Department of Conservation
Division of Oil, Gas, and Geothermal Resources

Underground Injection Control Action Plan

RESPONSE TO THE US EPA JUNE 2011 REVIEW OF CALIFORNIA'S UIC PROGRAM

Background and Introduction

The EPA approved the Division of Oil, Gas, and Geothermal Resources' (Division, or DOGGR) application for primacy in the regulation of Class II injection wells under section 1425 of the Safe Drinking Water Act in March 1983. This approval gave the Division primary responsibility and authority over all Class II injection wells in the State of California. The EPA remains a Division regulatory partner with Division oversight authority and separate enforcement authority for Class II well operators. Class II wells inject fluids associated with oil and natural gas production.

The Division is fully committed to implementing a strong Underground Injection Control (UIC) program and will continue to pursue additional resources to address program growth and/or UIC well count increases.

This Action Plan is in response to a review of California's UIC program, requested by EPA's Region Nine Ground Water Office, and performed by the Horsley Witten Group. The Horsley Report, March 2011 (Report) was submitted to EPA in June 2011, and forwarded to the Division on July 18, 2011.

The Report included several recommendations pertaining to the practices, processes and policies of the Division used to implement the State's oil and gas regulations. To address a number of Report recommendations and other needed UIC regulatory updates, the Division will begin a rulemaking in 2013 to update the UIC program, well construction, and plugging and abandonment regulations. Additionally, the Division will determine whether statutory changes are needed and work with the California Legislature as necessary.

It is important to note the Division has added 43 staff positions during the past three years; these staff are working in UIC program or other closely related programs. Additionally, the Division implemented an internal review processes such as audits and mandatory Headquarters technical reviews to ensure greater compliance with UIC mandates.

The Division has followed the Report's format in this Action Plan and responded to each recommendation as presented in the Report. Each recommendation is presented in summary form below in bulleted paragraphs using italicized text.

USDW DEFINITION AND PROTECTION

- *The DOGGR Class II UIC Program should address the lack of clarity regarding USDW protection and ensure that all USDWs are fully protected from fluid movement and resulting degradation. USDWs containing more than 3,000 mg/l TDS should be protected as much as fresh water aquifers are protected in the permitting, construction, operation, and abandonment of injection wells.*

The Division's UIC program protects underground sources of drinking water (USDW) and requires that all injection is confined to the approved zone of injection. When the injection fluid is confined to the intended zone, all other zones and waters are protected.

Sections 3220 and 3228 of the California Public Resources Code (PRC) require zonal isolation. These standards have been followed for setting casing in, and plugging and abandonment of, all wells, including injection wells. Since these statutes predate the Safe Drinking Water Act, the USDW term is not found in state law.

During the rulemaking process to begin in 2013, the Division will pursue, as necessary, additional plugging and cementing requirements to increase USDW protection.

AREA OF REVIEW / ZONE OF ENDANGERING INFLUENCE

These recommendations address area of review/zone of endangering influence (AOR/ZEI) determinations, well construction practices and the status of wells located within the AOR, and corrective action requirements.

AOR/ZEI Determinations

- *The ZEI should be calculated, especially for disposal wells, with an accurate representation or reasonable estimate of all the relevant parameters that determine the ZEI, including the static pressures of the injection zone and USDWs in the project area.*
- *Disposal into non-hydrocarbon zones and normally* [sic] *pressure hydrocarbon bearing zones should be carefully monitored for reservoir pressure increases beyond normal hydrostatic pressures that could cause the ZEI to increase beyond the AOR over time.*
- *A fall-off pressure test should be run to determine the static reservoir pressure in wells in which shut-in pressures do not fall to zero after an*

extended shut-in period. If not done, the permit to inject should be rescinded.

