices. Staff at the District Offices are divided into program teams; each team is supervised by a Senior Oil and Gas Engineer who is in turn supervised by the District Deputy. These staff coordinate, schedule, and manage the work of the inspectors in that District.

The inspectors within a District are each assigned to specific duties, rather than being assigned to a geographic area within that District. In some of the Districts, the inspectors will rotate on different 3-month work assignments. They may work on UIC wells, oil and gas wells, facilities, etc., for a period of approximately 3 months to gain specialized experience. After the 3-month period is over, they then work on another aspect of the program.

The Division has the statutory authority to access a lease or well location and to make unannounced inspections at any time. In practice advance notice of an inspection is not always provided to the operator. The Division tries to notify operators whenever possible but acknowledges that it is not always able to provide prior notice.

To maintain consistency throughout the Division, the field inspectors use specific standardized forms for each of the different types of inspections (such as MITs, well plugging, well testing, sample collection, etc.). These forms provide for various items to be recorded, such as well status (active or idle), tubing pressure, casing pressure, injection rate, presence of a well identification sign or an H₂S warning sign (if appropriate), presence of leaks, and general condition of the well site. A photo of the well is also taken during the inspection and is stored in WellStar.

On average a field inspector can inspect about four or five wells per day. This is comparable to the number of inspections performed by inspectors in other states. This number can vary widely, and an inspector may be able to inspect 10-20 or more wells in a day if they are located close together and there are no issues.

Many factors are considered when prioritizing inspections. Generally, the highest inspection priority is for injection wells located in urban areas, wells that are injecting into formations that

contain freshwater, and wells located near municipal drinking water source wells. Other considerations include the depth of the well, the age of the well, wells which are in environmentally sensitive areas, and wells operated by those operators with a history of noncompliance.

The type of well is also a consideration. Produced water disposal wells are prioritized above enhanced oil recovery injection wells. Steam injection wells for enhanced recovery generally have the lowest priority, because the injected steam is freshwater. Other criteria such as past enforcement status, or routine or repeated field problems may also be considered to establish inspection priorities on a case-by-case basis. All produced water disposal wells, H₂S injection wells, and any other wells that are considered high priority, are usually inspected at least once per year.

While well plugging operations are considered a high priority, witnessing of all plugging operations depends upon the availability of staff in each district. Consequently, staff typically witness those parts of the plugging operation which are statutorily required to be witnessed and those parts where risk is the highest, such as the placing of the casing shoe plug. Other operations that are not considered a DOGGR priority, such as placement of the surface plug and site restoration, are not usually witnessed. During the drilling of a well, the setting and cementing of the surface casing string, which is set through the near-surface freshwater zones and is thus a critical part of well construction, is not routinely witnessed.

Compliance and Enforcement

The process described below is a generalized summary of how DOGGR's enforcement process works.

In non-emergency situations enforcement starts at the inspector level with the issuance of a Notice of Violation (NOV). If necessary, this is followed with an administrative enforcement order (AEO), which is subject to appeal proceedings. If compliance is not achieved, DOGGR may refer the matter to its Office of Enforcement, which may utilize tools such as an expedited settlement offer, remedial order, civil penalty order, plugging and abandonment order or others. DOGGR may also contract to remediate the issue or refer the matter to a District Attorney for criminal prosecution. In emergency situations DOGGR may contract to remediate the issue and charge the cost of such action to the operator.

The enforcement tools used, and decisions made concerning the steps in the progressive enforcement process depend on the factors of each case. Such factors include the operator's

history of noncompliance, economic benefit derived from noncompliance, environmental justice considerations, and the harm or likelihood of harm to human health or the environment.

UIC Data Management

An effective review of California DOGGR's UIC program would not be complete without the review of the ongoing efforts to develop an agency wide data management system. The system is a high priority to DOGGR as part of their Renewal Plan⁴ and in their efforts to modernize and integrate into an open information world. DOGGR's application Well Statewide Tracking and Reporting (WellSTAR⁵) system is being developed on the Risk Based Data Management System's 3.0 (RBDMS 3.0) modern technical architecture. It is replacing an older distributed system that had become outdated and inefficient in providing the needs of the agency, regulated community, and public.

Efforts to modernize DOGGR's data management systems have been ongoing for many years. The tracking of electronic stimulation data and reporting was initiated as early as 2013. WellSTAR's first release occurred in 2017. At the time of this review it was in Release 2 of the phased approach. Release 3 occurred in October 2018, Release 4 occurred in April 2019, and Release 5 is scheduled for October 2019.

The development of WellSTAR, and what it means relative to managing wells, compliance tracking, field activities, and the additional day-to-day needs of a modern oil and gas agency, is essential to accomplishing the function of regulating the oil and gas community in California. The development of WellSTAR is broken down into logical release components. These releases are as follows:

- Release 1: Bond Management, Entity Management, General and Administration. Bond and Entity Management (Released: 8/31/2017)
- Release 2: Well Management, Transfer, Production, Payments, Facility Management, and Underground Injection Control (UIC) (Released: 04/30/2018)
- Release 3: Incidents, Complaints, Idle Well, Compliance, Public Access and Construction Site Well Review (Released 10/29/18)
- Release 4: EPA Report, Well Stimulation Treatment, Underground Gas Storage, Inspections (Released 4/29/19)
- Release 5: Additional items (estimated 10/19)

⁴ California Renewal Plan, <http://www.conservation.ca.gov/dog/Pages/RenewalPlan.aspx>, accessed 8/1/2018.

⁵ WellSTAR, http://www.conservation.ca.gov/dog/for_operators/Pages/WellSTAR.aspx, accessed 8/1/2018.

The above identified components of the system are expected to support an effective regulatory program and provide the tools necessary to strengthen the UIC program. It is critical that DOGGR continue their path of completing the WellSTAR system and the identified components that will be used by the UIC Program in their day-to-day scheduling and management of the program.

Overall Program Findings

The review team performed an in-depth review of the California UIC Class II program via a review of California laws and regulations, responses to a questionnaire, and a two-day state interview of DOGGR, SWRCB and Regional Water Board staff and management involved in the UIC program. Information provided by DOGGR prior to the state interview was of great assistance; though much of the understanding of the program was achieved during the actual in-state interview. DOGGR has devoted substantial resources in recent years toward improving the UIC program through their Renewal Plan which addressed four main issues; regulatory overhaul, new regulations for new realities, modernization of the Division's data management, and ensuring a high-quality workforce.

DOGGR has developed a very knowledgeable and dedicated staff, and both managers and staff show great flexibility in covering a wide range of duties. The review team was impressed with the quality of staff and the processes through which the program was being implemented.

The California UIC program is unique among state Section 1425 delegated programs in several respects:

1. It is the only known Class II UIC program with a preponderance of UIC wells that are steam flood or cyclic-steam flood wells. This presents unique challenges in program management in areas such as technical evaluation, well construction limitations, mechanical integrity demonstration needs, USDW protection methods and others.
2. It is the only program reviewed thus far under the revised GWPC Class II Peer Review process (Utah, Nebraska, Ohio, West Virginia, California) which uses a multi-tiered permitting and file review system that includes a "project" review and an "individual well permit" review. This structure results in the need for coordinated review between DOGGR and the SWRCB which tends to lengthen the overall review process. However, it also provides an opportunity for a more holistic approach to AOR, field injection pressure and volume determinations, and field level USDW protection evaluations.

3. While Project Approval Letters (PALs) are approved in the central office of DOGGR in Sacramento, the primary review of individual well permit applications is conducted in District offices with the Sacramento office exercising oversight and final review of the work conducted by a District engineer.

Overall, the review team finds that the California Class II UIC program managed by the DOGGR is well run and managed. The review team also finds that while the program does not specifically require surface casing across all USDWs, it does implement requirements designed to provide appropriate protection for USDWs in accordance with the provisions of federally delegated UIC program requirements. The staff of DOGGR has the professional and technical knowledge and experience needed to implement the program in a manner that is efficient and meets the requirements for an effective Class II UIC program under Section 1425 of the SDWA. The program is appropriately organized to meet the needs of highly variable injection environments, makes excellent use of professional staff, and is transitioning to the latest data management processes to assure that USDWs are adequately protected.

The suggestions and review team comments provided in this report represent opportunities to further strengthen the California Class II UIC Program. They are not intended to convey that the program does not meet any of the requirements of the UIC program as delegated to the state by USEPA. In all subject areas investigated as a part of this peer review, the DOGGR managed program has been found to provide the necessary elements from both a regulatory and activity standpoint to protect USDWs.

Introduction to Underground Injection

This section provides a general description of underground injection and how it is regulated by the US Environmental Protection Agency and state agencies throughout the United States. As such, it is not specific to the State of California. The comprehensive review of the California program begins with the Executive Summary of this report.

Underground injection is the placement of fluids, including but not limited to waste by-products, into the subsurface through a wellbore. Underground injection is not a new practice. The Chinese injected freshwater into the subsurface for salt extraction as early as A.D. 300. The first documented use of injection to dispose oilfield produced water (brine) was in Texas during the 1930s, over eighty years ago. Beginning in the 1930s, the oil and gas industry also began to inject produced water into pressure-depleted oil reservoirs to enhance recovery of crude oil resources. During the 1970s and 80s, oil refineries and chemical industries began to inject liquid wastes in deep disposal wells. Today, underground injection is used to remove more

than 50 percent of the liquid hazardous waste, and more than 98 percent of saltwater produced by onshore oil and gas operations from the surface environment.

Some waste is an unavoidable by-product of a myriad of resource development and manufacturing processes that create thousands of products that we use in our daily lives including steel, plastics, pharmaceuticals, fuels, and natural gas. Underground injection is an important waste management practice internationally and in the United States. Some renewable energy sources, such as geothermal, also rely on underground injection. Municipalities need underground injection to replenish aquifers (aquifer storage and recovery), to combat saline water encroachment in coastal areas, to dispose of residual waste streams generated by treatment and desalination of water for public use, and to dispose of treated sewage. While industries continue to develop ways to reduce waste volumes and recycle, generated wastes must be disposed in a safe manner. Various types of injection wells have unique associated benefits and risks. To dispose of fluids safely, injection wells must be properly constructed; located in an appropriate geologic setting; and operated, maintained and monitored in accordance with standards that are protective of our groundwater resources.

Liquid wastes can be managed in a variety of ways other than underground injection including:

- treatment and release into surface waters, such as rivers, through a National Pollutant Discharge Elimination System (NPDES) permit issued pursuant to the federal Clean Water Act;
- biological treatment;
- incineration;
- storage in evaporation pits;
- discharge into percolation pits; and
- beneficial re-use (e.g., irrigation, livestock watering, ice or dust control)

Each of these practices has its limitations and associated environmental risks. For many waste streams, including produced water generated during oil and gas exploration practices, the volumes are too great to rely solely on these alternative waste management practices. Furthermore, injecting highly saline fluids back into deep subsurface reservoirs that contain equally saline water is a common-sense waste management practice that poses fewer environmental or public health risks than these alternatives.

Underground injection plays a crucial role in disposing residual wastes, especially those that would pose the greatest risks to society if managed by any other method, such as discharge to surface waters. In other words, if underground injection is restricted or eliminated, the result will be more, not less risk of environmental harm.

In 1974, Congress passed the Safe Drinking Water Act (SDWA), which required the U.S. Environmental Protection Agency (USEPA) to develop minimum federal requirements for injection practices. Regulations adopted pursuant to the SDWA are now administered by USEPA along with state and tribal partners that collectively constitute the UIC Program. The purpose of the UIC Program is to protect public health by preventing contamination of underground sources of drinking water (USDWs).

A USDW is defined as an “aquifer or its portion which supplies any public water system or contains a sufficient quantity of groundwater to supply a public water system, and either currently supplies a public water system, or contains less than 10,000 milligrams per liter of total dissolved solids and is not an exempted aquifer.” Most groundwater used for public drinking water today contains less than 500 milligrams per liter of Total Dissolved Solids (TDS), and most water that is treated for drinking water contains less than 3,000 milligrams per liter TDS. Therefore, the UIC Program ensures that water resources that could be treated and used as drinking water in the future are protected today.

After passage of the Safe Drinking Water Act (1974), USEPA worked with a twelve-member state workgroup to develop the UIC Program regulations (1976-1977). From the onset of regulation development, regulatory officials sought to apply lessons learned from decades of injection experience. Prior to enactment of the federal regulations, USEPA and state officials examined best practices and problems associated with injection well operations that predated passage of the SDWA.

While developing the UIC Program regulatory framework, USEPA and state officials recognized six pathways through which injected fluids could potentially migrate into USDWs. Officials sought to develop regulatory standards that mitigate and effectively address the following pathways:

- migration of fluids through a faulty injection well casing;
- migration of fluids through the annulus located between the casing and wellbore;
- migration of fluids from an injection zone through the confining strata;
- vertical migration of fluids through improperly abandoned and improperly completed wells that penetrate the injection zone;
- lateral migration of fluids from within an injection zone into a protected portion of that stratum; and
- direct injection of fluids into or above an USDW⁶

⁶ Osbourne, P., 2001, Technical Program Overview: *Underground Injection Control Regulations*, Office of Water 4606, EPA 816-R-02-025.

The USEPA has defined six classes of injection wells that are permitted and regulated under the SDWA, which are summarized in the following table.

U.S.EPA Classification	Injection Well Description
CLASS I	Wells used to inject waste beneath the lowermost USDW
CLASS II	Wells used to dispose of fluids associated with the production of oil and natural gas
CLASS III	Wells used to inject fluids for the extraction of minerals
CLASS IV	Wells used to dispose of hazardous or radioactive wastes into or above a USDW
CLASS V	Wells not included in the other classes generally used to inject non-hazardous waste
CLASS VI	Wells used to geologically sequester carbon dioxide to reduce greenhouse gas emissions

Table 1 Injection well classification chart Source: after USEPA

The USEPA is charged with enforcement of the SDWA and exercises that authority directly or through formal agreements with state and tribal partners, under their oversight. The USEPA has given primary enforcement authority (primacy) over underground injection wells to those state agencies or tribes that have shown they are able to implement a UIC Program that is effective in protecting groundwater resources. These requirements are in Sections 1422 and 1425 of the SDWA, and the Federal Register (40 Code of Federal Regulations Sections 144 through 147). The states that USEPA has determined have regulations, laws, and resources in place that meet the federal requirements and are authorized to run the UIC Program, are referred to as Primacy states. Primacy states manage their programs subject to periodic audits and program reviews conducted by USEPA. In states that have not received primary responsibility for the UIC Program, USEPA remains the responsible regulatory agency. These states are referred to as Direct Implementation (DI) states, because USEPA directly implements the federal UIC regulations in these states. Some states share responsibility with the USEPA, with authority over some well classes residing at the state level, and other well classes being regulated by USEPA.

The Class II UIC Program

Class II injection wells are used primarily to inject fluids that are associated with oil and gas exploration and production (E&P) activities including drilling, stimulation (hydraulic fracturing), and production operations. Since the inception of oil and gas exploration and development (1860), the oil and gas industry has been generating and managing produced water. Produced water is the water extracted from the subsurface during oil and gas E&P activities. Produced water occurs naturally within underground formations and is brought to surface along with oil and gas through a cased wellbore.

Produced water is generated during several oil and gas E&P activities including:

- drilling through saline water zones that naturally occur in the subsurface and overlie the target oil and gas reservoir(s);
- stimulation of oil or gas reservoirs by hydraulic fracturing during the flow back and swabbing process; and
- workover operations, and
- during day-to-day production operations

Long before hydraulic fracturing operations started in the 1940's, the oil and gas industry generated large volumes of produced water that was capable of harming the environment if not properly managed.

Produced water characteristics and physical properties vary considerably depending on the geographic location of the field, the geological formation with which the produced water has been in contact for thousands of years, and the type of hydrocarbon product being produced. Produced water properties and volumes can even vary throughout the lifetime of an oil and gas well or reservoir. Produced waters can be highly saline, with salt concentrations exceeding 200,000 milligrams per liter of chloride (more than ten times as salty as sea water) or may be pure enough for agricultural or irrigation purposes. In addition, produced water commonly contains many organic and inorganic compounds that can lead to toxicity. Some of these are naturally occurring dissolved or emulsified hydrocarbons derived from associated crude oil while others are related to chemicals that have been added for well-control or reservoir stimulation purposes. These fluid wastes are specifically excluded from hazardous waste classification under the Resource Conservation and Recovery Act (RCRA).⁷

The 1980 amendments to the RCRA required USEPA to conduct a study of the environmental and potential human health impacts associated with E&P wastes and their associated waste

⁷ Veil, J.A., M.G. Puder, D. Elock, R.J. Redusik, 2004, A White Paper describing Produced Water from Production of Crude Oil, Natural Gas, and Coal Bed Methane, prepared by Argonne National Laboratory, prepared for the U.S. Department of Energy, 79 pp.

management practices. USEPA completed its two-year study in 1987. Based on the findings in the Report to Congress, and on oral and written comments received during public hearings in the spring of 1988, on June 30, 1988, USEPA decided not to recommend federal regulation of E&P wastes as hazardous wastes under Subtitle C of RCRA (USEPA 1988). This determination is commonly referred to as the “RCRA exemption”. Although produced water is exempt from one section of RCRA, it is subject to requirements in RCRA Subtitle D and the Safe Drinking Water Act.

