

# Narrative Description of Well Stimulation Draft Regulations

On September 20, 2013, Governor Brown signed into law Senate Bill 4 (Pavley, Chapter 313, Statutes of 2013). SB 4 complements existing rules that require some of the strongest well construction standards in the nation by enacting further safeguards to public health and safety and the environment regarding the practices known as well stimulation, including hydraulic fracturing.

SB 4 requires a permit from the Division of Oil, Gas, and Geothermal Resources to conduct well stimulation. The permit application must include detailed information about the fluids to be used, a ground water monitoring plan, and a water management plan. Copies of an approved permit must be sent to neighboring property owners and tenants, and water well testing must be provided upon request. SB 4 requires the Division to prepare regulations to ensure that well stimulation is done safely and to require detailed public disclosure about the well stimulation. The Division must develop an internet website to facilitate public disclosure of well stimulation information, and the website must allow the public to easily search and aggregate the information.

The well stimulation regulations that the Division will develop will be among the most protective in the nation and will address important operational requirements such as pressure testing, well evaluation, geologic evaluation, well monitoring, and storage and handling of fluids. The Division will also develop regulations to implement SB 4 permitting and neighbor notification requirements.

SB 4 requires the Division to prepare an environmental impact report consistent with the California Environmental Quality Act, addressing the practice of well stimulation in California. Additionally, SB 4 requires the Natural Resources Agency to complete an independent scientific study on well stimulation treatments, and the State Water Resources Control Board to develop groundwater modeling criteria and implement ground water monitoring programs.

The Department of Conservation (Department) has released the Division's proposed regulations governing well stimulation. This narrative describes, in lay terms, the current regulations governing well stimulation and the effect of the proposed regulations. This document addresses only the well stimulation regulations and does not summarize other requirements of SB 4, such as the EIR or independent scientific study.

## Background

All oil and gas wells in California are constructed to meet a high standard. The Division reviews well designs before drilling to ensure the construction plans meet stringent well construction standards. Some states have lower standards for "typical" oil and natural gas wells and then raise their standards for wells through which a well stimulation practice like hydraulic fracturing



or acid matrix stimulation will occur. California maintains a high construction standard for ALL wells.

Well construction standards have a fundamental purpose – to ensure “zonal isolation.” Zonal isolation means that oil and gas coming up a well from the underground geologic production zone will not escape the well and migrate into other geologic zones, including zones that might contain fresh water. Zonal isolation also means that any fluids an oil and gas operator puts down a well for any purpose will either stay in that zone or be brought up to the surface, and are not allowed migrate to another zone. To achieve zonal isolation, current rules require that a cement barrier be placed between the well and the surrounding geologic strata or stratum. The cement bonds to the surrounding rock and forms a barrier against fluid migration between the well and the surrounding rock. Cement barriers must meet certain standards for strength and integrity. If they do not meet the standards, they must be fixed or replaced. Metal casings – sometimes several layers of metal and cement, depending upon the well depth – also separate the fluids going up and down a well bore from the surrounding geology. If the integrity of a well is compromised by ground movement or other mechanisms, the operators must fix the well.

Once well operators drill into oil- and gas-bearing geologic formations, if there is recoverable oil or gas, they begin extraction of the resource. In some cases, the oil or natural gas will not flow freely to the well and the hydrocarbon formation must be stimulated (commonly referred to as either “production stimulation” or “well stimulation”). There are a variety of stimulation techniques intended to increase the permeability of the hydrocarbon formation and, thus, improve the flow of oil or natural gas from the geologic stratum to the well so hydrocarbon resources can be produced.