- *The ZEI calculations should be reviewed if fall-off test results indicate higher than normal hydrostatic pressure in the injection zone. If the original AOR is smaller than the ZEI, the AOR should be expanded, or the permit to inject should be rescinded.*

Well Construction Practices and Status of Wells Located within the AOR

- *When casing repairs occur or when wells are plugged and abandoned, cement placement should be required at the base of USDWs in injection wells and AOR wells.*
- *Unless USDWs are known to be absent in the area, new injection wells should be required to have long string casing cemented to the surface.*

As outlined in our Primacy Application (ftp://ftp.consrv.ca.gov/pub/oil/publications/safe_water.pdf), the Division utilizes the one-quarter (1/4) mile fixed radius; if appropriate data is available, a radial flow equation may also be used to determine the ZEI. Although the Division has typically utilized the one-quarter mile fixed radius, we are now using other methods, such as Bernard's equation, the modified Theis equation, and equations included in the EPA's publication *Radius of Pressure Influence of Injection* (EPA-066/2-79-170) to determine the ZEI. The Division is pursuing new requirements for waste fluid disposal wells, and will consider including a more in-depth evaluation of the ZEI.

The Division is concerned with any injection well where injection zone pressure exceeds hydrostatic pressure. This may indicate an over-pressurized injection zone and a greater threat of non-confinement. In these cases, the Division looks at the ZEI and evaluates all wellbores within the ZEI to ensure fluid confinement to the intended zone of injection. In addition to the AOR, the Division requires mechanical integrity testing of all injection wells on a periodic basis. If a well lacks mechanical integrity, the Division requires the operator to immediately cease injection and to repair the well.

As for well construction requirements, the Division's long-standing requirements set by regulation dictate isolation of all oil and gas zones and any underground or surface water suitable for irrigation or domestic purposes. This is accomplished by requiring the cementing of casing and the placement of cement plugs. In addition, when wells are plugged and abandoned, the Division requires the use of heavy drilling mud in those portions of the hole that do not have cement. All these requirements will be evaluated for adequacy and updated as necessary in the rulemaking to

begin in 2013 to ensure UIC program requirements are adequate for USDW protection.

DIVISION ANNUAL PROJECT REVIEW

- *This recommendation addresses records of well activity, pressures, inactive well and noncompliance data associated with injection well projects. Comprehensive project reviews should be conducted annually for all active injection well projects, including meetings with the operators for the most critical projects.*

The Division is fully committed to comprehensive project reviews. There are now two processes in place to address this concern -- a project audit, and an annual project review.

The Division has acquired additional staff who will audit injection projects to ensure that the projects are:

- permitted in accordance with state mandates;
- continued in compliance with mandates and approvals; and
- monitored and tested to ensure that fluid is injected into the intended zone.

This practice is authorized by the broad protection mandates of PRC section 3106 (a).

Additionally, the Division has increased UIC staff to ensure an annual project review for all injection projects. This amounts to a review of District office project data, and when necessary, a corresponding request that operators submit any missing data. Division staff will also meet with operators to discuss injection project operations to ensure that projects are operating in accordance with their project applications and approvals.

MONITORING PROGRAM

These monitoring program recommendations address mechanical integrity tests (MIT) and maximum allowable surface pressure (MASP).

Mechanical Integrity Tests

- *SAPT pressures equal to the maximum allowable surface injection pressure should be required if it will not cause damage to the casing. The newer wells should be able to withstand the MASP.*
- *If tested at less than the MASP, more frequent SAPTs and monitoring/reporting for anomalous pressure on the annulus should be required.*
- *Static temperature logs should be required more often in slimhole/tubingless completions where USDWs are present and especially for USDWs that are protected by only one casing string and/or lack cement at the base of USDWs.*

- *Cement bond logs should be required in new and newly converted injection wells unless USDWs are known to be absent in the area.*
- *Static temperature logs should be required if an existing well lacks sufficient cement at the base of USDWs, and/or squeeze cementing should be considered at the USDW base to ensure isolation from fluid movement.*

Maximum Allowable Surface Injection Pressures

- *Injection pressure should be maintained below fracture pressure in all new and existing projects, as determined by approved SRTs.*
- *SRTs should be required in new wells to determine the fracture pressure of the injection zone unless the formation fracture gradient is known with acceptable confidence based on SRTs in nearby wells.*
- *A pressure gauge should be required to measure bottom-hole pressures in SRTs directly rather than relying on calculation of friction losses from surface pressure measurements and injection rates.*

The Division now mandates that the Standard Annular Pressure Test (SAPT) be performed either to the approved injection pressure or 200 psi, whichever is higher. The Division does not allow variance from this policy unless there is the potential to damage well casing.