Approximately 20.5 billion barrels of produced water are generated by federal and state onshore operations in 2012. Generally, the volume of produced water from oil wells does not remain constant over time. The water-to-oil ratio can increase over the life of a conventional oil well. For such wells, water makes up a small percentage of produced fluids when the well is new. Over time, the percentage of water increases and the percentage of crude oil declines. On average, more than seven barrels of water are produced for each barrel (bbl.) of oil. For crude oil wells nearing the end of their productive lives, water can comprise as much as 98% of the fluid brought to the surface.

Shale gas wells generate most of their produced water after hydraulic fracturing operations are completed and pumping pressure is relieved from well. During the flow back process, water-based fracturing fluid mixed with natural formation (connate) water begins to flow back to surface. Most of the produced water recovered from typical shale gas operations is recovered during the first several months.⁸ California’s shale formations flow back roughly 10% of injected fluids.

Produced water is separated from crude oil or natural gas at the surface facility associated with producing oil and gas wells. It is delivered to Class II injection well facilities by pipeline or truck. Once delivered to the storage facility at the injection well, any remaining crude oil is skimmed, the water may be filtered to remove solids such as sand or silt, and the water may undergo other types of treatment prior to injection

Today there are approximately 168,000 Class II injection wells operating in 31 states. There are three types of Class II injection wells:

- Hydrocarbon storage wells;
- Enhanced oil recovery wells; and,
- Produced water disposal wells.

⁸ Ground Water Protection Council and ALL Consulting, 2009, *Modern Shale Gas Development in the United States*, a Primer, prepared for the United States Department of Energy, 98 pp., Web 1, March, 2011.

Hydrocarbon storage wells are used to pump crude oil and other hydrocarbons that are liquid at standard temperature and pressure underground for temporary storage, prior to recovery, processing and use. Enhanced oil recovery (EOR) wells are used to prolong the productive life of oil wells within a specific oil field. Secondary recovery is an EOR process commonly referred to as water-flooding. Salty water produced with oil is separated from the oil at surface and re-injected in the oil-producing formation to drive oil to proximal, pumping oil wells completed in the same reservoir. This saline waste-water by-product is referred to as “produced water” or “saltwater” because salts (sodium, calcium, magnesium, potassium chlorides) are the predominant dissolved constituents in produced water. Produced water disposal wells are sometimes referred to as “saltwater disposal wells” because they inject fluids into deep saline reservoirs for disposal purposes. Nationally, approximately 60 percent of all saltwater produced with onshore oil production wells is re-injected at Class II EOR wells, while 40 percent is injected for disposal.

USEPA has awarded primacy for the Class II Program to 43 states and territories, and two tribes. Primacy for Class II programs may be awarded under Sections 1422 or 1425 of the Safe Drinking Water Act. Most states with Class II programs have applied under Section 1425, as it provides regulatory flexibility to address the specific conditions present in an individual state.⁹ Some states have instead chosen to apply under Section 1422, where the regulations are more prescriptive, which allows a state to obtain primacy for most UIC well classes through a single primacy application process. At present only one state (North Dakota) has obtained primacy for the Class VI program. The following map shows the distribution of Class II Primacy states and Direct Implementation states.¹⁰

⁹ Safe Drinking Water Act, Section 1425, Amended 1996, <https://www.gpo.gov/fdsys/pkg/CPRT-106SPRT67528/pdf/CPRT-106SPRT67528.pdf>

¹⁰ Note: Figure 1 still shows Idaho as a primacy state even though primacy was returned to USEPA on July 30, 2018

the integrity of the casing, operators must run tests to demonstrate that no significant fluid movement into a USDW through vertical channels adjacent to the injection well bore is occurring.

- All known wellbores that penetrate the proposed injection zone are evaluated within an “Area of Review” (AOR) surrounding the proposed injection well. Wellbores that pose potential avenues for fluid migration by their construction or plugging status must be mitigated before injection can be authorized.
- Injection owners must monitor their operations and submit reports regarding injection pressures and fluid volumes.

Produced water is injected into depleted oil and gas reservoirs or deep reservoirs that are naturally saline. These saline reservoirs contain water with similar chemistry to the injected produced water. Typically, produced water is injected into porous and permeable sandstone or dolomite formations that are overlain by “confining strata”.

Confining units consist of rock types that typically have low permeability, such as shale, halite (salt), anhydrite, and some limestone formations. When confining units overlie oil and gas reservoirs, they are also referred to as “cap rocks” because the strata have effectively sealed oil, natural gas and even CO₂ in the underlying reservoir for millions of years with no, or minimal, leakage. The effectiveness of confining units has been further validated through extensive stratigraphic tests, and decades of successful experience at gas storage and injection operations.

Constructing a wellbore and maintaining mechanical integrity throughout injection operations is a key principal of injection well regulations. An injection well is said to have “mechanical integrity” if:

- 1) there are no significant leaks in the casing, including injection tubing (the string of steel pipe through which fluids are actually injected), and
- 2) there is no significant fluid movement behind casing (either behind cement or in uncemented annular spaces) into a USDW

Class II regulations require operators to construct a well in a manner that allows mechanical integrity to be tested and monitored.

Injection well operators are required to verify that each Class II well has mechanical integrity before commencement of injection is approved; at least every five years thereafter; and every time down hole equipment, such as injection tubing or packer, is removed for servicing or repair. These standards are enforced to protect USDWs and ensure that fluids are injected into the authorized injection zone.

The Peer Review Process

The Groundwater Protection Council (GWPC) conducts the Class II UIC Peer Review process under the joint GWPC and Interstate Oil and Gas Compact Commission (IOGCC) “States First Initiative”. The purpose of this process is to assess the effectiveness of Class II UIC programs that have been delegated to states under Sections 1422 or 1425 of the Safe Drinking Water Act (SDWA) and to offer suggestions designed to strengthen the program.

The review team consists of the following persons:

- Two to three volunteer state Class II UIC program persons from primacy programs of states that reside outside of the USEPA Region of the state being reviewed
- A GWPC staff member
- A facilitator hired by the GWPC
- A federal observer from the USEPA Region in which the state being reviewed resides

The review process and desired timing is as follows:

- 1) Initial contact with states to solicit volunteers for review (GWPC)
- 2) Coordination of timing for the review with the state program (GWPC)
- 3) Recruiting of review team members at least 60 days prior to the in-state interview (GWPC)
- 4) Distribution of the questionnaire to the state program to be reviewed at least 60 days prior to the in-state interview (GWPC)
- 5) Notification to state program of review team members at least 30 days prior to in-state review (GWPC)
- 6) Submission of the completed questionnaire to the GWPC at least 30 days prior to the in-state interview
- 7) Review of the completed questionnaire and development of follow-up questions no later than two weeks prior to the in-state interview (Review team)
- 8) In-state interview of up to 1 ½ days (Review team and state program staff)
- 9) Prepare draft report within 60 days following in-state interview (Non-observer team members, facilitator and GWPC representative) *NOTE: Due to the complexity of the California review draft preparation was expected to take between 120-180 days.*
- 10) Initial review of draft report by team within 30 days following draft completion
- 11) Submission of draft report to state program within 30 days following team review (GWPC)
- 12) Review and comment submission by the state to GWPC within 30 days of receipt of draft

- 13) Revision of draft within 30 days following receipt of state program input (Non-observer team members, facilitator and GWPC representative)
- 14) Approval of the final report within 15 days of revision completion (GWPC Executive Director)
- 15) Printing of copies of the final report per state request within 10 days following approval by GWPC Executive Director (GWPC)
- 16) Posting of the final report on the GWPC website within 10 days following approval by GWPC Executive Director (GWPC)
- 17) Distribution of 25 copies of the printed report to the state program (GWPC)

The general protocol for a review includes the following:

- Review team members agree to maintain confidentiality and may not discuss the review findings or draft report with persons who are not members of the team until the final report is published
- Observers are entitled to submit questions to the review team as part of the in-state interview but are not permitted to participate in drafting of the report
- Observers may submit comments on the draft report at their discretion
- Preparation and approval of the draft report will be accomplished using a consensus approach
- Minority reports, other than those that may be published by the reviewed state, are not allowed
- Comments in the report will not be attributed to any individual team member
- The GWPC is solely responsible for the content of the final report
- The report is the intellectual property of the GWPC and any distribution of or quotation from the report may only be done with the express permission of the GWPC

California Class II UIC Peer Review

Review Team

The following persons conducted the California Peer Review:

State team members:

Beth Hernly, PG, Assistant Director of Permitting, Underground Injection and Technical Services, Indiana Department of Natural Resources, Division of Oil and Gas

George Hudak, UIC Coordinator, Montana Board of Oil and Gas Conservation

Larry E. Organek, Engineer, Oil, Gas, and Minerals Division, Michigan Department of Environment, Great Lakes and Energy

GWPC staff and consultants:

Mike Nickolaus, PG, Special Projects Director, GWPC

Mark Layne, PhD, PE Technical Director, GWPC

John Taylor, PE, Former USEPA Region 5 UIC Program Manager and GWPC Facilitator

Observer:

Calvin Ho, Geologist, USEPA Region 9

Review Summary

The peer review of the Class II UIC program administered by the California Department of Conservation, Division of Oil, Gas and Geothermal Resources (DOGGR or Division) was conducted by a review team made up of UIC managers and technical staff from state Class II agencies of states outside of the USEPA region in which California resides (Region 9). This included an in-state interview of staff and management of DOGGR and the State Water Resources Control Board (SWRCB) and Regional Water Quality Control Boards (RWQCB) (collectively Water Boards). Interviews were conducted at the DOGGR office in Sacramento, California on June 19-21, 2018. The in-state interview was based on responses to a comprehensive questionnaire completed by DOGGR and Water Boards staff and follow-up questions posed to the state staff during the interview. In addition, the interview team members reviewed the state's statutes and regulations governing the UIC program, including regulations currently undergoing promulgation and other materials provided by the state.

Part I: General Administrative Overview

Statutory Authorities and Regulatory Jurisdictions

Overall responsibility for California's Oil and Gas program, including the injection of produced fluids for disposal or enhanced recovery (UIC Class II wells), has been delegated by the state legislature to DOGGR. Their main office is in Sacramento, California. The Sacramento office handles the administrative aspects of the UIC program including grants management, financial assurance, enforcement process management, and overall program oversight. A dedicated UIC unit has been established in Sacramento to coordinate these functions. In addition, an enforcement unit has recently been established in Sacramento and is currently being staffed.

The Class II UIC program implemented by DOGGR is structured to recognize and accommodate the significant geologic, geographic, demographic, petrologic, and engineering differences between various producing areas. To manage these diverse regions, the state has been divided into the following administrative Districts: Northern, Southern, Inland, and Coastal (See Figure 2 on Page 19). Since each District has unique geologic characteristics, this arrangement allows each District to focus on the practices and types of wells common to that area. Accordingly, these four District offices handle the day-to-day management of permitting, inspections, well testing, compliance, field operations and enforcement.

DOGGR has authority to adopt regulations and make orders as necessary to administer operations for and relating to the production of oil and gas, including UIC Class II wells. Chapter 1 (Oil and Gas Conservation) of Division 3 (Oil and Gas) of the Public Resources Code (commencing with Section 3000) governs oil and gas activities in the State. Chapter 1 establishes DOGGR as the principal state agency charged with regulating the drilling, operation, maintenance, and abandonment of oil and gas wells in the state. Public Resources Code § 3106 provides the State Oil and Gas Supervisor broad authority to protect public health and safety while ensuring the wise development of the State's oil and gas resources. Public Resources Code § 3013 provides broad authority to adopt regulations.

The State Oil and Gas Supervisor manages these activities on behalf of DOGGR as well as the operation, maintenance, and removal or abandonment of tanks and facilities attendant to oil and gas production. Public Resources Code § 3106 states that such supervision is "to prevent, as far as possible, damage to life, health, property, and natural resources; damage to underground oil and gas deposits from infiltrating water and other causes; loss of oil, gas, or reservoir energy, and damage to underground and surface waters suitable for irrigation or domestic purposes by the infiltration of, or the addition of, detrimental substances."

In regulating oil and gas activities and related facilities to protect the public and environment, DOGGR's regulatory powers include, but are not limited to: (1) issuing permits or approvals for oil and gas activities, such as the drilling or abandonment of wells; (2) investigating the environmental conditions and inspecting facilities associated with oil and gas activities and preparing related reports; (3) ordering and/or undertaking tests or remedial work; and (4) issuing enforcement orders for violations of applicable oil and gas law and permits or approvals.

Article 2.5 of the Public Resources Code (§§ 3130-3132) specifically relates the procedures for proposing aquifer exemptions to USEPA. . UIC wells are generally governed under Public Resources Code 3000 et seq. and the various implementing regulations under Title 14, Division 2, of the California Code of Regulations. The existing regulations include specific data requirements that an applicant must satisfy before DOGGR will approve an injection project). Project data requirements include engineering studies (including area of review determination and casing diagrams), geologic studies (including structural contour and isopach maps and reservoir characteristics), and injection plans (including identification of the proposed maximum anticipated surface injection pressure and proposed monitoring system or methods to ensure no damage is occurring)

In addition to regulatory requirements, DOGGR at times issues Notices to Operators (NTOs) regarding policies and information affecting oil, gas and geothermal operations. These notices are advisory only but are often used to make operators aware of new requirements. Examples of recent NTOs related to the UIC program include "Guidelines for Collection of Oilfield Water Quality Data", "Underground Injection Control Project Data", "Cessation of injection", and "Aquifer Exemption Compliance Deadline."

Approved injection projects are subject to additional filing, notification, operating and testing requirements throughout their operational lifespan (Title 14, § 1724.10). Among other requirements, DOGGR regulations provide that all piping, valves and facilities shall meet or exceed design standards for the maximum anticipated injection pressure and shall be maintained in a safe and leak-free condition (Title 14, § 1724.10, subd. (f)). Most injection wells other than those that inject steam are required to be equipped with tubing and packer (Title 14, § 1724.10, subd. (g)). Accurate operating pressure gauges or recording devices must be available at all times, and wells must be equipped for installation and operation of such devices (Title 14, § 1724.10, subd. (e)).

The operator must also perform tests to establish the maximum allowable surface injection pressure, perform tests to demonstrate ongoing mechanical integrity of the well, and maintain data to establish that no damage to life, health, property or natural resources is occurring by

reason of the injection project. (Title 14, § 1724.10, subds. (h), (i) and (j).) A chemical analysis of the injection fluid must also be made and filed with DOGGR. (Title 14, § 1724.10, subd. (d).) The SWRCB and nine RWQCBs play a role in both project review and approval in ensuring that injection will not adversely degrade underground sources of drinking water (USDW) that may otherwise have current and future beneficial uses. The RWQCBs are the state agencies with primary responsibility to protect surface water and groundwater quality. The SWRCB and the RWQCBs derive their authority primarily from the State Porter-Cologne Water Quality Control Act and, where applicable, the federal Clean Water Act and its implementing regulations. The Solid Waste Disposal Regulatory Reform Act of 1993 provides additional authority for the SWRCB and the RWQCBs to regulate the disposal of solid waste for the purpose of protecting the waters of the state.

The USEPA granted California primary enforcement authority (primacy) for permitting and regulating UIC Class II injection under Section 1425 of the Safe Drinking Water Act (SDWA) on March 14, 1983. This authority covers all lands of the state except those that are designated as Indian lands where the authority remains with USEPA Region 9. Currently, there are no Class II UIC wells on Indian lands in California. At the time of this peer review, DOGGR regulated a total of 1775 Class IID (produced water) wells, including 7 commercial wells, and 53,804 Class IIR (enhanced oil recovery) wells. Of the latter category, there were 6791 water flood wells, and almost all the rest were steam related wells, either cyclic steam or steam flood.