There are three broad types of well stimulation used in California that are the focus of SB 4 and the Department's supporting regulations:

- Hydraulic fracturing (HF) involves the temporary application of fluids at very high pressures to the oil or gas producing stratum designed to create new fissures through which oil or gas can flow back to the well and be produced. Without these fissures, the geologic zone would not as easily release the oil or gas and the well would not flow. The pressures applied must be high enough to break the geologic formation (i.e., higher than the stratum's “fracture pressure”). In HF, a fluid with chemicals and additives intended to achieve certain ends is injected into the formation under pressure. A “proppant” (typically sand, or small resin or ceramic beads) is added so that the fractures created by the pressure do not collapse back on themselves under the weight of thousands of feet of overlying rock. If the fractures were to close after the stimulation treatment, no additional flow of oil or gas would occur. Some chemicals and additives in the fracturing fluid help make sure the proppant remains in a gel-like solution (instead of settling to the bottom of the fluid) for circulation into the fissures. Other additives dissolve the gel after the fractures are created to allow the “fracturing fluid” to come back to the surface and leave the proppants behind in the fissures. Still others are inserted to ensure that bacteria from the surface are not accidentally injected into the



geologic stratum, where they might form biofilms or cultures that could clog the flow of the well.

- Acid fracturing is similar to HF in that the fluids are injected above the hydrocarbon-bearing formation's fracture pressure to create fractures in the hydrocarbon zone. Unlike HF, however, sometimes a proppant is not used. In this case, the formation that is fractured is also etched by the acid, creating channels through which oil and natural gas can flow back to the well bore for production to the surface. When no proppant is used, gelling agents to hold proppant in suspension are not necessary. The acidity of the fluid may also remove the necessity of using other chemicals as biocides, although that is dependent upon the type and strength of the acid used.
- Acid matrix stimulation is the application of acid below a formation's fracture pressure to etch existing fissures, increase the hydrocarbon formation's permeability, and increase flow of oil or natural gas to the well bore. The pressures involved in this injection are lower than the fracture pressure of the surrounding rock, as the acid used is propagated into the hydrocarbon formation without need to fracture the formation. The need for gelling agents and agents that break the gel are not necessary, as no proppant needs to remain in suspension. Similarly, the use of other chemicals as a biocide may be reduced, dependent upon the concentration of acid used.

Some of the chemicals used in fracturing fluids are non-toxic, but others have potential health hazard properties. Once the fluids are injected, most of them are produced back to the surface through the same well into which they were injected.

California oil and natural gas is almost always associated with "produced water" – that is, brackish water that is sometimes as salty as the Earth's oceans has already been trapped in the oil or gas formation for millions of years. Generally, there is far more water in a reservoir formation than there is oil or natural gas; 80-90 percent water is not uncommon in California oil and gas fields. This means that, on average for all wells in the state, for every 100 barrels of fluid produced, more than 80 of the barrels of fluid are brackish water. One of three things can happen to this water: it can be re-injected through regulated injection wells for enhanced oil operations; it can be re-injected into regulated wastewater disposal wells; or it can be treated to meet standards that allow use for other purposes or discharge. When well stimulation occurs, most of the fluid used in the stimulation is pumped to the surface along with the produced water, making separation of the stimulation fluids from the produced water impossible. The stimulation fluid is then co-disposed with the produced water. Current regulations specify the disposal requirements for these fluids – for instance, existing regulations govern how fluids are disposed of in disposal wells, how they are used to enhance oil production from existing reservoirs, or how they are treated.



## Current Well Approval Process

Operators apply to the Department before drilling an oil or gas well. If their well construction proposal meets the Department's standards, the Division of Oil, Gas, and Geothermal Resources approves the proposal. Once the well is authorized, the operator is allowed to construct the well to the applicable standards and operate it in accordance with existing rules. If the well loses integrity – for example, damage to the well results in an inability to provide zonal isolation – the operator must remedy the situation. Also, if the well operator wants to change the well's depth or change the well from a "producing well" to an "injection well" or to a "disposal well," the Department/Division must review the proposed change. The Department's existing regulations protect groundwater, public health and safety, and the environment through adherence to high construction standards and maintenance of the well's integrity. These protections remain in effect, regardless of the well stimulation techniques applied to the geologic formation through the well.