Since continuous monitoring of the annular space has advantages over the once-every-5-years SAPT, the Division now allows a positive-pressure annulus monitoring system with regular reporting with a lower-pressure, 5-year SAPT. These two testing options verify annular integrity while providing flexibility to operators.

The Division agrees that if wells are completed by way of slimhole/tubingless completions, static temperature logs should be required more often than for traditional completions. Division staff is moving forward to develop a policy to address this issue; if additional regulations are necessary, the Division will include this item in the rulemaking to begin in 2013.

The Division's regulations require that injection pressure be maintained below the fracture pressure as determined by a Step Rate Test (SRT). The Division has implemented a new SRT policy, based largely on EPA's procedures, which require downhole pressure monitoring. These improvements, along with additional field inspection staff and upgrades to electronic data management systems, increase the Division's oversight of injection operations, particularly the injection pressure.

INSPECTIONS AND COMPLIANCE / ENFORCEMENT PRACTICES AND TOOLS

- *A high priority should be placed for inspection of wells in or near residential areas and where USDWs are present.*
- *Cement placement operations should be witnessed to ensure the correct volumes and quality of cement are pumped into a well.*
- *Witnessing RATs in enhanced recovery wells should be given a higher priority, especially where USDWs may be present. At least 25 percent of RATs and all SAPTs in wells where USDWs are present should be witnessed.*
- *Whenever possible, districts should avoid giving advance notice of routine inspections to operators.*
- *Copies of an inspection report should be provided to the operator whether or not deficiencies are found during inspections.*
- *The installation of a pressure gauge on the tubing and the casing/tubing annulus should be required as a permanent fixture on all injection wells.*
- *Wells that fail MITs should be repaired or plugged and abandoned within a set time period, preferably within six months or sooner depending on the nature of the leak and potential threat to USDWs.*

The Division has successfully pursued additional UIC field staffing resources to increase UIC oversight in all areas. Although the Division regulations do not distinguish between rural and urban injection wells, the Division does allocate additional resources to oil fields in highly urbanized areas.

The Division's additional UIC resources have increased its oversight of wells in direct relation to their priority. The Division places a higher priority on inspecting water disposal wells which can pose a greater risk of contaminating USDW and fresh water.

The Division requires the witnessing of cement plugging operations. The witnessing of the plugging operations continues to be one of the highest priorities for Division field staff. In the office, detailed reviews of well work histories by Division engineers determine whether plugging operations comply with State mandates. If not, remedial work is ordered. Additional staffing, along with increased training, is ensuring the Division is properly evaluating cementing operations.

The Division has a goal to witness at least 25% of the Mechanical Integrity Tests (MIT), with a higher emphasis on disposal wells. Once new UIC personnel are fully trained the Division intends to increase this percentage.

The Division has been evaluating the performance of cyclic steam wells, which should be tested at least once a year, or immediately if evidence of casing damage or failure is found. This testing requirement is supported by data showing that cyclic steam wells undergo more stress than other types of injection wells. The Division will address additional cyclic steam well testing in the rulemaking to begin in 2013.

When staff witness detailed tests, a report is provided to the operator. In addition to witnessing tests, the Division performs thousands of inspections a year without prior notice to the operators. Because of the volume of inspections, the Division only documents that an inspection was performed and what deficiencies were found. The list of deficiencies is included in a letter to the operator, which details what must be done and the timeframe to bring the operation into compliance.