Administration, Staffing and Funding

DOGGR funds the UIC program with funds from a per barrel fee on oil production, described below. It also receives a small amount of funding from USEPA. However, the federal funds cover very little of the costs of carrying out DOGGR's responsibilities under the primacy agreement. The Class II portion of Fiscal Year 2018 USEPA UIC grant was \$528,000, for which DOGGR provided a 25% state match of \$176,000. The DOGGR budget for Fiscal Year 2018 is \$83,057,000 and includes 268 positions, of which 86 have at least some involvement with the UIC program. While DOGGR devotes substantial resources to the UIC program, at the time of our review they were not able to estimate the work years and dollars devoted to UIC activities. DOGGR is currently engaged in a planning exercise which when completed will allow them to better identify current UIC resources, costs and future needs. Since the funding levels available to USEPA for the UIC program have been essentially unchanged for the past 25 years, states have had to assume increasingly greater amounts of the total cost of running the UIC program. In California, this has resulted in the state providing the great majority of the funds needed to administer an effective Class II UIC program over and above the 25% match provided by the state

In addition to the USEPA grant each fiscal year (FY), DOGGR obtains funding from an annual assessment levied on oil and gas production in California. This assessment requires operators of oil and gas wells to pay a charge based on their annual production volume; at a uniform rate either per barrel of oil, or per 10,000 cubic foot volume of gas. Operators of underground gas storage facilities pay an assessment charge based on field capacity and number of wells rather than annual production volume. Operators currently pay roughly 50 cents per barrel to support DOGGR, the SWRCB and RWQCB, and California Air Resources Board oil related regulatory activity. This fee is adjusted each year to cover the annual budget approved by the state legislature for DOGGR. No other fees, such as for filing a permit application, are charged.

In the span of 8 years from fiscal year 2010, DOGGR's approved budget has increased to approximately 4 times previous levels. At the same time, 139 new positions were authorized. FY 18-19, DOGGR requested and received an additional 21 positions for field inspections and witnessing, and 6 additional enforcement staff from the state legislature. A substantial portion, but not all of the work to be done by these new employees will be related to the UIC program. At the time of this review, DOGGR had over 37 vacancies. However, detailed recruitment plans were in place with the aim of filling as many positions as possible within a reasonable time.

Interagency Coordination

DOGGR works closely with the Water Boards, which, as the legally responsible parties for the overall management of state water resources including groundwater and for solid waste disposal, play a major role in the review and approval of oil and gas related projects, including injection wells. There is an existing 1988 Memorandum of Agreement (MOA) with the SWRCB, which was revised, signed by both parties and became effective on July 31, 2018. This agreement more clearly defines the roles of both parties and requires Water Board concurrence in a project before it can move forward.

There is a three-step process to review a proposed UIC project. First, an operator must submit a UIC project proposal to DOGGR for review. Second, after DOGGR's review, the application is submitted to Water Boards staff to evaluate whether the proposed project is a threat to water quality. If Water Boards staff have no objection to the proposed project, DOGGR submits a Draft Project Approval Letter (PAL or draft permit) to the Water Boards for final review. The Water Boards may require additional protective measures such as limits on injection pressure, groundwater monitoring, or other mitigations to ensure that water quality is not degraded. Lastly, DOGGR then issues a final PAL. If an agreement cannot be reached between the agencies at normal working levels, the issue is escalated upward for resolution. While Water Board reviews will primarily focus on projects, they will be given the option of reviewing individual well permit applications if they choose to. It is anticipated that Water Board reviews

of individual well permits will occur infrequently.

DOGGR has always enjoyed an excellent relationship with the USEPA. This has included close contact with USEPA Region 9, including meetings on at least a monthly basis. Over the past 8 years, the Region has worked closely with DOGGR in helping to identify areas of the program which needed improvement and then coordinating with DOGGR on the state's Renewal Plan to address these concerns. Special emphasis has been placed on existing wells which needed to either be included in an aquifer exemption or else closed.

DOGGR has also been an active member of national organizations involved with groundwater protection and the oil and gas industry. These include GWPC and the IOGCC. Through these organizations, DOGGR has interacted with state agencies from across the country, USEPA Headquarters and Regional offices, environmental organizations and industry groups. This has led to a productive exchange of experiences and approaches, which has been helpful to DOGGR in building and refining their UIC program.

Changes in Program Activities since Primacy

Since primacy was approved, DOGGR has run the program with only minor regulation and programmatic changes. However, as noted above, in 2010, DOGGR requested an independent audit of its programs including the UIC program. The audit, which was arranged through USEPA, was conducted in 2011 by the Horsley Witten Group and identified several areas for improvement especially in the administration of UIC. On November 16, 2012, DOGGR provided a response to USEPA regarding the critiques raised in the audit. Following the discovery of permitting into nonexempt aquifers, DOGGR and the SWRCB provided an additional letter to USEPA on February 6, 2015. This letter identified a path forward to address issues that were noted in the audit, as well as how to bring the program more generally into compliance with the Safe Drinking Water Act. Subsequently, in October 2015, DOGGR developed a Renewal Plan with specific steps to address deficiencies noted in the audit. The Renewal Plan addressed four main issues; regulatory overhaul, new regulations for new realities, modernization of DOGGR's data management, and ensuring a high-quality workforce.

A key component of DOGGR's renewal plan is the overhaul of the underground injection control regulations. A discussion draft of proposed regulations was prepared, and based on comments received, has been revised and DOGGR is now proceeding with the formal rulemaking process. Specifically, the revisions address the following issues:

- Clarifying and strengthening standards to ensure "zonal isolation" of injection projects – that is, making sure that what is injected goes into and stays in the

proper geologic zone to protect groundwater.

- Strengthening and clarifying permitting and ongoing project data requirements for all underground injection control operations, including cyclic steam—in which a well is injected with steam to enhance oil production and then used to pump up oil.
- Strengthening and clarifying mechanical integrity testing requirements for all underground injection control operations, including cyclic steam.
- Establishing permitting and regulatory requirements for cyclic steam operations.
- Establishing a process and standards to determine maximum allowable surface pressure for injection operations.
- Defining key water quality protection criteria.

In furtherance of this effort, the California legislature passed Senate Bill 83 in 2015, which formalized a process for submitting aquifer exemption proposals to USEPA. These provisions can be found in Public Resources Code §3131. DOGGR and the SWRCB have provided regular compliance updates to the USEPA. These updates provide notification on the status ~~on~~ of Class II injection wells which may have been completed outside the boundaries of an existing exempted area. The compliance schedule includes developing aquifer exemption proposals for aquifers with enough data to merit exemption approval by the USEPA. Currently there are 30 such proposals that are in some stage of review by the State or USEPA. In addition, new bonding requirements took effect on January 1, 2018 which significantly strengthened DOGGR's ability to assure that wells were properly plugged. These provisions can be found in Public Resources Code §3204 and §3205.

Senate Bill 83 of 2015 also mandated the formation of an independent panel ("Panel") to evaluate the regulatory performance of DOGGR's administration of the Underground Injection Control (UIC) program and to make recommendations on how to improve its effectiveness. The Panel's scope includes evaluating both the regulations governing this activity and the implementation of those regulations. The Panel was instituted in spring of 2018. In accord with the Bill, it is comprised of a stakeholder group with representatives from public health, natural resources, scientific and academic research, environmental advocacy and environmental justice groups, the oil and gas industry, and agriculture. As directed by the Bill, the Panel is seeking and receiving input from the broader stakeholder community. As specified by the Bill, the Panel will consider resource needs and statutory or regulatory changes, as well as potential program reorganization, including the utility of transferring the Class II UIC program to the State Water

Resources Control Board. DOGGR has asked the Panel to include consideration of this review of California's Class II UIC regulation by the GWPC in its work.

Identified Strengths

- 1) DOGGR has demonstrated a strong commitment to improve the effectiveness of its program by enacting the oil and gas regulation renewal plan and idle well testing and management plan and by promulgation of new UIC regulations.
- 2) The Class II program staff is knowledgeable and experienced and demonstrates a high degree of technical competency. They have benefitted from the many years of relevant experience provided by DOGGR management.
- 3) The District Office structure has been designed to focus on the geologic and petrologic conditions present in various areas of the state.
- 4) The establishment of an enforcement unit in Sacramento will provide for more efficient coordination of compliance related actions.
- 5) The team approach to coordination of UIC activities helps ensure a more efficient process.
- 6) DOGGR is currently prioritizing the filling of vacancies and has held hiring fairs to fill vacant positions. This should provide a substantial increase in field staff.
- 7) The Department is currently in the process of seeking a new "Oil and Gas Engineer" state civil service job classification to allow for the hiring into entry level positions of college graduates with limited work experience. This would help DOGGR fill its vacancies and develop entry level staff for future leadership.
- 8) The funding mechanisms used to support the UIC program do not rely on taxes or the price of oil and gas. As a result, they help assure stable funding for the program.
- 9) DOGGR has substantially expanded coordination with the SWRCB and RWQCBs, as reflected by the new MOA, which has now taken effect. This will help ensure that water resources are protected, while reducing delays in review time.
- 10) DOGGR meets monthly with USEPA Region 9 representatives to discuss relevant issues, with a focus on aquifer exemption reviews, thus helping move the approval process forward.

Review Suggestions

- 1) It would be highly advisable for DOGGR and the Water Boards to consider consolidating the project tracking system so that they are using the same system for this process.
- 2) DOGGR may wish to consider conducting an inventory of wells by type and then formally assigning them a risk profile for prioritization of inspections, well tests,

file/project reviews etc., with a risk escalation process to also assure low priority wells eventually receive attention.

- 3) DOGGR needs to complete the current planning exercise, which will allow them to better identify the current resources devoted to UIC activities and future needs.

Part II Permitting and Compliance Review

Permit Application Flow and Review Process

The UIC permitting process is divided into two primary tiers. The first of these is the permitting or authorizing of the overall area of operation. This is referred to as a “project”. A project may contain as few as one or as many as a thousand wells or more. The project level is where the primary environmental reviews occur. These include the designation and evaluation of an AOR in the project, a determination of the maximum injection pressures and rates allowable within the overall project and an evaluation of the potential risk to groundwater posed by the project. During fiscal years 2015 through 2017, DOGGR received 103 project applications, and permitted 60 projects.

The second tier of permitting refers to the individual wells within a project. At this level each well is evaluated to assure that well drilling and construction meet the requirements of state regulation and mechanical integrity demonstration. DOGGR issues permits to drill, rework and abandon wells, as well as supplemental permits, which are essentially amendments to the original permits, in each category. Permits for wells located within approved projects must be acted upon by DOGGR within 10 working days of receipt and are typically approved within that timeframe. However, if the well review requires more than 10 days, the operator is issued a “letter of abeyance”, which halts the ongoing permitting process until identified issues are resolved. After resolution the permit process is continued, and the operator is provided with a permit upon completion of the review. During fiscal years 2015 through 2017, DOGGR issued the following permits:

- Drill –8862, Supplemental Drill – 2163
- Rework –9765, Supplemental Rework – 778
- Abandon –8606, Supplemental Abandon - 311

Each of these tiers (projects and well permits) has individual application requirements including public notices, checks for applicant qualification, financial assurance and others. While projects were not posted on-line as of the time of this review, project data became available on-line

with the third release of WellSTAR on October 28, 2018. individual well information is also posted on-line after the well is approved.

In addition to the application reviews conducted by DOGGR, Water Boards also are given the opportunity to review applications in accordance with the recently revised MOA between DOGGR and the SWRCB. In the case of project applications, the Water Boards will almost always participate. While the Water Boards may review requests to add individual injection wells to existing approved injection projects, it is likely that they will only choose to participate in such reviews when the addition of an injection well has the potential to exceed or change the scope of the existing project approval to which it would be added. Permit applications for individual wells are submitted to the DOGGR District offices and reviews are performed at that level, in addition to issuance of the permit.

Water Board reviews are performed by the RWQCBs, and initial discussion occurs between the DOGGR Districts and the RWQCBs. Final PALs are issued by the Sacramento central office of DOGGR after receiving concurrence from the SWRCB based on consultation with the RWQCB. Under the newly revised regulations, each injection well has its own individual approval to inject, and each injection well is also associated with an overarching approved injection project. Individual injection wells may gain or lose approval to inject without directly affecting the approval status of the injection project with which they are associated. Currently, PALs contain an automatic expiration date.

Project applications are very detailed, and the review and approval process can be lengthy, in many cases exceeding a year. It is anticipated that the new procedures negotiated between DOGGR and the Water Boards, as reflected in the revised MOA, should streamline the process and condense the approval timeframe to a matter of months. This includes frequent communication between the two groups throughout the entire review process.

Either the SWRCB or the RWQCB may submit comments recommending that DOGGR add provisions to a UIC project under review to address the SWRCB's or RWQCBs concerns pertaining to the protection or monitoring of water quality. This includes protecting water that is, or may reasonably be, used for any beneficial use, as well as aquifer exemption related conditions. The SWRCB and RWQCB may provide concurrence with a proposed project, or they may submit comments recommending that DOGGR either disapprove a proposed project or rescind an approval for a UIC project.

During the project phase, the designation and evaluation of an AOR around the project occurs, as well as a determination of the maximum injection pressures and rates allowable within the

overall project. Once these parameters have been established, individual well permits to drill and construct a well can be processed quickly if they fit within the approved project criteria. Each well is evaluated to assure that it does not cause any of the approved parameters to be exceeded. In addition, area permits are not used. Each well contributes toward the overall volume of the project, and its zone of endangering influence (ZEI) is reflected in the project AOR.

Conversions of existing wells are also treated the same as new wells, and all current requirements must be met. If a well application is consistent with the approved project, DOGGR policy is to process the permit within 10 working days but may take longer depending on the specific circumstances. Permits are effective for the life of the well, although they are subject to review when the overall project receives a periodic review. Wells must be drilled within 2 years of permit approval and while no formal authorization to inject is given, the well must pass a Part 1 mechanical integrity test prior to injection and a Part 2 mechanical integrity test within three months of beginning injection.

Applications may be submitted either electronically or in hard copy paper form. Paper text applications are submitted to the respective District offices, where they are date stamped by the front office receiving clerk. As of late April 2018, when WellSTAR 2.0 went live, operators can now log on and submit their injection project applications electronically. Operators still have the option to submit a hard copy of their application, in which case DOGGR personnel enter the information into the database. The applications are then passed along to a District office engineer for review.

For UIC projects, whether new or the modification or periodic review of an existing one, the DOGGR District office forwards a copy of the application material to the RWQCB for review to ensure protection and monitoring of water quality measures are in place when necessary. This includes the project data requirements as listed in California Code of Regulations (CCR) Title 14, §1724.7. DOGGR also can require, when appropriate, any additional data pertinent and necessary for proper evaluation of a proposed project in accordance with CCR Title 14, §1724.6.

With the implementation of WellSTAR, a series of tasks will be generated and assigned to the appropriate District office staff member. This is usually an Associate Oil and Gas Engineer or Geologist. In WellSTAR, an application is not considered complete until all fields have been filled in. If the operator has not completed all fields, the remaining ones can be filled in by DOGGR staff if the information is available. The documents are then reviewed to ensure that all the documents required for an underground injection project are submitted in accordance applicable project data requirements.

Applications for projects and permits are tracked by the appropriate District office. Each project has a tracking sheet which shows progress and an estimated time to complete. It is anticipated that eventually timelines for milestones or targets will be developed based on experience and will utilize WellSTAR for this purpose. At the same time, the Water Board also tracks their review through a separate system. At present there is no agreement for the Water Board to use the same tracking system as DOGGR, and adoption of the WellSTAR system for this purpose by the Water Board would require additional funding.

If an application is determined to be incomplete, additional information is requested via phone, email, letter, or a combination thereof. Notices are officially provided to the company agent who submitted the application, with the technical contact informally copied. With the implementation of WellSTAR, document/data input milestones within WellSTAR will automate much of the application “completeness” checking for the operators by indicating if project data requirements have not been met. Currently, there is no time limit given to the operator to reply and submit the requested information. All applications for projects or permits are suspended until the operator responds. For a well permit application, the statute provides that if operations have not commenced within 24 months after DOGGR receives the application, the application shall be deemed cancelled. Since project applications are assigned a permanent project number upon receipt, under WellSTAR, the application and associated data will become public and will be kept by DOGGR. If denied, that application data may help or apply to current, future or offset UIC projects. (See Part V Data Management for further information concerning WellSTAR)

Technical reviews of applications are normally performed by associate engineers, with a secondary review performed by a senior engineer. Each associate engineer must have at least 4 years of experience, and senior engineers must have 5 years, including at least 2 years as an associate engineer. The final permit is then signed by the District Deputy, or their designee, who is at least a senior oil and gas engineer. Each District Deputy is required to be a competent engineer or geologist, preferably licensed in the state, experienced in the development and production of oil and gas with at least 2 years’ experience as a senior engineer or 5 years broad oil, gas or geothermal experience.