## Operator Requirements Under the Proposed Regulations and SB 4

### 1. Evaluation Prior to a Well Stimulation Treatment.

*Cement Evaluation.* The proposed regulations require an operator to perform a cement evaluation log to demonstrate that the cement outside of the production casing is competent to ensure zonal isolation during and following a well stimulation treatment. Another cement evaluation method may be used if it is capable of demonstrating the adequacy of the cement. If adequate cement coverage and bonding cannot be demonstrated, then the operator must develop a plan for remediating the cement before a well stimulation treatment is performed. Cement evaluation may be waived if the well has cement in place beyond what is required under the applicable well construction regulation, or if the Division is satisfied that past experience with drilling and production in the area has proven that the method of well construction and cementing employed will ensure that there will be no voids in the annular space of the well.

*Well Stimulation Treatment Radius Analysis.* The proposed regulations require an operator to perform a well stimulation treatment radius analysis to demonstrate that there is no potential conduit for fluid to migrate out of the hydrocarbon zone where the well stimulation treatment will occur. Based on modeling approved by the Division, the operator is required to review a three-dimensional area that is twice the anticipated distance of the well treatment to verify that there is no well or fault in that area that could act as a conduit for fluid to contaminate protected water. If the area of five times the anticipated well treatment length extends beyond the hydrocarbon zone where the well stimulation treatment will occur, then the operator must also demonstrate that the adjacent geological formations will contain the well stimulation treatment.

*Well Stimulation Treatment Design.* The proposed regulations require an operator to prepare a well stimulation treatment design that demonstrates that the cement evaluation and the well



stimulation treatment radius analysis have been completed and that the findings have been synthesized and employed.

## **2. Well Stimulation Permit Application.**

SB 4 requires operators to obtain a permit from the Division in advance of performing a well stimulation treatment. The permit application includes the following: the identification and location of the well; the time period during which the well stimulation treatment is planned to occur; a water management plan; a list of the anticipated identity and concentration of the chemical constituents of the well stimulation treatment fluids the operator plans to use; modeling of the well stimulation treatment and identification of plugged and abandoned wells and geologic faults within the modeled treatment area; a groundwater monitoring plan meeting the criteria of the applicable Regional Water Quality Control Board; an estimate of treatment-generated waste materials that are not addressed in the water management plan; identification and contact information of the operator; the depth of the base of fresh water; and the results of specified evaluation and modeling.

The Department's proposed regulations make clear that well stimulation treatments must be performed in accordance with the conditions of the permit issued by the Division, and establish the permit process that must be followed by operators.

**3. Neighbor Notification and Water Testing.** SB 4 requires operators to hire an independent entity or person to provide notification to every tenant and owner of neighboring property within a specified distance from the wellhead and horizontal projection of a well that will have a well stimulation treatment performed on it. The statute requires operators to provide neighbor notification at least 30 days prior to commencing the well stimulation treatment and notified property owners may request baseline and followup water quality testing at the operator's expense.

**4. Pressure Testing Prior to Well Stimulation Treatment.** The proposed regulations require operators to pressure test the well, and the equipment to be used for hydraulic fracturing, prior to commencing a well stimulation treatment. Pressure testing must be performed to a pressure equal to 125 percent of the pressure anticipated during the well stimulation treatment. If there is a pressure drop of 10 percent or more, then the casing or tubing cannot be used unless the problem is corrected and there has been a successful pressure test. The operator must give the Division at least 24-hours notice before pressure testing so that the Division will have an opportunity to witness the testing.

**5. Monitoring During a Well Stimulation Treatment.** The proposed regulations require the operator to monitor the surface injection pressure, the slurry rate, the proppant concentration, the fluid rate, and the pressure of each annuli of the well during a well stimulation treatment for indications that a well breach may have occurred or that fluid is not confined to the intended zone. Further, the proposed regulations specify two thresholds at which the operator must terminate the well stimulation treatment, report the incident to the Division, and conduct diagnostics. The Division must be notified when diagnostics are conducted so that Division staff



has an opportunity to witness the diagnostics. If diagnostics indicate that a well breach did occur during well stimulation treatment, then the operator must immediately shut-in the well and isolate the perforated section. In addition, the operator must provide essential information about the event to the Division and the local Regional Water Quality Control Board to facilitate incident response. The information that the operator must provide includes a description of events leading up to the well breach, an exact description of the chemical composition of the fluids in the well at the time of the well breach, an estimate of the volume of fluid lost during the well breach, and available data about the protected water closest to the well breach.