The permanent installation of pressure gauges on UIC wells is not a current requirement. With technological advancements, capturing pressure data is non-burdensome to operators. In 2013 when the Division moves forward with updating its UIC regulations, pressure monitoring via a gauge or equivalent equipment will be pursued.

If the MIT should indicate a mechanical integrity issue, the well is required to be shut-in immediately. The Division does not allow injection until the well is repaired. If the well should become idle (i.e. no injection for six continuous months over a five-year period) the well previously fell under the Division's idle well program (IWP) only. The IWP, which includes fluid level and casing integrity testing, is designed to eliminate the potential threat caused by idle wells. In addition to IWP, the Division has changed processes to ensure idle injection wells remain within the UIC program to ensure UIC program testing is conducted. Since current regulations lack clarity on when a well is to be repaired or plugged and abandoned, the Division will pursue such clarity in the rulemaking to begin in 2013.

IDLE WELL PLANNING AND TESTING PROGRAM

- *The idle well management and testing guidelines at Section 138 in the MOI should be modified to clarify which provisions apply statewide and which apply only to District 4.*
- *Idle well fees and bond/escrow amounts should be reviewed and increased amounts to levels that would encourage operators to reactivate or plug idle wells.*
- *The testing program should be modified to base the fluid level survey pass/fail results on the rise of fluid to the base of USDWs rather than the BFW.*
- *SAPTs should be required in wells after two years of inactivity and every two years after that where USDWs are present.*

- *Regardless of the fluid level survey results, an SAPT should be required if USDWs are present in wells with tubing and packers installed.*
- *Bridge plugs or cement plugs above the injection and below the base of USDWs should be required where USDWs are present in wells lacking tubing and packers. In addition, wells should be required to successfully pass an SAPT to remain in idle status.*
- *Idle wells that fail the SAPT should be repaired or plugged and abandoned within six months in areas where USDWs are present or within 60 days if USDWs are at risk of potential fluid movement.*

The Division will revisit the Idle IWP through the legislative process with the intent to update the law to address the excessive number of idle wells. The solution will address the potential financial liability to the State, the obligations of owners, and intends to address all of the recommendations listed in the above. Although program implementation in the 1990s did result in a drop in the idle well count, the idle well count in recent years has stabilized or crept upward.

Since all wells within an AOR are evaluated for zonal isolation, idle wells are reviewed as part of the Division's UIC program. The Division's IWP is operated separately from the Division's UIC program. However, both programs share the common goal of resource protection.

FINANCIAL RESPONSIBILITY REQUIREMENTS

- *Bond amounts should be reviewed and updated periodically to cover current plugging and abandonment costs.*
- *The financial responsibility program should be modified to require bonds and other financial responsibility instruments be held until wells are plugged and abandoned.*
- *Operator funding requirements and the number of deserted wells plugged and abandoned should be increased to numbers that will significantly reduce the inventory of orphan/deserted wells each year.*

The current bonding amount requirements are specified in State statute passed by the legislature; these amounts are outdated and therefore insufficient. Additionally California oil and gas wells are not required to have life-of-the-well bonding. The Division is committed to working with the legislature, the oil and gas industry, and interested parties to bring bonding requirements up to reasonable standards.

To partially offset the financial liability to California's citizens from orphan wells, the legislature has provided the Division with funding for orphan well plugging and abandonments.

PLUGGING AND ABANDONMENT REQUIREMENTS

- *Cement plugs should be placed at the base of USDWS to ensure long-term protection from fluid movement into or between USDWs.*
- *The presence of a DIVISION inspector should be required during cement placement in P&A operations to monitor and ensure that adequate cement quality and adequate quantities are pumped into a well.*

The Division's mandates require resource protection. Because the Division's UIC program requires that the injected fluid remain confined to the intended zone and that all oil and gas zones are isolated, USDWs are protected from any harm caused by injection. These basic requirements have not changed since the Division was granted Class II primacy; however the Division will review them to determine if updates are necessary for USDW protection.