Site reviews are not normally conducted as part of the project permit review process but may be conducted to address specific concerns. For instance, a CEQA review conducted during the project phase may provide an in-depth assessment of local conditions that would be relevant to a permit application, and if significant problems are identified could lead DOGGR to conduct a site review. There are currently 7 commercial wells permitted in California, and the review process for these wells is the same as for any other well, except for an increased bonding

requirement along with a requirement for injected fluids manifests. The manifests are kept on-site and are sometimes reviewed by a District Engineer during a visit to the facility. If necessary, other operational restrictions could also be added on a case-by-case basis.

Applications for a permit modification are treated the same as a new well application, except that substantial changes to the project would require a new public notice. Determinations as to what constitutes a substantial change are somewhat subjective but include significant increases in injection pressures, changes in the injection zone, or significant changes in injection fluid or other changes that could result in the need to modify the conditions of project approval. Changes that do not increase important project parameters, such as volume, are normally considered minor, as is the addition of a few wells to a large project.

Operators who fail to comply with a DOGGR enforcement order or fail to pay assessment charges can be placed on a proposed well deny operations list in accordance with Public Resources Code §3203. This does not affect project approvals but does impact individual well permits, where the authorization to inject could be withdrawn. The operator would then need to reapply for the authorization to inject once the violations were corrected.

There have been very few appeals of permitting decisions, and as such, no formal appeal procedures have been established. While DOGGR orders can be appealed through a formal administrative process, a permitting decision would likely need to be pursued through civil court proceedings. If objections are raised to a permit application, a public hearing could be held.

Upon completion of a project, paper files have previously been maintained. DOGGR is currently scanning these files and they will be archived in WellSTAR. Once scanned, most paper files will be disposed of.

Technical Aspects of the Permit Review Process

The primary objectives of the technical aspects of the review process within the AOR are to identify the depth of the lowest USDW and beneficial waters, evaluate well construction, and assign operating specifications. An extensive checklist has been developed to help guide DOGGR staff and operators through the technical review process.

Historically, DOGGR's primary regulatory concern was to protect water in zones above the "Base of Freshwater" (BFW), defined as the lowest extent of water with a TDS of 3000 mg/L or less. Because the sections regarding injection wells in the California Public Resources Code (PRC) predate the Safe Drinking Water Act (SDWA), the term USDW was not found in then-

current state law. Despite these regulatory shortfalls, DOGGR's "Section 1425" program effectiveness demonstration and resultant primacy agreement with USEPA reflected a commitment to meet the objectives of the SDWA. However, critiques from an audit requested in 2010 and conducted by the Horsley Witten Group suggested that this regulatory practice was not sufficient to comply with the SDWA. Senate Bill 83, enacted in 2015, addressed this lack of compliance.

With the enactment of Senate Bill 83, DOGGR now recognizes three types of defined waters for their technical review of UIC projects: the historic BFW (TDS of 3000 mg/L or less); the deepest USDW (TDS of less than 10,000 mg/L); and waters suitable for irrigation, industrial, and domestic purposes ("beneficial waters"), which may have a TDS of 10,000 mg/L or more. The identification of the BFW is continued to assist in recommendations during the aquifer exemption process; aquifers with a TDS of 3,000 mg/L or less are excluded from consideration for aquifer exemption. The category of "beneficial waters" was added after the Horsley Witten audit to protect waters that may not be protected as a USDW, but which still have use in agriculture and industry.

During the technical review process, DOGGR is responsible for identifying and protecting all USDWs which are 10,000 TDS or less. To determine the location and depths of USDWs and "beneficial waters" in the UIC project area, DOGGR obtains significant information from the SWRCB through a memorandum of agreement (MOA) that was originally made in 1988 and updated in 2018. This data may be supplemented by information from one or more of the nine RWQCBs. Additional information is also obtained from operators and existing databases. DOGGR and SWRCB collect depths and water quality data to recommend what waters should be protected. The SWRCB collect and maintain records on the local municipal water quality data. The SWRCB and the California Geological Survey (CGS) are endeavoring to map the USDW and "beneficial waters" for the entire state.

DOGGR requires fluid analysis of water zones within the project area and, if needed, water analysis of drinking water supply wells within the project area. DOGGR has well-developed operator guidelines for sampling through a system of NTOs. Operators are guided in their collection of oilfield water quality data by the Amended NTO 2018-02, published June 28, 2019, entitled "Guidelines for Collection of Oilfield Water Quality Data." Sampling procedures are required to be consistent with:

- 1) the American Petroleum Institute (API) Recommended Practice 44, Sampling Petroleum Reservoir Fluids;
- 2) API's Recommended Practice 45, Analysis of Oilfield Waters; and

3) DOGGR's Quality Assurance Program (QAP) for Class II Fluid Sampling and Analysis, dated August 14, 1986.

To ensure that injection fluids are confined to the approved injection zones, well construction is engineered based on the geologic conditions present in the UIC project area. The applicant is required to submit an engineering and geological study which provides data on geologic structure, faults, fractures, and/or fissures. Injection zone reservoir characteristics such as porosity; permeability; average thickness; areal extent; fracture gradient; original and present temperature and pressure; and original and residual oil, gas, and water saturation are required. Additionally, each injection zone reservoir fluid must be characterized by gravity and viscosity of the oil, water quality, concentration of non-hydrocarbon components, and specific gravity of gas. The geological studies also include isopach maps of all injection zones, electric logs to a depth below the deepest producing zone, and identification of all hydrocarbon zones. These geologic factors are taken into consideration when engineering the construction of the project area.

Operators and DOGGR report, store, and share data regarding UIC projects using the WellSTAR data management software program. Operators also have the option to allow laboratories to report sample data through WellSTAR. If information regarding UIC projects is submitted by operators or labs by some other method (usually paper reports), this data is subsequently entered in WellSTAR by DOGGR staff. At the time of review, most of the legacy systems that DOGGR has used have been migrated to WellSTAR. This data can be view by SWRCB, DOGGR, operators, and the general public. Data collected and stored by the SWRCB utilizes other data management systems to the exclusion of WellSTAR.

The regulatory focus for the UIC program is based on the premise that injection fluids must always be confined to the permitted injection zone(s). DOGGR generally approves well construction based on site specific data. However, DOGGR's historic approach to well construction was guided by two regulatory requirements: 1) ensure that the zone(s) above the Base of Freshwater (BFW) was protected by cemented casing; and 2) ensure injection fluids remain confined to the injection zone by requiring enough cemented casing (typically 500') above the injection zone(s) to prevent upward migration of injection fluids. DOGGR's well construction requirements are the same for commercial and private Class II wells. Furthermore, if existing Class II wells do not meet the current construction standards, operators are required to modify the wells to comply with those construction standards.

California Code of Regulations § 1722.4 requires that the annular space of intermediate and production casing, if not cemented to surface, be cemented to at least 500' above: 1) oil and gas zones and 2) anomalous pressure intervals; and 100' above the BFW. DOGGR has the authority to require testing of cement jobs. A cement bond log (CBL) is used to determine the

quality and effectiveness of the casing cement job. If a CBL is not available, DOGGR uses volumetric calculations to determine the extent of the cemented zone. Typically, DOGGR would require casing pressure tests and CBL's on wells with overlapping casing strings. If the cement volume is calculated to be insufficient, DOGGR can require additional testing.

DOGGR has the authority to witness a blowout prevention equipment (BOPE) test, casing pressure test, and cement and mudding operations. A BOPE test is required before the casing shoe is drilled out. A standard annular pressure test (SAPT) is also required before commencing injection. Regulation §1724.1 requires operators to submit to DOGGR copies of well summary; core records; all electrical, physical and chemical logs; tests and surveys; and mud log, within 60 days after completion of the work.

Currently DOGGR does not have specific USDW cemented casing requirements, although new regulations under development, would require cemented casing from the base of the lower-most USDW/BFW to one hundred feet above the waters to be protected. For enhanced oil recovery wells, two strings of casing cemented through this same zone could be accepted in lieu of tubing and packer, subject to Division approval that it constitutes a technical equivalent to the packer that will isolate the production tubing from the inside of the casing.

Exceptions to the general well construction requirements are granted in cases where the existing well has a slim hole construction, or when the geological formation tends to slump, causing shearing of the well casings. In these situations, DOGGR waives the tubing and packer requirements. Slim hole construction is no longer permitted for new wells.

DOGGR no longer allows for dual completion wells that include both injection zones and production zones. Few of these types of wells were constructed in the past and are no longer in operation.

In addition to the casing, tubing, and packer requirements, DOGGR requires that all piping, valves, and facilities shall meet or exceed design standards for the anticipated maximum injection pressure (MIP), and shall be maintained in a safe and leak-free condition. Determinations of the MIP and maximum injection rates (MIR) are determined using step-rate-testing. This test determines the fracture gradient of the reservoir. The MIP is limited to 95% of the determined fracture gradient. The MIR is limited to the injection rate used during the step-rate-test. Prior to the start of injection, each injection well is pressure tested to the Maximum Allowable Surface Pressure (MASP). Injection above the MASP is not allowed.

DOGGR requires the operator to submit water samples of the injectate and the fluids in the injection zones in accordance with CCR Title 14, §1724.7.2(a). Liquid analysis required under this article includes testing for all of the following: total dissolved solids; total petroleum

hydrocarbon as crude oil; major cations (Ca, Mg, Na, K, Fe, Mn, Sr, B); major anions (Cl, SO₄, HCO₃, CO₃, Br, I); total alkalinity and hydroxide; electrical conductance; pH; and temperature (Amended NTO 2018-02 issued June 28, 2019). The use of geologic cross sections, contour maps, isopachs, and other geologic/engineering data are also used to ensure injectate confinement.

Area of Review (AOR) Consideration and Procedures

Before the use of project areas was widespread, DOGGR managed technical reviews of injection wells using a fixed ¼ mile radius AOR around individual wells as a standard for technical reviews. More recently, the well AOR has also been determined using the calculated distance encompassing within and beyond the intended injection zone to which the pressures or temperature in the intended injection zone may cause the migration of fluid. Most commonly referred to as the Zone of Endangering Influence (ZEI), a modified Theis equation is used, to make the AOR calculation, and/or other equations included in the USEPA's publication *Radius of Pressure Influence of Injection* (EPA-066/2-79-170). A fixed ¼ mile radius is used until data is available to an AOR using the ZEI calculation.

DOGGR now primarily manages technical reviews of injection activities in groups of one to many wells called projects. With this two-tiered approach, the term AOR can be used in reference to an individual well or a whole Project Area, though the term "project" or "project area" is also used as to mean the AOR of the project.

A project is an area that could contain as few as one well or as many as a thousand or more wells in an injection operation. The project areas (project AOR) are determined by:

- a default buffer distance around an entire project area;
- multi-well streamline models which calculate the migration of the injection fluid in the formation;
- a composite of individual injection well AOR's combined to make one larger area; or
- some other method deemed appropriate by DOGGR staff.

DOGGR takes in account the proposed injection activities and the geologic setting to calculate the AOR. Throughout the life of the project, as more data is collected, the AOR can be recalculated. When the calculation indicates that a smaller AOR is appropriate, the permissible radius or buffer can be less than ¼ mile.

After determining the project AOR, the operator identifies wells within the AOR drawn from public records or otherwise known to the operator. Wells within the area that penetrate the injection zone(s) are evaluated to determine if the construction is sufficient to prevent

migration of injection fluids out of the permitted injection zone(s). These wells are required to have cemented casing or a concrete plug at least 500 ft above the oil and gas zones sufficient to prevent flow of formation fluids into zones containing beneficial waters, USDW, or into “zones of freshwater” as per California Code of Regulations Title 14, §§ 1723 et seq., 1745 et seq. DOGGR considers this requirement to generally be the equivalent to the zone of injection. In addition, plugs are tested in the field to ensure they are competent.

DOGGR does not address the USDW based on current plugging regulations, but new regulations are being developed. The current standard requires that a cement plug shall be placed to extend from the total depth of the well or from at least 100 feet below the bottom of each oil or gas zone, to at least 100 feet above the top of each oil or gas zone. Plugged and abandoned wells within the AOR must 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 oil and gas zone. 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 injection.

If corrective action is required on wells within the proposed UIC project area, permits are allowed with restrictions based on corrective action requirements. These corrective action requirements are listed as a Condition of Approval (COA) in the PAL. DOGGR requires that whenever possible, an operator must correct construction of the inadequate well(s) within the AOR. If construction cannot be remediated for these well(s) and plugging is not possible, DOGGR may allow a monitoring well program as a corrective action alternative or provide for a no-injection buffer or injection restrictions around the identified inadequately constructed or improperly plugged well(s). The static pressures of the injection zone(s) must be provided, and hydrostatic pressures are monitored. The operator may be required to consult with the Water Boards if groundwater monitoring is a required part of the injection project.

Induced Seismicity Considerations

California has historically had injection activities in parts of the state where seismic activity has occurred. DOGGR contracted the Lawrence Berkeley National Laboratory (LBNL) to study oil field related injection induced seismicity at one site in the southern San Joaquin Valley. While the study reached a conclusion that there is no relationship between periods of net injection in most of the oilfield areas and seismicity, it is important to note that the conclusion relates only to that field and not the entire state.

The result of the study was a paper entitled *Regional and Site Specific Analysis of Spatio-temporal Relationships between Fluid Injection Associated with Oil Production and Induced*

Seismicity in California. The following is an excerpt from the study that summarizes the conclusion that there has been no definitive evidence that oilfield injection as resulted in induced seismic activity in the field that was studied.

“The conclusion from the time correlation analysis is that there is no apparent relationship between periods of net injection in most of the oilfield areas and seismicity, except possibly in the Valy pool of the Tejon Western area between 1981 and 1987. The variation in seismicity rates for this and the oilfield areas based on the available earthquake catalog are considered to be too small to allow meaningful quantitative cross-correlation analysis. The correlation between net injection and increased repeater activity associated with the Tejon Western area is weakened by the fact that less than half of the repeater events are located at depths less than 10 km. Furthermore, a feasibility assessment based on the stratigraphy underlying the Valy pool indicates that it is unlikely pressure changes caused by injection would have propagated to the depths of even the shallowest events in the candidate sequence. This does not preclude the possibility that at least some of the events could have been induced by remote stress changes resulting from the pyroclastic response to the net volume change in the pool. The results of the demonstration application of the methodology to a relatively small area of the San Joaquin Basin are not necessarily indicative of the potential for fluid-induced seismicity within the other parts of the San Joaquin Basin or in other oil basins in California. A variety of factors, including geologic structure within oilfields, the seismogenic potential of faults, and injection and production practices, that can influence the likelihood of induced seismicity may be substantially different from those in the demonstration area, particularly at oilfields in western and southwestern California.”

Currently, DOGGR does not require an applicant to report or to monitor for induced seismicity. However, seismic safety is an important issue to DOGGR, so they have developed a new approach to track possible seismic activity related to injection. Under this approach, DOGGR will rely on earthquake data published by the United States Geological Survey (USGS) and the CGS. DOGGR has developed a mechanism to access the data stream from USGS and CGS which will enable DOGGR to monitor for earthquake activity on a near real-time basis. DOGGR will accumulate a database of noted earthquake events that will allow for geographic analysis designed to look for potential correlations with UIC and well stimulation activity captured by WellSTAR. This will involve developing a linkage to several different databases, and work has already begun on this task. DOGGR’s goal is to fully implement this new system by the summer of 2019.

CGS and DOGGR are both part of the Department of Conservation and are housed in the same headquarters building, enhancing coordination and information sharing between them. CGS also broadcasts notable seismic events on the “Shake Cast” system which alerts DOGGR immediately via email.

Administrative Aspects of Permit Application Review

In California, most public involvement in the UIC permitting process typically occurs during the project phase. The CEQA statute requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. DOGGR’s CEQA unit works to ensure compliance with the CEQA and to conduct CEQA reviews in the most effective and efficient manner possible. The CEQA unit coordinates with DOGGR programs, local jurisdictions, state and federal agencies, and the public. Staff also assists operators in avoiding or reducing environmental impacts from the development of oil, gas, and geothermal resources in California.

CEQA requires state and local public agencies to identify the significant environmental impacts of their actions, and to avoid or mitigate those impacts where possible. CEQA serves to:

- Inform decision-makers and the public about potential impacts to the environment
- Prevent or reduce environmental impacts
- Promote inter-agency cooperation
- Encourage public participation in the process
- Disclose public agency decisions

In most instances, a CEQA review is conducted by the local land use authority in connection with the conditional use permit authorizing oil and gas production operations. For example, in Kern County, in connection with revisions to its land use ordinances, the County conducted project-level CEQA review addressing oil and gas production operations throughout the county. Therefore, DOGGR is generally a responsible agency relying upon environmental review conducted by the local agency to ensure compliance with CEQA.