**6. Monitoring After a Well Stimulation Treatment.** The proposed regulations require operators to perform ongoing monitoring of a well that has had a well stimulation treatment to determine if there is any indication of a well breach and, if there is such indication, immediately inform the Division and the local Regional Water Quality Control Board, conduct diagnostics, and take all appropriate measures to prevent contamination of protected water or loss of hydrocarbon resources. The required monitoring includes monitoring of production pressures and monitoring the oil, gas, and water produced from the well, including the readily identifiable volume of well stimulation treatment fluid flowback. This monitoring must occur at least once every two days for the first thirty days and monthly after that. Monitoring of the well output may be stopped once the operator has seen a 95 percent reduction in the amount of well stimulation treatment fluid in the produced fluid. The proposed regulations also require operators to report annular pressures to the Division on an annual basis, and immediately inform the Division in the case of specified occurrences. For monitoring purposes, the annular valve must be kept accessible at the surface, unless the Division is satisfied that there are no voids in the annular space of the well. A pressure release device is required for the annulus and the maximum set pressure is specified. The Division may waive the requirement of a pressure release device if satisfied that the need for one is alleviated by other forms of technical analysis and or by operating experience in the area.

**7. Disclosure.** SB 4 requires an operator to post, within 60 days following the cessation of a well stimulation treatment, specified information regarding the composition and disposition of well stimulation fluids, including, but not limited to, hydraulic fracturing fluids, acid well stimulation fluids, and flowback fluids, to a Web site designated or maintained by the Division, and accessible to the public. The proposed regulations reiterate the disclosures specified in the statute, with some minor additions and non-substantive revisions for the sake of clarity.

**8. Trade Secrets.** Some operators and contractors for operators claim that the chemical composition of the well stimulation fluids they use are subject to trade secret protections. Trade secret protections are specified primarily in the California Civil Code. SB 4 requires that, whether or not the information is claimed as trade secret, it must be disclosed to the Division. A supplier may designate that the information is a trade secret, and submit the information to the Division along with a specified justification. The Division is then required to make a determination of whether or not the information is a protected trade secret. After the determination, SB 4 sets forth a process by which the information can be obtained, how the trade secret information would be disclosed, and how the supplier may seek to obtain a



preliminary injunction prohibiting disclosure of the information to the public if it disagrees with the trade secret determination of the Division. SB 4 also provides that even if the information is a protected trade secret, it must be disclosed to specified government entities, or for a health professional who reasonably believes that the information may be necessary in the diagnosis or treatment of a patient.

**9. Storage and Handling of Well Stimulation Fluids.** Current law and regulations administered by the Department/Division contains provisions governing notification, response and clean-up of spills in the oil field environment. The proposed regulations clarify that well stimulation fluids are subject to those reporting, response, and clean-up requirements. Concentrated well stimulation fluid stored on-site prior to mixing, mixed well stimulation fluids, and produced fluids, including the well stimulation fluid flowback, will all be subject to those requirements. In addition, the proposed regulations specify that well stimulation fluids may not be stored at any time in unlined sumps or pits. Further, in the event of a release or spill, operators will be required to provide a report to the Department/Division detailing activities leading up to the release, types and volumes released, cause of release, actions taken to stop, control, and report the release, and steps taken to prevent future releases.

**10. Post Well Stimulation Treatment Report.** The proposed regulations require an operator to submit a report to the Division detailing what happened during the well stimulation treatment. Within sixty days after a well stimulation treatment, the operator is required to report to the Division on what the results were, what pressures were encountered, and how the operations differed from what was anticipated in the treatment design. In addition, the operator is required to review data available from the U.S. Geological Survey and indicate to the Division if there have been any seismic events of magnitude 2.0 or greater in the area of the well stimulation treatment.