Division inspectors are present during well plugging operations. To address the volume of plugging operations, regulations require that Division staff witness either the plug placement or the plug tagging (location and hardness) to verify that the plugging operation was completed in accordance with State mandates.

UIC STAFF QUALIFICATIONS

- *UIC-specific training (e.g., EPA-sponsored UIC Inspector Training Course) should be provided to new and recent hires in the DIVISION UIC Program within one year of employment.*
- *Inspectors should be required to hold a petroleum engineering or geology bachelor's degree or related degree or equivalent college courses and relevant experience.*
- *Consideration should be taken to adjusting compensation and benefits for UIC professional positions to levels more consistent with the oil and gas industry.*

The work required from Division staff is based on geology and petroleum engineering, and the Division is taking steps to ensure that the most qualified individuals are hired and promoted.

In the UIC program, knowledge of geology and petroleum engineering are critical. In addition to the knowledge acquired through formal education, the Division is seeking individuals with experience relevant to the duties they will be performing.

The Division is assessing existing staff to identify weaknesses and is providing training to ensure that staff is knowledgeable in critical areas. In cases where staff lack the appropriate education, their job duties will be limited until they gain the necessary knowledge and skill sets.

The Division operates within the State's civil service compensation mandates. Salaries are negotiated with established bargaining units. The Division has interest in ensuring that compensation mandates meet our needs and will work with the administration to achieve our goals.

GENERAL AND DISTRICT-SPECIFIC RECOMMENDATIONS

Although this section of the Report listed specific cases in various District offices, the Division is responding in more general terms. The Division has had several meetings with staff to discuss and explain duties and expectations. It has been made clear to staff that these expectations will be enforced uniformly throughout the Division.

To address UIC shortcomings the Division aggressively pursued and was granted additional resources. The Division has focused on the evaluation of new and existing project applications, and field surveillance to ensure compliance. The recommendation to acquire software to aid staff with regulating UIC operations is being pursed along with other Division data management needs.

The Division's UIC program includes more than protecting USDWs and fresh water; the Division is also mandated to protect hydrocarbon zones from damage. Under our statutes, the protection of fresh water and USDW s coexists with the protection of hydrocarbon resources.

The Report recommends higher inspection priority for wells located near residential areas or when a USDW is present. Although inspection frequency is not addressed in regulations, additional staffing is augmenting Division resources for all UIC inspection needs. As indicated above, the Division's regulations do not distinguish between rural and urban injection wells. However, the Division does allocate additional resources to oil fields in highly urbanized areas.

Conclusion

The Division has been required to protect oil, gas, and water resources, since its inception in 1915. Some statutes have changed very little since that time. With changes in oilfield practices and advancements in technology, the Division has been slow to change its regulatory framework. Although the Division has a strong regulatory program, the Division is pursuing greater and more consistent enforcement.

In 2009, the Division began an in-depth evaluation of the UIC program and identified some barriers to full compliance. This was the first of many steps to bring the Division's program back into greater compliance with our mandates. The Division has already ensured greater UIC program compliance by:

- Providing staff greater understanding of UIC program mandates and staff expectations;
- Adding 43 additional staff to UIC and associate programs;
- Creating an internal audit program; and
- Requiring an additional technical review for UIC projects.

The Division acknowledges that some operators have operated UIC projects without meeting all the requirements outlined in statutes and regulations, and have resisted coming into full compliance. The Division is committed to bringing all operators into compliance.

The Division has not had significant changes to its UIC regulations since the original primacy application. Regulatory amendments will be pursued through a rulemaking process to address these needs. The Division's goal is to ensure our regulations are:

- adequate for protection of public health, the environment, and resources;
- adequate to address the UIC program mandates;
- flexible to address industry practices now and into the foreseeable future;
- created in a transparent process;
- predictable for the regulated community; and
- properly implemented and enforced.

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November 2012