DOGGR routinely solicits input from all interested members of the public, and particularly welcomes comments from the residents of communities situated near oil and gas operations. It is DOGGR policy and practice to publish a notice in a regionally available newspaper inviting public comment regarding each request for approval of a new underground injection project or for approval of substantial changes to an existing underground injection project.

Once DOGGR's technical review of the project has been completed, this public comment period is initiated. This includes a three-day notification posting in a local newspaper by the operator, followed by a waiting period for public comments of 15 days. Concurrently, the operator is required to notify offset operators of the proposed action. However, there is no requirement to notify nearby landowners or to provide any other form of public notification, such as posting the proposed action on the DOGGR website. Regardless, WellSTAR will be accessible to the public via DOGGR's website, although links to projects at a specific location have not yet been established. If there is a significant change to the project after the comment period, or a significant error in the notice, then a re-posting of the notice would be required. This might include an item like a change in the township/range/section location.

If significant public comments are received during the 15-day comment period, a decision is made on whether to hold a public hearing, which would be held at an appropriate location within the local District. This decision would normally be made by the State Oil and Gas Supervisor or the local District Deputy. A key factor in making that decision would be whether the commenter is likely to be directly affected by the proposed project.

If a public hearing is held, it is a formal hearing with transcripts. Attendees are invited to make oral comments at a lectern and/or provide written comments within the public comment period. Transcripts of oral comments are combined with all written comments, and then are reviewed and summarized by the Office of Legislative and Regulatory Affairs (OLRA) and then forwarded to District staff to prepare written responses which are reviewed by the Department of Conservation (DOC) Legal office.

Depending on the interest shown in the project, DOGGR could post the summary of comments of a public hearing on their website, however, there is no specific policy on that subject, and web posting would be decided on a case-by-case decision. For hearings on a proposed aquifer exemption, relevant documents and the application are posted throughout the process. In addition to the formal portion of the public hearing, DOGGR staff may also make themselves available to answer citizen's questions informally in conjunction with the hearing.

DOGGR seldom receives comments on proposed projects and it is very rare for a public hearing to be requested. This is considered to be a result of the extensive CEQA process which occurs prior to an application being filed. Accordingly, DOGGR has no current plans to extend the public comment period beyond the current 15 days, or to place notices on the DOGGR's website. While there is a complaint process established by PRC § 3235, no specific procedures have been established, as there have been very few complaints related to proposed projects.

Financial assurance requirements do not apply to the approval of a project, but rather to the implementation of a project which occurs when individual wells are permitted. In the 2011 audit of the DOGGR program some potential issues relative to financial assurance were identified. At that time, individual bonds were normally released after a noncommercial injection well had injected fluids for a six-month continuous period if DOGGR was satisfied that the well was mechanically sound. Blanket bonds were not normally released until all the operator's wells were abandoned or until the operator specifically requested the release of a well from bond coverage. However, this release only occurred after the well was demonstrated to be mechanically sound following six months of continuous injection. In addition, the amount of bonds required for each well in 2011 was viewed as potentially inadequate to cover all plugging and abandonment costs.

After the release of a bond, DOGGR still had the authority to order an operator to perform remedial or corrective work on a well. If the operator failed to perform the required work, DOGGR could enter the property and perform the necessary work. The expenditures constituted a lien against the owner or operator's real or personal property. DOGGR could also order the abandonment of any well that had been deserted whether any damage was occurring or threatening to occur.

Actions have now been taken to provide greater assurance that wells can be properly plugged and abandoned. New statutes effective on January 1, 2018 closed the gap in bond coverage and increased the bond amounts. Bonds are not released until a well is properly plugged and abandoned. For individual wells, a bond of \$25,000 applies if the well is less than 10,000 feet deep. The bond increases to \$40,000 if the well is 10,000 or more feet deep. Commercial wastewater disposal wells require a bond of \$100,000. If 20 or more wells are applied for at one time, an operator may choose to use a blanket bond instead. Required amounts for blanket bonds are as follows:

- \$200,000 for 50 or fewer wells in the state
- \$400,000 for 51 to 500 wells in the state
- \$2,000,000 for 501 to 10,000 wells in the state
- \$3,000,000 for more than 10,000 wells in the state

These new statutory requirements apply not only to newly drilled wells, but also to existing wells whenever any sort of re-work action occurs. Wells also become subject to the new regulations if a change in ownership occurs. It is estimated that 99% of all UIC wells will now be subject to these new requirements. A further strong point of the bonding program is the ability, which is included in statute, to increase the required bond amount for operators who

have shown a pattern of non-compliance. This option has been used in a few cases to date.

Aquifer Exemptions

Under the Federal SDWA, aquifers or portions of aquifers which qualify as a USDW may be exempted from protection under the UIC program if certain criteria are met. These criteria are listed in Title 40 Code of Federal Regulations (CFR) 146.4. Under this regulation the USDW must meet the following requirements for exemption:

- “(a) It does not currently serve as a source of drinking water; and
- (b) It cannot now and will not in the future serve as a source of drinking water because:
 - (1) It is mineral, hydrocarbon or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible;
 - (2) It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical;
 - (3) It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or
 - (4) It is located over a Class III well mining area subject to subsidence or catastrophic collapse;or
- (c) The total dissolved solids content of the groundwater is more than 3,000 and less than 10,000 mg/l and it is not reasonably expected to supply a public water system.”

When DOGGR received primacy from the USEPA for the Class II UIC Program in the early 1980s, certain USDW aquifers were designated exempt based on pre-existing data. Over the following decades, limitations inherent to the data the Division and the USEPA relied upon to make those determinations in the early 1980s contributed to instances of injection being approved into some aquifers or portions of aquifers that fit the criteria of a USDW but that had not been formally designated exempt.

In late 2011, a Senior Engineer at DOGGR made the discovery that the Memorandum of Agreement displayed on DOGGR’s website (MOA1) was inconsistent with the agreement that appeared in the internal manual of instruction (MOA2). Eleven aquifers which had been designated as exempt in MOA2 were non-exempt in MOA1; their exempt status thus depended on which agreement was considered valid. DOGGR informed USEPA of the discrepancy between the two versions of the agreement in 2012. USEPA’s investigation concluded that MOA1 was the valid version and the eleven aquifers in question should not be treated as exempt. In response to this conclusion, DOGGR and USEPA agreed that DOGGR would identify

all the wells injecting into non-exempt zones and urge oil operators in those zones to begin the process of applying for an aquifer exemption. The response plan also included a review of all wells injecting into non-exempted aquifers using a risk management profile based on the following classification scheme from highest risk (Category 1) to lowest risk (Category 3):

- a. Category 1 Wells: Class II produced water disposal wells injecting into non-exempt, non-hydrocarbon-bearing aquifers or the 11 aquifers historically treated as exempt
- b. Category 2 Wells: Class II enhanced oil recovery (EOR) wells injecting into non-exempt, hydrocarbon-bearing aquifers
- c. Category 3 Wells: Class II produced water disposal and EOR wells that are inside the surface boundaries of exempted aquifers, but that may nevertheless be injecting into a zone not exempted in the primacy agreement

Since 2014 the Division, the USEPA, and the State Water Resources Control Board have developed a plan to address wells injecting into non-exempt aquifers. The wells injecting into nonexempt aquifers have been identified, categorized by type (water disposal or enhanced oil recovery), and prioritized by the relative risk the injection wells pose to existing water supply wells. Some injection wells were found to pose an immediate threat and, as a result, the Division either ordered the wells shut in or obtained permit relinquishment for 23 of the thousands of wells reviewed.

In 2015, the State estimated that there were approximately 50,000 class II injection wells located throughout California. Of the 50,000 class II wells that were identified, the State found that 5,625 injection wells in 75 fields warranted further review. Shortly thereafter, the Division adopted regulations establishing a compliance schedule. In the initial stages of this compliance schedule, the State found that 155 wells were injecting into aquifers with no hydrocarbons and less than 3,000 TDS. All 155 of these wells have since been brought into compliance with the SDWA.

A component of the compliance plan required that the Division reach out to operators with injection wells in non-exempt aquifers, providing them with an opportunity to prepare technical proposals to support exemption of those aquifers under State and federal law. In considering those proposals, DOGGR has worked closely with the Water Boards in determining the relative threat posed by these wells and whether an aquifer exemption is appropriate for

them. An application to exempt an aquifer is first reviewed by DOGGR and then forwarded to the RWQCB. The RWQCB's evaluation of exemption applications addresses the following questions:

- Are there any current or potential future beneficial uses of the groundwater at issue?
- Will injection affect the quality of water that is, or may reasonably be, used for any beneficial use?
- Will the produced water injected back be contained in the exempted area?

If both DOGGR and SWRCB staff concur with the aquifer exemption proposal, the proposal is then public noticed and if appropriate subject to a public hearing. The application and supporting documents are posted on the Department's website when the notice of public hearing is issued. The aquifer exemption package, including any public comments, is then sent to USEPA for evaluation and final approval. Once the package is determined by USEPA to be complete, they have normally provided a decision regarding approval within 40 to 60 days.

On May 23, 2018, DOGGR advised USEPA of progress made in addressing wells which needed an aquifer exemption. All the wells previously injecting into USDWs where there is not enough data to apply for aquifer exemption have been shut in and DOGGR has secured voluntary relinquishment of their permits from the operators.

DOGGR continues to work in coordination with the Water Boards to develop aquifer exemption proposals, which are then forwarded to USEPA for review and approval. As of May 2019, the USEPA has approved sixteen aquifer exemption applications. They are: Arroyo Grande; Edison Phase 1; Lost Hills; Fruitvale; Round Mountain; Tejon; Mount Poso; Jasmin; Kern Front (Vedder); San Ardo/McCool Ranch; Elk Hills Phase 1; Elk Hills Phase 2; Poso Creek; Kern Front (Chanac); Cymric; and McKittrick. These represent about 52% percent of the aquifer exemption applications. An additional four applications have been submitted and are pending approval by the USEPA.

Since the adoption of the new aquifer exemption procedures by DOGGR and the Water Boards, only one request was identified for a new well. The request was for the expansion of an existing aquifer exemption in Monterey County.

Periodic File Review Process

In addition to the review of projects potentially needing an aquifer exemption, in 2014 the Division also launched a project-by-project review of all underground injection projects. This review is a Division-wide effort to bring more uniformity to UIC program management and recordkeeping and will ensure that all projects have the appropriate data on file for effective regulatory oversight.

The review is proceeding in two phases. The first phase of the project-by-project review includes inventory, prioritization, and file reviews of all active UIC project files to identify data or documentation deficiencies. The second phase is intended to ensure the project meets standards, to address any issues identified with the project, and will include a detailed review and evaluation of completed project files. The second phase will be conducted in cooperation with the Water Boards. The major milestone for project-by-project review in 2018 was the development of a Memorandum of Agreement that outlines the review roles and expectations for the Water Boards and the Division.

If additional conditions or reporting requirements are identified as necessary during the review, new PALs will be required. Finally, after the project-by-project review has been completed, subsequent reviews will take place periodically, but not less than once every three years.

An extensive checklist has been developed to help guide DOGGR staff and operators through the review process. This checklist will also be used for new projects. The main goal is to ensure that all District office project data is complete and to request any missing data from the operator. DOGGR staff may also meet with operators to ensure projects are operating in accordance with the project parameters.

The checklist includes detailed processes to determine a variety of parameters regarding the project, including formation fluid quality; AOR; geologic setting, engineering study, & injection plan. Changes in the project may necessitate the recalculation of the AOR to determine if it needs to be adjusted or if there should be a modification to injection and operating specifications, such as maximum injection rates (MIR) and maximum injection pressures (MIP).

All data collected during the initial review and subsequent periodic reviews recorded in WellSTAR and made available for review by other DOGGR staff, the Water Boards, and operators.

Identified Strengths

- 1) The project/ individual well permit structure is a good management tool to assure better management of larger areas with multiple wells.
- 2) The peer review team commends DOGGR for elimination of existing production/injection dual completion wells, and the ban on future dual completion wells.
- 3) The statewide USDW map currently under development will be highly beneficial in managing the Class II UIC program.
- 4) The significant level of detailed technical data used to describe the geologic setting of the project is a program strength.
- 5) The review team commends DOGGR for utilizing step-rate tests for all UIC project areas.
- 6) The working relationship that has developed between DOGGR and the SWRCB in identifying waters to be protected is commendable.
- 7) DOGGR has well developed sampling guidelines for operators.
- 8) For well conversions, DOGGR requires that wells be brought up to current construction standards.
- 9) Based on the large variability of the geology, the review team commends DOGGR on the variety of analytical methods used to determine the AOR.
- 10) The review team commends DOGGR on providing the option to use monitoring wells for corrective action within an AOR when remediation is not possible.
- 11) The review team commends DOGGR for its efforts concerning seismic safety. The new system of coordinating with USGS and CGS will help provide a quick response to injection related seismic events and their effect on the oilfield operations and will assist in the study of connections between injection activities and earthquake events.
- 12) The CEQA process, which includes extensive local involvement, helps educate the public regarding proposed projects and thus simplifies the public participation process for all involved.
- 13) DOGGR can require increased bonding based on a pattern of non-compliance.
- 14) New bonding regulations have significantly strengthened ability to properly close wells.
- 15) DOGGR and the Water Boards have placed a very high priority on resolving the status of all wells which had been injecting into aquifers which needed, but did not have, an aquifer exemption.
- 16) Conducting periodic reviews of all injection projects will strengthen DOGGR's oversight of injection activity, and progress is being made in accomplishing that goal. The review checklist for file reviews is a major tool to help organize and streamline that process.

Review Suggestions

- 1) When appropriate, DOGGR may want to consider issuing “Authorization to Inject” (ATI) letters to ensure adequate documentation exists for approvals given to operators to begin or resume injection operations and so that injection is in accordance with DOGGR regulations. One option would be for DOGGR to utilize ATI letters following the initial SAPT following the initial drilling and construction and also for following reworks and/or instances after repairs that would occur following a notification of loss of mechanical integrity.
- 2) DOGGR should consider establishing a timeline under which they would hold pending applications and then returning/canceling them. In addition, perhaps charging a fee to file a permit application might discourage the filing of applications which are unlikely to proceed.
- 3) DOGGR should consider creating criteria for major vs. minor permit modifications to assure consistent application of regulations.
- 4) To improve transparency, DOGGR should consider placing more information on projects on-line where it can be readily accessed by the public. WellSTAR could be utilized to accomplish this objective.
- 5) DOGGR should consider utilizing existing well records from domestic and commercial water wells, injection wells, oil and gas wells, etc., in the UIC program study area and any existing logs to develop the USDW depths in areas that lack mapping.
- 6) The review team suggests that DOGGR and the Water Boards consider utilizing the WellSTAR system for collecting technical data.
- 7) The state should continue to take steps toward the development of USDW maps and depths across the state and publish these as soon as practical.
- 8) DOGGR should ensure that any new proposed plugging regulations require plugging with cement below the base of USDWs.
- 9) The review team suggests that there be a specific distance below the base of the lowest USDW beyond which injection fluids cannot be allowed to rise in an inadequately constructed or improperly plugged well within the AOR of an approved project.
- 10) The review team urges DOGGR to continue to place priority on the implementation of the new Shake Cast system of coordinating with USGS and CGS on seismic data, since the relationship between seismic events and injection has only been studied to date in one field in the southern San Joaquin Valley.
- 11) DOGGR should proceed with posting all notices related to a project or permit on their website through the full implementation of WellSTAR.
- 12) DOGGR should consider extending the public comment period for proposed actions to 30 days to provide better public access.

- 13) DOGGR should consider developing more specific procedures to accommodate the complaint process established by PRC § 3235. This could include more accessibility through DOGGR's website.
- 14) DOGGR should continue to place high priority on completing the aquifer exemption process for all wells that need an exemption.
- 15) The review team urges the continued development and completion of a clear risk-based metric for the prioritization of file reviews including target dates.
- 16) DOGGR should ensure that all wells go through the initial review before periodic reviews begin.
- 17) DOGGR may want to consider lowering the MIP to 90% of calculated or tested formation fracture gradient as an additional safety measure.
- 18) DOGGR should assure that the proposed regulations for well plugging provide adequate protection for USDWs

Part III Well Construction

Casing, Cementing, Tubing, and Packer Requirements

The current casing program design requirements are found at California Code of Regulations (CCR) 1722.2 and 1722.3.

CCR 1722.2 requires that each well shall have casing designed to provide anchorage for blowout prevention equipment and to seal off fluids and segregate them for the protection of all oil, gas, and freshwater zones. All casing strings shall be designed to withstand anticipated collapse, burst and tension forces with the appropriate design factor provided to obtain a safe operation. Casing setting depths shall be based upon geological and engineering factors, including but not limited to the presence or absence of hydrocarbons, formation pressures, fracture gradients, lost circulation intervals, and the degree of formation compaction or consolidation.

The typical well construction practices for casing and cementing of Class II injection wells have been predicated upon the requirement that all injected fluids must remain confined within the injection zone. This practice is referred to as "zonal isolation." Zonal isolation is the concept that fluids injected into a geologic zone or strata will remain in that zone and not migrate into a different zone. Thus, if the zone is a non-USDW and if the fluid is confined to that zone, no USDWs will be threatened.

To ensure that zonal isolation is accomplished, CCR Section 1724.6 et seq., requires that plugged and abandoned wells in the area not have an adverse effect on the project or cause damage to life, health, property, or natural resources, and that formation pressures are not

exceeded to the extent that damage occurs. Meeting these regulations requires extensive reviews of formation geology and of existing wells nearby that are drilled into the injection zone, to determine if they are compromised or could otherwise become a conduit for injection fluid into a different zone. Well integrity is required for all injection wells and all wells must meet casing requirements aimed at achieving zonal isolation. Casing must be of specified strength, competence, and length and extend through all oil and natural gas formations that contain not just hydrocarbons, but also water. In the case of UIC wells, there are high standards for mechanical integrity testing, owing to the importance of well construction and well integrity in achieving zonal isolation. DOGGR has recently conducted extensive reviews of previously approved project areas to ensure that the general concepts of zonal isolation have been adhered to.

The proposed UIC regulations under CCR 1724.7.1 would require casing diagrams to be submitted that include identification of the base of freshwater and the base of the lowermost USDW to be penetrated by the well. The proposed regulations would also require identification of USDWs in the UIC project area and will also include a definition of both freshwater and USDWs. The proposed regulations do not specify the depths to set casing with respect to freshwater zones or USDWs.

Geologic conditions in California pose challenges for protection of both freshwater zones and USDWs because depths to the base of freshwater and depths to USDWs may vary significantly at a single location.

The identification of freshwater zones and USDWs is the responsibility of DOGGR and in practice the Division has determined BFW and used the concept of “vertical confinement” through zonal isolation to protect all USDWs. DOGGR obtains data to determine depth and quality of water whenever water exists in the receiving formation injection zone within a UIC project. The data can range from direct laboratory analysis of analytes to log analysis in order to estimate Total Dissolved Solids (TDS) of the formation water. DOGGR is responsible for identifying and determining the basal elevation of water suitable for irrigation and domestic purposes. When reviewing project applications, staff evaluates data such as geological maps, electric logs, and well construction standards. The Division requires operators to submit water samples of their injection zones and requires that the operator demonstrate injection will be confined to the zone. Project data requirements include such information as geologic cross sections, contour and isopach maps, and engineering data to ensure confinement to the approved zone(s).

In recognition of the significant geologic and engineering differences across the state, DOGGR has established Field Rules with which operators must comply. Field Rules supplement more broadly applicable statutory and regulatory requirements. Each Field Rule is specific to a field, and in many cases, specific to Areas and Zones or Pools within a field. The Field Rules identify downhole conditions and well construction information that oil and gas operators should consider when drilling and completing oil and gas wells. Field Rules have been made mandatory where they have been included in the permit as part of the conditions of approval. However, there are no consequences for failure to follow a Field Rule that has not been included as a permit condition. Failure to follow a permit condition is a violation that can result in project suspension and would be subject to additional enforcement as appropriate. Field Rules are continually reviewed and updated as ongoing field operations generate new technical information including geologic data. Operators planning to drill should review the most recent field regulation versions before drilling.

CCR 1722.4 is the applicable regulation for cementing of casing operations. It requires the surface casing annulus to be filled from the casing shoe to the surface in all wells almost without exception. For intermediate casing or production strings, cementing in the annulus is required to be at least 500' above oil and gas zones and anomalous pressure intervals. A minimum of 100' feet of cement is required to be set in the annular space above the base of a freshwater zone either by lifting cement around the casing shoe or cementing through perforations or use of a cementing device placed at or below the base of the freshwater zone. All casing is required to be cemented in a manner that ensures the proper distribution and bonding of cement in the annular spaces. The appropriate Division District Deputy may require a CBL, temperature survey, or other survey to determine cement fill or lack of fluid blow behind casing.

DOGGR staff indicated that while adding additional requirements for cementing are not within the new UIC regulations, new well construction standards and new cementing standards may be included in the future. As of this writing, well construction regulations related to casing and cementing requirements are still in "pre-rulemaking" development. DOGGR has indicated that proposed draft regulations would require cemented casing from the base of the lower-most USDW/beneficial water to one hundred feet above the waters to be protected. The current proposed regulations would now allow for a technical equivalent to the packer that would isolate the production tubing from the inside of the casing, subject to Division approval. Thus, if an EOR injection well proposes two strings of casing cemented from the base of the lower-most USDW and 100 feet above the USDW, DOGGR would not require tubing and packer set in the well during active injection operation. DOGGR indicated that the double layer of cemented casing is considered adequate to protect the USDW's. On behalf of DOGGR, research is being

conducted at various national laboratories on well construction and cementing standards and recommendations will be forthcoming for consideration.

Radioactive tracer surveys or temperature surveys are currently required for all Class II wells to demonstrate external mechanical integrity (Part 2 of MIT). In addition, DOGGR staff currently review CBLs and cementing volume calculations to ensure adequate cement placement. The quality and effectiveness of the casing cement job is confirmed by a CBL. If a CBL is not available, DOGGR uses volume calculations to determine the extent of the cemented zone based on the amount of cement used. The Part 2 MIT provides a top perf check to ensure the cement job restricts flow to only the perforations and does not allow migration up the annulus. Additional testing can be required by DOGGR if the cementing may be considered inadequate or the amount inconclusive.

The tubing and packer arrangements for class II injection wells are required by CCR 1724.10 (g). All injection wells except steam, air, and pipeline-quality gas injection wells must be equipped with a tubing and packer arrangement. The packer is required to be set immediately above the approved zone of injection. Proposed regulations regarding tubing and packer arrangements are as follows:

Except as provided in this subdivision below, all injection wells shall be equipped with tubing and packer, with the packer isolating the injection zone set no more than 100 feet above the approved injection zone. The packer shall not be set below open perforations if the packer is set within the approved zone of injection. The operator may use a technical equivalent of a packer instead of a packer, provided that the Division has approved the alternative as an effective means to isolate the production tubing from the casing. Injection wells equipped with tubing and packer may inject through the tubing, but not through the casing-tubing annulus unless the operator has written approval from the Division. Tubing and packer are not required for the following:

- (1) Steamflood and cyclic steam injection wells;
- (2) Any injection well that the Division approves for operation without tubing and packer and for which the operator demonstrates based on documented evidence, that:
 - (A) The well does not penetrate any USDW;
 - (B) The well is completed with more than one string of casing cemented to the satisfaction of the Division below the base of the lowermost USDW penetrated by the well; or

(C) There is other justification for a determination that all USDW, hydrocarbon, and anomalous zones can be protected without the use of tubing and packer.

(3) An injection well that was not required to be equipped with tubing and packer prior to April 1, 2019, is not subject to the requirements of this subdivision until April 1, 2021.

Exceptions to the tubing and packer arrangement may be made when there is no evidence of USDW-bearing strata, more than one string of casing cemented below the base of freshwater or other justification, as determined by the District Deputy, or based on documented evidence that USDW and oil zones can be protected without the use of tubing and packer. DOGGR staff indicated that an accurate inventory of injection wells (not including cyclic steam or steam flood wells) without a tubing-packer arrangement is needed and is being compiled.

Well Construction Inspection

Operators are required to notify DOGGR staff prior to certain drilling and well construction activities such as blow-out preventer testing prior to drilling out the casing shoe, certain cementing and mudding operations, and when conducting mechanical integrity testing. DOGGR is tracking the percentages of activities/tasks that are witnessed by staff, but the tracked percentages of these activities witnessed was not available prior to completing this review. Most notifications require a 24-hour notice in advance to allow for scheduling and travel times. On-site inspections during the setting of casing and cementing operations have not been a high priority for DOGGR staff. Historically, BOP testing has been utilized for cementing verifications. Witnessing mechanical integrity tests is a priority and many Districts are witnessing close to 100% of the SAPT's (Part 1 MIT) conducted. If a well fails an MIT test, the retest must be witnessed.

Data Requirements for Well Construction Operations

CCR 1724 Required Well Records, require operators to create and maintain certain records regarding well construction such as depths to formations, including water bearing strata, abnormal pressures encountered, casing size and weights, tubing equipment data, geophysical logs, pressure testing results, hole sizes, cementing data, and other information.

CCR 1724.1 Records to be Filed with the Division require records to be filed with the Division as follows: "Two true and reproducible copies of the well summary, core record, and history, and all electrical, physical and chemical logs, tests and surveys run, including mud logs shall be filed with the Division within 60 days after the completion, plugging and abandonment, or

suspension of operations of a well. Dipmeter surveys shall be submitted in a form indicating the computed direction and amount of dip.” The proposed UIC regulations do not reflect any updates for requirements regarding the submittal of well construction data.

The Division is transitioning to a new data management system called WellSTAR which is the California implementation of the Risk-Based Data Management System (RBDMS) which is used by many oil and gas producing states to manage oil and gas data including UIC data. This system will have the ability to track compliance related events such as mechanical integrity tests, generate well bore diagrams based upon inputted data, and house and generate reports of other important data related to oil and gas operations including UIC operations. (See Part V Data Management for additional information concerning WellSTAR)

MIT Procedures and Exceptions

MITs are currently required by CCR 1724.10 (i), which requires a two-part (internal and external) testing to ensure injected fluids are confined to an approved zone.

Part 1 MIT consists of pressure testing the casing-tubing annulus and Part 2 consists of the testing necessary to demonstrate the absence of fluid migration behind the casing, tubing, and packer. The new UIC regulations also extend mechanical integrity testing requirements to injection wells that do not have tubing and packer, such as steam flood wells. As a result, the requirements are thereby applied to the casing in tubingless wells. Such wells will be allowed 5 years starting from the date of implementation of the new regulations, April 1, 2019, to meet the mechanical integrity demonstration requirements.

Prior to commencing injection operations, each injection well must pass an internal MIT commonly referred to as a standard annulus pressure test (SAPT). Thereafter, an SAPT is required once every five years from the last test date. If a well is modified by replacing the tubing or packer, or if a loss of mechanical integrity occurs, or if requested at the discretion of DOGGR, mechanical integrity must be re-demonstrated, and the five-year clock is re-started.

Prior to April 1, 2019 the regulations did not provide actual specifications for satisfactory SAPT test requirements, however the new UIC regulations under CCR 1724.10 do include such specifications. These include allowing the operator to select the initial test pressure of the pressure test, provided that the pressure test is conducted at an initial test pressure of at least 200 psi above surface pressure, and the maximum allowable surface injection pressure for the injection well, as determined under Section 1724.10.3, does not exceed the initial test pressure used during the most recent successful pressure test. The successful test must be continuous for at least thirty minutes, and not show more than a 3% change in pressure. A cyclic steam

injection well will be allowed an increase in pressure of up to 10%. The operator will be required to notify the Division at least forty-eight hours before performing a test and digital copies of the test results are required to be filed with the Division within 60 days of the test. Current practice is to run a test for 15 minutes with not more than a 10% decline in pressure.

New regulations effective April 1, 2019 will allow continuous pressure monitoring of the annulus as an alternative to running an SAPT for wells equipped with tubing and packer, subject to DOGGR's approval. An initial SAPT will be required at a minimum of at least 500 psi, and a pressure of at least 100 psi must always be maintained on the annulus. In addition, there will need to be an observable pressure differential of +/- 10 % of the tubing pressure or at least +/- 50 psi between the annular pressure and the tubing pressure. Variations from these requirements can be considered on a case-by-case basis when enough documentation is provided that allows DOGGR to determine that the proposal will represent a stronger demonstration of ongoing mechanical integrity.

The new regulations effective April 1, 2019 will also provide the option of using an alternate mechanical integrity testing method to satisfy the requirement to pressure test the casing of an injection well. This is intended primarily for wells which do not have tubing and packer and requires that the alternate testing method be approved by DOGGR on a case-by-case basis as being at least as effective as pressure testing to demonstrate the integrity of the well at the calculated pressure value under Section 1724.10.3(a)(1).

External testing requirements are listed under the new UIC regulations under CCR 1724.10.2 (a)-(g); they include conducting radioactive tracer surveys, noise logs, and temperature surveys. Within three months after commencement of injection, an external integrity test must be performed. Each type of well is subject to testing frequencies based on risk as identified in the following schedule: disposal injection wells are tested at least once per year; enhanced recovery injection wells and cyclic steam wells other than low use every two years; and steamflood injection wells equipped with tubing and packer and low-use cyclic steam injection wells once every five years. The specifications for external integrity requirements under the new regulations are well detailed. These specifications essentially codify current practices in order to ensure consistency throughout the state. Exceptions, modifications, or alternative testing measures to either standard annular tests or external testing requirements may be allowed upon written approval of the Division.

Identified Strengths

- 1) DOGRR is proposing several new regulations pertaining to UIC including a regulation that will require identification of USDWs in UIC project areas. Specifically, section 1724.7(a)(2)(E) requires a cross section that indicates the base of freshwater and base of the USDW while section (F) requires a representative electric log identifying all geologic units including USDWs and freshwater aquifers. Casing diagrams also require identification of USDW. This will help ensure that USDWs are adequately protected when casing and cementing plans are approved.
- 2) DOGRR requires an MIT to be witnessed if the previous MIT was failed.
- 3) The new UIC regulations set high standards for standard annular pressure tests, which require the tests to be conducted for thirty minutes with no more than 3% pressure loss.
- 4) The new UIC regulations set detailed requirements for conducting external (Part 2) mechanical integrity testing.
- 5) DOGRR will allow continuous pressure monitoring on injection wells as an alternative to a SAPT when enough justification is provided and will require operators to maintain that information and provide it upon request.

Review Suggestions

- 1) DOGRR should consider requiring operators to provide any available information regarding USDWs in areas proposed for UIC projects.
- 2) Where practical, all newly drilled wells should have surface or intermediate casing set through the deepest USDW and cemented back to surface or into the next higher cemented string of casing to ensure confinement.
- 3) DOGRR may want to consider adding a minimum requirement for cement in the annulus above an injection zone and a USDW.
- 4) DOGRR may want to consider requiring cement evaluation logs to be run and submitted on USDW protection casing when cementing operations are not witnessed.
- 5) DOGRR may want to consider requiring notification in advance of running and setting of the USDW protection string and use this notification to emphasize witnessing of this activity.
- 6) DOGRR may want to consider requiring operators to submit cement tickets (cementing service company records) when cementing operations are not witnessed.
- 7) When used or reconditioned casing is to be used in a well, DOGRR may want to consider requiring this information be included in the permit application and the completion report.

- 8) DOGGR may want to consider evaluating whether the proposed regulations adequately require the submission of all well construction data that CCR 1724.1 requires.

Part IV: Inspections

Management of Inspections

DOGGR field inspectors work out of the District Offices. Staff at the District offices are divided into program teams; each team is supervised by a Senior Oil and Gas Engineer who is in turn supervised by the District Deputy. These individuals coordinate, schedule, and manage the work of the inspectors in that District.

The inspectors within a District are each assigned to specific duties, rather than being assigned to a geographic area within that District. In some of the Districts, the inspectors will rotate on different 3-month work assignments. They may work on UIC, or oil and gas wells, or facilities, etc., for a period of approximately 3 months to gain specialized experience. After the 3-month period is over, they rotate to another aspect of the program. This type of work scheduling results in inspectors who will eventually be trained in all aspects of the regulatory programs, both for UIC wells and for production wells. Thus, any inspector who is called on to witness an MIT, for example, or a well test, etc., should be adequately trained in that aspect of the job. Any one inspector will have the ability to fill-in for any other inspector in any portion of the District.

The Division has the statutory authority to access a lease or well location and to make unannounced inspections at any time. In practice, prior notice of an inspection is not always provided to the operator. The Division tries to notify operators whenever possible but acknowledges that it is not always able to provide prior notice.

The inspectors are usually required to sign-in when they enter the lease property to do an inspection. The oilfield operator will also require them to have the proper safety equipment needed to work on-site. This generally includes items such as hardhats, steel-toed boots, and safety glasses, but sometimes may also include fire-retardant clothing, H₂S safety equipment, and other equipment of a specialized nature. All safety equipment is provided to the inspector by the Division.

To maintain consistency throughout the Division, the field inspectors use specific standardized forms for each of the different types of inspections (such as MITs, well plugging, well testing, sample collection, etc.). These forms provide for various items to be recorded, such as well

status (active or idle), tubing pressure, casing pressure, injection rate, presence of a well identification sign or an H₂S warning sign (if appropriate), presence of leaks, and general condition of the well site. A photo of the well is also taken during the inspection and is stored in WellSTAR.

On average a field inspector can inspect about four or five wells per day. This is comparable to the number of inspections performed by inspectors in other states. This number can vary widely, and an inspector may be able to inspect 10-20 or more wells in a day if they are located close together and there are no issues. However, to witness something like a difficult well plugging operation, the inspector may need to be on-site for a day or two or even longer. The total UIC inspection numbers are tracked and monitored via the EPA 7520 report.

Inspection Priorities

Many factors are considered when prioritizing inspections. Generally, the highest inspection priority is for injection wells located in urban areas, wells that are injecting into formations that contain freshwater, and wells located near municipal drinking water source wells. Other considerations include the depth of the well, the age of the well, wells which are in environmentally sensitive areas, and wells operated by those operators with a history of noncompliance.

The type of well is also a consideration. Produced water disposal wells are prioritized above enhanced oil recovery injection wells. Steam injection wells for enhanced recovery generally receive the lowest priority, because the injected steam is freshwater. Other criteria such as past enforcement status, or routine or repeated field problems may also be considered to establish inspection priorities on a case-by-case basis.

All produced water disposal wells, H₂S injection wells, and any other wells that are considered high priority, are usually inspected at least once per year. The inspector performs a variety of checks when inspecting a well, including noting the condition of the tubular goods, the injection pressure and rate, annulus pressure if the well is equipped with tubing and packer, well identification signs, and the general condition of the wellsite.

While well plugging operations are considered a high priority, witnessing of plugging operations depends upon the availability of staff in each district. Consequently, they witness those parts of the plugging operation which are statutorily required to be witnessed and those parts where risk is the highest, such as the placing of the casing shoe plug. Other operations that DOGGR does not consider high priority, such as placing of the surface plug and site restoration, are not

usually witnessed. The drilling of a well, the setting and cementing of the surface casing string, which is set through the near surface freshwater zones and is thus a critical part of well construction, is not routinely witnessed.

Inspection forms are filed with the Division and entered into WellSTAR. A DOGGR Supervisor reviews the inspection reports to check the thoroughness of the inspection and adherence to proper procedures. The inspections are available for the public to view after they are entered into WellSTAR. The operator does not normally receive a hard copy of the inspection report unless they request one or there is a deficiency or violation.

Witnessing of Mechanical Integrity Testing

The MIT schedule is monitored on WellSTAR. Produced water disposal wells receive an annual MIT, while enhanced recovery wells and cyclic steam wells other than low use are tested once every two years. Steamflood injection wells equipped with tubing and packer and low-use cyclic steam injection wells are tested once every five years.

Maintaining mechanical integrity is one of the cornerstones of the UIC program, yet DOGGR policy does not require the witnessing of routine MITs. In the past, inspectors had been witnessing about 25% of routine MITs. However, DOGGR has been attempting to increase this percentage as much as possible within the bounds of staff availability. An operator is required to contact DOGGR 24 hours in advance of performing the test and 2 hours' notice should be made to the District office to allow for inspector travel time to the site. Regardless of whether a test is witnessed, DOGGR does have a policy that any well which has failed an MIT must always have the next MIT witnessed by an inspector.

When an operator performs an MIT that is not witnessed by a DOGGR inspector, the operator must provide test data in the form of pressure charts or other documentation to DOGGR, where they will be evaluated by a DOGGR engineer.

DOGGR's new regulations will require, starting April 1, 2021, that well specific pressure be continuously recorded at all times that a well is approved for injection by the Division. Until then, operators are required to make gauges available to the inspector whenever needed, but gauges do not have to be installed on the wellheads. Pressure gauges are required to be recalibrated routinely by the operator following the manufacturer's recommend specifications., DOGGR field inspectors do not carry their own pressure gauges, and for safety and liability reasons, the field inspector is not allowed to install a gauge, nor to open or close any valves or

operate any of the oilfield equipment on-site. Any such work that is needed must be performed by an employee of the operator.

Inspector Training

Inspectors are generally trained on the job, usually by a more experienced inspector who guides them for the first several months. In addition, at times the Field Supervisor may accompany a new inspector for training or mentoring, and at least once per year the Field Supervisor will accompany an inspector during routine inspections to evaluate their work. After the training period is over, the inspectors usually work by themselves. In addition to their on-the-job training, the inspectors are also trained in a variety of safety procedures, including H₂S training, safety procedures around steam operations, blowout equipment training, rig safety, and driver training.

DOGGR recently filled a new position for a Technical Training Coordinator. This person will implement the Division's Training Plan to help ensure that the necessary training for all Division staff is provided. These training opportunities include regular meetings of Division staff to share information and help improve teamwork, as well as establishing training opportunities with academic and/or research institutions and service companies.

Most of the inspectors have attended at least one of several popular training courses on oilfield operations offered by TOP Energy Training (TOPCORP). Some have also attended the USEPA inspector training course, although the last USEPA course DOGGR staff attended was in 2013. Inspectors also can take additional training, such as OSHA's Hazardous Waste Operations and Emergency Response (HAZWOPER) training, and the Inspector Certification Course offered by the IOGCC. In addition, the Division has started developing a video safety library and a well-site safety video training course.

In the past, DOGGR has had some difficulty hiring adequately qualified staff. To improve this process, the Division has been working more closely with the California Department of Human Resources to institute certain revisions in the hiring process. These include such things as participating in job fairs, advertising in non-traditional venues such as 'LinkedIn' and other professional networking sites and developing new minimum education requirements so that in certain specific situations, a candidate can substitute work experience for educational requirements.

DOGGR recently received an additional 4.25 million dollars for fiscal year 2018-19 budget, some of which will be used to hire an additional 21 field inspectors. A job fair was held in Bakersfield in July of 2018 to help fill these positions and another 40 vacant positions in DOGGR.

Compliance and Enforcement

The process described below is a generalized summary of how DOGGR's enforcement process works.

The enforcement process usually begins at the field inspector level, with an identification of non-compliance and a determination whether the situation requires emergency response. Staff and management then analyze and evaluate the facts to support actual and/or potential harm to life, health, property and natural resources.

In an emergency, DOGGR can direct the operator to immediately remediate the issue or DOGGR may act on its own to remediate the issue. Where DOGGR acts to remediate the issue, the cost of such action may be charged against the operator (this can include placing liens and levying on the operator's bond).

In non-emergency situations, based on the evidence of non-compliance it gathered, DOGGR can take informal actions (such as issuing a "Notice of Violation" or "NOV") or issue a "formal" administrative enforcement order (AEO), which is subject to appeal proceedings. Usually, the process is "progressive," i.e., first DOGGR would issue an NOV with a compliance deadline. If the operator did not comply with the NOV by the deadline, DOGGR would then issue an AEO. If the process moves to an AEO, the matter is referred to DOGGR's Office of Enforcement. Among the tools which can be used at this point are an expedited settlement offer, a remedial order, a civil penalty order, a plugging and abandonment order, or other orders as needed. If compliance is still not achieved, additional actions will be considered which include the listing the operator on a "Do Not Permit List", contract work to achieve compliance, and referring the case to a District Attorney for criminal prosecution.

The enforcement tools used, and decisions made concerning the steps in the progressive enforcement process depend on the factors of each case. Such factors include the operator's history of noncompliance, economic benefit, environmental justice considerations, and the harm or likelihood of harm to human health or the environment.

Response to Citizen Complaints and Emergency Situations

Although DOGGR receives a limited number of emergency complaints and citizen complaints related to field activities, they are considered a high priority and are addressed immediately upon receipt. The field inspector can often resolve a minor complaint at his or her level, usually by meeting with the complainant and reviewing and discussing the situation. Resolution often occurs within a few days, and rarely takes longer than about 30 days. If this is not successful, the matter will be escalated, and the Senior Engineer may need to become involved. Both the operator and the complainant are kept informed of the situation. All communication records regarding the complaint and investigation are stored in WellSTAR, and a report is written and filed as appropriate. All formal communication normally takes place at the Senior Engineer level.

Identified Strengths

- 1) Use of an escalating enforcement process that begins with informal communication allows DOGGR to resolve non-compliance at the most appropriate level of action. This means that in many cases, issues can be resolved prior to the need for formal enforcement action.
- 2) The Division generally maintains a strong field presence that will likely become stronger with the hiring of additional inspectors.
- 3) Cross training the inspectors 3 months at a time on different aspects of the job is commendable. Having inspectors capable of performing any of the variety of tasks in the oilfield will result in an inspection team that can respond to almost any issue that may arise.
- 4) Coordinating inspections at the District Field Engineer level provides for a more thorough and consistent approach to inspections. Some inspectors, left to do their own scheduling, may be tempted to schedule inspections based on their distance from the home office, rather than on other, more-important criteria. The inspection system is risk-based and takes into consideration factors such as well type and location.
- 5) The ability to try to resolve both complaints and compliance issues at the field inspector level, if possible, helps to avoid having relatively small problems occupy the time of the engineers in the office. In addition, the field inspector may have a better perspective on many problems, as he or she is in the best position to understand and evaluate the situation and the personalities involved. These efforts are well-coordinated between the field inspectors and the office engineers.
- 6) DOGGR's ability to assess civil penalties for non-compliance enhances the effectiveness of their enforcement program.

- 7) DOGGR's establishment of an enforcement unit and on-going development of a penalty matrix helps to ensure a consistent approach to violations.
- 8) Storage of all inspection data on WellSTAR will keep all the information in one place, accessible to the regulators and to the public.
- 9) Witnessing an MIT on a well after that well has failed an MIT is perhaps a higher priority than any other MIT. DOGGRs policy to witness the next MIT after a failed MIT helps mitigate DOGGRs relatively low rate of witnessed MITs.
- 10) Having the DOGGR Engineer review all inspection reports helps ensure the inspectors are doing their inspections in a consistent manner, which also helps the operators know what is expected by the inspectors.
- 11) The review team commends DOGGR for requiring the regular calibration of the operator's pressure gauges.

Review Suggestions

- 1) The review team suggests DOGGR prioritize the witnessing of surface cementing jobs and MITs. Both activities are critical parts of the regulatory program, and an inspector's presence helps to both ensure they are being performed properly, and to communicate to the industry that DOGGR regards them as particularly important. In order to help ensure these activities are witnessed, DOGGR should continue to place a high priority on increased funding and staffing.
- 2) The office project reviews should be coordinated with associated field inspections, because it is possible that things may be occurring in the field of which the office reviewer is unaware.
- 3) Even though the proposed regulations will require the operator's gauges to be calibrated in accordance with the manufacturer's recommendations, enforcing this regulation might be logistically cumbersome and difficult. For this requirement to be effective, DOGGR will need to ensure that it is being enforced at the field inspector level. It might be helpful to establish a calibration certification process where reports would be submitted to the District office on a routine basis and the WellSTAR system would then monitor them to assure that all gauges are meeting a calibration schedule.
- 4) The review team urges DOGGR to continue to place priority on the development of the penalty matrix system noted in the Identified Strengths to assure consistent application of penalties.
- 5) We recommend DOGGR send more of the field inspectors to USEPA's UIC inspector training when it is available. This training is free,

- 6) The review team suggests that inspections should normally be conducted on an unannounced basis to assure that they more accurately reflect the natural conditions of the wellsite.

Part V UIC Data Management

General Overview

An effective review of DOGGR's UIC program would not be complete without the review of the ongoing efforts to develop an agency wide data management system. The system is a high priority to DOGGR as part of their Renewal Plan¹¹ and in their efforts to modernize and integrate into an open information world. DOGGR's application Well Statewide Tracking and Reporting (WellSTAR¹²) system is being developed on the Risk Based Data Management System's 3.0 (RBDMS 3.0) modern technical architecture. It is replacing an older distributed system that had become outdated and inefficient in providing the needs of the agency, regulated community, and public.

Efforts to modernize DOGGR's data management systems have been ongoing for many years. The tracking of electronic stimulation data and reporting was initiated as early as 2013. WellSTAR's first release occurred in 2017. At the time of this review it was in Release 2 of the phased approach. Release 3 went live on October 29, 2018, Release 4 went live on April 29, 2019, and Release 5 has now been added to continue the advancement of the system with a go-live date of October 2019.

The development of WellSTAR, and what it means relative to managing wells, compliance tracking, field activities, and the additional day-to-day needs of a modern oil and gas agency, is essential to accomplishing the function of regulating the oil and gas community. The development of WellSTAR is broken down into logical release components. These releases are as follows:

- Release 1: Bond Management, Entity Management, General and Administration. Bond and Entity Management (Released: 8/31/2017)
- Release 2: Well Management, Transfer, Production, Payments, Facility Management, and Underground Injection Control (UIC) (Released: 04/30/2018)
- Release 3: Incidents, Complaints, Idle Well, Compliance, Public Access and Construction Site Well Review (Released 10/29/18)

¹¹ California Renewal Plan, <http://www.conservation.ca.gov/dog/Pages/RenewalPlan.aspx>, accessed 8/1/2018.

¹² WellSTAR, http://www.conservation.ca.gov/dog/for_operators/Pages/WellSTAR.aspx, accessed 8/1/2018.

- Release 4: EPA Report, Well Stimulation Treatment, Underground Gas Storage, Inspections (Released 4/29/19)
- Release 5: Additional items (estimated 10/19)

The above identified components of the system are expected to support an effective regulatory program and provide the tools necessary to strengthen the UIC program. It is critical that DOGGR continue their path of completing the WellSTAR system and the identified components that are used by the UIC Program in their day-to-day scheduling and management of the program.

The implemented WellSTAR components (Releases 1 & 2) reviewed during this peer review include required modules for managing data on Operators, Financial Assurance, Wells (including Construction), Well Permitting, UIC Injection Monitoring, UIC Projects, and UIC Permits. It should be noted that the implementation of the Production Tracking portion of WellSTAR also tracks produced water. These modules provide a solid foundation for the support of the rest of the regulatory program requirements to be developed during later releases.

WellSTAR is being developed atop the modern information technology architecture of RBDMS 3.0. It will provide connectivity to DOGGR's stakeholders (internal and external). This openness provides better communication, more effective management of the program and more transparency to the public on the regulation of the industry. The development environment is:

- Microsoft (MS) Visual Studio's C# Language
- MS SQL Server
- MS Azure Cloud (hosted outside of the State's network)
- MS Office (full integration)
- Well Shadow: Wellbore Diagram Tool
- File Based Document Management System

The current legacy systems are slated to be retired with the full implementation of WellSTAR. The Division's historic data management systems, California Well Information Management System (CalWIMS), developed in the mid-2000's, continues to support some of the functions of the UIC program and will continue to do so until Release 3 of the WellSTAR system. The legacy system Well Statistics (WellSTAT), which managed production and injection data, has already been retired with Release 2 of WellSTAR.

Each staff member will have a dashboard containing assigned tasks and notifications to their workgroups when they log into WellSTAR. This dashboard will provide them a means to track work to be performed and pending deadlines on UIC Program issues to be addressed.

Supervisors will have the option to adjust tasks and reassign workload as necessary based on staff availability. This process will help assist the UIC Program in maintaining prompt response to issues that arise and keep items from being neglected. This system will be integral to all portions of the UIC Program from Permitting to Compliance to Enforcement.

WellSTAR will also provide access to the public. It will provide the means for the public to data mine UIC information from the database. It will not have the ability to receive public comments on activities related to UIC, but the DOGGR website and WellSTAR is expected to provide a listing of public notices specific to UIC activities. Activities such as project applications will be part of the searchable data provided to the public through the WellSTAR interfaces.

The WellSTAR system will provide interfaces to the public to be able to submit complaints and incidents. These actions are not strictly related to UIC issues only, but UIC is included in the actions that the public will be able to perform on these interfaces.

Permitting and File Review

With the implementation of WellSTAR Release 2, DOGGR has an electronic means of tracking the application for projects and permits and performing file reviews for UIC wells. The process of performing project and permit processing from submission to approval or denial is outlined below. As of the time of the Peer Review, WellSTAR had processed a total of 800 well permits (including non-UIC) since coming online and with the use of WellSTAR processing times for applications have been diminishing. The specific number of UIC well permit applications was not readily available. It should be noted that all received applications and approved applications are expected to be available to the public via online WellSTAR data by January 2020.

Submission of Applications

DOGGR has three options for receiving and processing project and permit applications (for the purposes of this section the discussion of either project or permit applications are considered applications unless specifically notated). These include accepting paper, electronic, or combination of paper and electronic applications (e.g., the operator has identified portions of the application that will be sent to DOGGR by paper). A combination paper/electronic application will be treated as a paper submission in this narrative. The submission process for accepting paper applications varied slightly by District, but the processing of the applications, either paper or electronic, is consistent throughout DOGGR with the advent of WellSTAR. WellSTAR will stop/deny submission of applications and issuance of permits if the operator is currently on a deny permit list due to failure to comply with a final administrative enforcement order or failure to pay production assessment charges.

When a paper application is received, it is either received by, or routed to the respective District office responsible for review and processing. The application is then entered in WellSTAR via the same procedural process as would be used by an operator performing an electronic application submission. Upon receipt at the District office, the paper application is time stamped by the receiving clerk and routed to the appropriate assigned engineer for entry into WellSTAR.

When an operator enters an application into WellSTAR, and it is submitted for approval, it is automatically time stamped and routed to the appropriate District staff for completeness review. In both cases of submission, paper or electronic, WellSTAR automatically generates a series of tasks and assigns those tasks to the appropriate staff via assigned workgroups.

Prior to an application being routed to an engineer for a completeness evaluation, a first step for determining completeness is performed by the data entry and submission processes of WellSTAR. Each application must meet the requirements of a checklist managed in WellSTAR. If an application is deemed complete by the submission process or said to be complete by the submitter, it will continue to the review process and tasks will be assigned by workgroup for further processing. Follow-up work performed on the application by DOGGR will be tracked in WellSTAR.

There is a possibility that a paper submission may not be deemed complete by the engineering staff doing the data entry into WellSTAR; this determination is dependent on workflows developed in each District office. If this happens, the engineer may initiate data requests from the submitting operator as outlined below.

To maintain consistency, when entering a paper application, the support documents submitted will be scanned and stored in WellSTAR's Document Management System (DMS). In addition, when an application is submitted as complete in WellSTAR, Portable Document Format (PDF) documents will be generated representing the application based on the data entry and stored in the DMS. This will maintain an application submission audit trail outside of the maintenance of electronic data records. WellSTAR and its associated DMS will become the official archive of the agency.

Review/Tracking of Applications

Once an application has been submitted via WellSTAR (via entry of paper application by District staff or online by an operator) review and tracking tasks will be assigned to workgroups maintained in WellSTAR.

A completeness review of the submission is then performed by the District Engineer. This is performed prior to assessing the validity of the application for approval. If the application is deemed incomplete, additional information will be requested of the submitter before further processing. Either the District or WellSTAR will generate communications requests for the information to the applicant. How the requests are made depends on identification of the submitter, paper vs. electronic submission, and contact information on file for the operator. The operators themselves may stipulate, upon submission, what type of follow-up communication they desire for requests. Requests for information will be sent to the application submitter, agent of the operator, and technical contact for the operator. Currently no time limits are applied for the response to requests by DOGGR. WellSTAR will track the communications to the submitter throughout the entire permitting process.

Once an application has been deemed complete and ready for engineering/technical review, WellSTAR will generate tasks to workgroups to perform evaluation of the application. Notifications will be sent to staff and other responsible parties that the application is ready for review. Many times, this will be the same engineer performing the completeness review. WellSTAR will also provide the submitting operator with the ability to review the application and see what its status is as it moves through the approval process.

If an application is withdrawn by the operator, the information on the application will remain in WellSTAR. This information will be used for reporting to USEPA on Form 7520 and for statistics of activity in the UIC Program, but at the time of this review, decisions had not been made on whether withdrawn applications will remain publicly available through WellSTAR.

Required submissions for water quality data is not submitted to DOGGR. Instead that data is first submitted to the Water Boards. The DOGGR staff needs to access that information to complete their review of the application. Having a means to more quickly access that data ad hoc will be important to completion of the workflow permitting process.

Approval of Applications

Once the application is deemed complete it goes into an approval process. Tasks are assigned to the appropriate reviewers, including notifications to the appropriate Water Board(s).

Tracking of the tasks to be completed during the approval process is managed in WellSTAR.

These tasks include:

- Review and approval by the appropriate Water Board.
- Aquifer Exemptions
- Review of well(s) construction
- Review of wells/pathways in an AOR/ZEI

- Review of injection volumes requested

Each of the above tasks have their own assigned efforts to assess the application for approval. The individual efforts of the tasks may or may not be tracked by the capabilities in WellSTAR. The tasks to perform an approval or denial, and how they are assigned and managed, are fully managed in WellSTAR and by the staff/supervisors. Certain engineering calculations and reviews performed on the application submissions are not expected to be performed in WellSTAR, but the results of those evaluations will be recorded in the database.

Currently the Water Boards are notified of a pending application needing their approval prior to issuing the permit. The Water Boards will perform their analysis of the application outside of the WellSTAR application and log into WellSTAR to provide their recommendations on the application. Tools necessary to assess the protection of the lowermost USDW are not accessible in WellSTAR. This includes management of water quality data housed at the Water Boards. In addition, no statewide GIS coverage for the base of the lowermost USDW currently exists that can be used to assess if the proposed projects/permits meet requirements to protect that USDW. Those assessments are performed ad hoc for each application. Development of statewide GIS coverages could also be used to validate the data application prior to submission for completeness review (i.e. minimum surface casing depths).

The WellSTAR system currently tracks the documents associated with and authorizing of aquifer exemptions. This includes aquifer exemption application documents submitted to USEPA. These documents are available to the permit writers for review from the Document Management System (DMS) accessible from WellSTAR. If a project is dependent upon an aquifer exemption, the individual data elements and application process for the aquifer exemption is not currently tracked in WellSTAR.

Expected development in WellSTAR includes compiling well construction data for the specific well(s) in the application as well as for wells identified in an AOR. This will allow the permit writer to assess the wells and determine if corrective actions are necessary to be accomplished prior to issuing a PAL. As review of the wells identified in an AOR is performed, the electronic data for any additional research performed will need to be entered into WellSTAR. Use of available GIS information for water wells and other potential issues in an AOR should be documented.

As part of the review of well construction for the wells in the AOR, any additional concerns related to potential pathways from the injection zone to a USDW should be noted and relevant data stored in WellSTAR. Also, when data is available, a ZEI should be performed and the results of that analysis should be stored in the system. This information may also be relevant

for file reviews. Storing the information in WellSTAR during the application review will provide the future file reviewer the information they need to be efficient and effective.

If the review results in a determination that the application should be approved, the application will be marked complete and the project or permit approved. After approval, a Project/Permit PDF document authorizing the injection project/permits will be generated, sent to the applicant, and stored in a DMS accessible by WellSTAR. This will be the official archive of the authorizing documentation, and the permit will be available for public view.

Denial of Applications

If the application is denied, the operator will be notified by the appropriate means and that communication will be tracked in WellSTAR. Even if paper communication is used to send a notice to the operator, that communication will either be generated from WellSTAR or scanned and stored in WellSTAR as part of the official record. The application may be denied based on the operator being put on the Deny Permit List due to failure to comply with a final administrative enforcement order or failure to pay production assessment charges WellSTAR will notify the permit writer if that is the case. If that occurs, the application may have to be resubmitted into WellSTAR. At the time of this report, it is uncertain if the denied application will be available for public view.

File Review of Projects and Permits

Data for existing projects and permits has been converted into WellSTAR and significant progress was being made on the first phase of project by project reviews at the time of the review. A risk matrix has been assigned to wells so that they are reviewed in a timely manner. WellSTAR will set tasks for DOGGR staff to perform reviews in the future based on time and risk factors.

Injection monitoring data has also been converted into WellSTAR. This allows the engineer to perform AOR calculations as necessary during file reviews. If it is determined that the original AOR is not sufficient, then WellSTAR will assist in the performance of an updated AOR in a similar manner as described in Approval of Applications above. This might necessitate the modification of a permit's allowable injection volumes.

Well Construction

WellSTAR collects and maintains well construction and related completion information on the wells regulated by DOGGR. This includes information on wellbores, casing, cement, geology,

and well logs. Access to this information when evaluating a well for UIC conversion or review of proposed construction of new UIC wells is critical to the success of the program. As work is performed by DOGGR on reviewing permits or assessing wells critical to the permitting process, information discovered in paper or electronic documents representing well construction records needs to be updated into WellSTAR.

When evaluating well construction through WellSTAR, having access to information on USDWs and the geology of the area to be drilled is critical to evaluating if the proposed well construction will be sufficient to meet the needs of the UIC program. Values for lower-most USDWs and other zones that may require additional cementing need to be maintained in WellSTAR.

WellSTAR is integrated with a wellbore diagram tool. This will assist DOGGR staff with visualizing the well's construction and identifying where there may be deficiencies in a well's construction. Maintaining accurate wellbore, casing, tubing, packers, cement, and geologic information is critical in providing information to the wellbore diagram tool.

Inspections

Development of a fully integrated electronic well inspection and field activity system in WellSTAR is included in Release 5, October 2019. The system provides the inspector the ability to enter data in the field directly to the WellSTAR system. It is expected that when fully implemented, the inspection records will be immediately available to the public when an inspector uploads their data into WellSTAR. This is part of the WellSTAR and California's open records policy through the California Public Records Act.

The WellSTAR inspection components are expected to provide full capabilities required to effectively regulate the oil and gas program under the auspices of DOGGR. Workflow and workload capabilities are expected to be integrated into the inspection system. This will include critical notice for immediate inspections, and scheduling of routine periodic inspections.

By making inspections immediately available to the public, they will also be available for the operator to review. Operators will receive an alert that individual well inspections have been performed. For inspections where a deficiency/compliance issue is identified, the operator will receive an official notice.

Well MIT's and other well operation inspections, such as construction/cementing, are expected to be scheduled in the WellSTAR system. Operators should also be required to provide notice to DOGGR through the WellSTAR system when activities are going to be performed at a well. This will allow DOGGR the opportunity to schedule an inspector to be onsite.

WellSTAR is expected to automatically schedule routine and periodic inspections based on a risk ranking for wells. In addition, required activities such as MITs should be identified, scheduled, and tracked through WellSTAR.

Identified Strengths

1. The adoption of the RBDMS 3.0 framework and development of WellSTAR by DOGGR demonstrates a commitment to the regulatory programs managed. It is expected that once statistics can be compiled, the observed increase in efficiency of program operations will greatly benefit the overall regulatory processes.
2. Developing common processes that are implemented statewide in the management of UIC data and having that data available to all DOGGR stakeholders on an as needed basis is a great benefit to UIC Program Management consistency.
3. Having a task tracking and notification tracking system in WellSTAR to manage workload and maintain deadlines on activities is an essential tool to maintaining a UIC Program's efficiency.
4. Storage of well, project and permit information in electronic format makes information readily available for review. This assists in the monitoring and management of the program and assessing the program's health over time.
5. WellSTAR's capability of tracking the status of the applications and the tasks completed for the approval or denial of applications provides DOGGR with a means to track necessary workload to effectively manage the program.
6. Reassigning work through the WellSTAR workgroups and tasks system assures that work is performed promptly, and tasks do not get neglected.
7. When necessary, the task tracking system provides the ability to escalate tasks. This provides DOGGR a means to assess when critical program efforts need to have additional efforts expended to accomplish goals.
8. WellSTAR can set and assign tasks to workgroups based on assigned risk levels and required timelines for such items as file reviews.
9. WellSTAR records and maintains well construction records and a geologic record of what zones are penetrated. Proposed well construction and new completion reports are submitted into WellSTAR along with any required logs and are readily available to the engineer when evaluating wells.
10. WellSTAR is integrated with a wellbore diagram tool. This will greatly help in the evaluation of a well's construction when assessing it as a candidate for injection or evaluating its integrity during an AOR.
11. Electronic inspection modules will assist in the management of personnel and scheduling of inspection workflow.

12. Consistent inspection procedures proscribed using WellSTAR will assist in uniform enforcement across DOGGR.

Review Suggestions

1. DOGGR has devoted substantial resources toward improving the UIC program through the development of WellSTAR. The review team recommends that DOGGR complete their current implementation plans for the WellSTAR system. Expansion of the system to manage additional needs may be evaluated after Release 5.
2. Through the implementation of WellSTAR, DOGGR should evaluate the efficiency increases gained and if necessary, reallocate people to focus on additional regulatory needs beyond the aspect of maintaining data.
3. Modern database systems are important tools that allow state oil and gas regulators to do more work with existing staff, monitor compliance, and track enforcement actions. Building tools in WellSTAR to manage day-to-day communications, repetitive tasks, track statistics of actions taken, and do an accounting of worked performed, will allow DOGGR the ability to better focus on more critical regulatory program needs. The review team encourages DOGGR to continue to place priority on this activity.
4. The review team suggests that the integration of the RWQCB' review of the applications be performed and tracked in WellSTAR as soon as possible.
5. The review team suggest providing a means to store water quality analysis data received by the Water Boards along with the application in WellSTAR or integrating with the water quality data collected so that it is readily available by staff using WellSTAR. NOTE: This suggested change is planned for October, 2019.
6. The review team suggests that DOGGR review how emails containing notices to operators which are not initiated in WellSTAR are managed to assure that communication with operators submitting applications occurs promptly and effectively.
7. The review team suggests that statewide Base of Freshwater and USDW depth GIS Coverage maps be developed to allow for validation of construction criteria for surface casing and application validation of construction requirements prior to submission of an application. It will also assist in determination of the lowermost USDW, which will provide protection ~~on~~ during the evaluation of wells identified in the AOR.
8. DOGGR should consider setting time limits on receipt of information requests on applications from WellSTAR and tracking those time limits as tasks to be performed in operator's dashboard.
9. DOGGR should consider complete development of tools in WellSTAR for defining the area and wells required for review in an AOR.

10. The review team suggests expanding GIS coverages available to WellSTAR to include items such as water wells for use in an AOR.
11. DOGGR should develop standard statewide operating procedures for the processing of applications received via paper into WellSTAR.
12. DOGGR should consider defining whether a withdrawn application will be removed from public viewing and how that will be accomplished within the WellSTAR system.
13. The review team suggests developing additional engineering tools in WellSTAR to make Step Rate Tests, ZEI and Cement Calculations consistent across users in the system when evaluating permit applications.
14. The review team suggests providing the ability in WellSTAR to notify DOGGR Inspectors of pending well construction activities and assign staff to witness well construction when possible.
15. DOGGR should consider developing a geologic module in WellSTAR to assist in the identification of problem zones that may be drilled or may cause issues with existing well integrity in an AOR. WellSTAR could then highlight those areas to the engineer when evaluating wells.
16. DOGGR should consider developing a tool to provide consistent cement top estimates for evaluating well construction when logs are not present to identify tops. Identify when cement tops are estimates in records and wellbore diagrams.
17. The review team suggests that all inspections follow a process where they are reviewed by a supervisor prior to being placed in the public view. This will assist in QA/QC and help eliminate potential miscommunication with the public. Review of the records should be of high priority and have short review times.
18. DOGGR should ensure that when an inspection is released publicly, WellSTAR provides notice to the operator's dashboard that an inspection has been posted, regardless of the status of the inspection. Notices for deficiency/compliance issues discovered should be escalated beyond the dashboard.
19. DOGGR should ensure that notices of field activities being performed are provided to DOGGR through WellSTAR.

Appendix A: List of Acronyms

AO – administrative order
AOR – area of review
API – American Petroleum Institute
BBL. – barrels
CBL – cement bond log
CFR – Code of Federal Regulations
CGS – California Geological Survey
Class IID – saltwater disposal well
Class IIR – enhanced recovery well
COAs – condition of approvals
DI – direct implementation
DOC – Department of Conservation
DOGGR – Division of Oil, Gas, and Geothermal Resources
EOR – enhanced oil recovery
ESRI – a GIS company
E&P – exploration and production
GIS – geographic information system
GPP – Groundwater Protection Plan
GPS – global positioning system
GWPC – Groundwater Protection Council
IOGCC – Interstate Oil and Gas Compact Commission
MIP – maximum injection pressure
MIT – mechanical integrity test
MOU – memorandum of understanding
NOD – notice of deficiency
NOV – notice of violation
NPDES – National Pollution Discharge Elimination System
QA/QC – Quality Assurance/ Quality Control
RBDMS – Risk Based Data Management System
RCRA – Resource Conservation and Recovery Act
RWQCB – Regional Water Quality Control Board
SAPT – standard annulus pressure test
SDWA – Safe Drinking Water Act
SOP – standard operating procedure
SWRCB – State Water Resources Control Board
TDS – total dissolved solids
UIC – Underground Injection Control

USDW – underground source of drinking water

USEPA – United States Environmental Protection Agency

UPS – United Parcel Service

WellSTAR – California Oil, Gas and Geothermal Data Management System

ZEI – Zone of endangering influence

