

SB 4 WELL STIMULATION TREATMENT REGULATIONS

ECONOMIC IMPACT ANALYSIS

INTRODUCTION

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

SB 4 requires a permit from the Department of Conservation, Division of Oil, Gas, and Geothermal Resources (Division) 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.

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 monitor programs.

The proposed regulations are intended to supplement the Division's current oil and gas regulatory framework with regulations specific to well stimulation to meet the mandates of SB 4. The proposed regulations satisfy the goals and requirements of SB 4 by setting requirements to ensure integrity of wells, well casings, and the geologic and hydrologic isolation of the oil and gas formation during and following well stimulation treatments; and by requiring full disclosure of the composition and disposition of well stimulation fluids, including hydraulic fracturing fluids, acid well stimulation fluids, and flowback

fluids. The proposed regulations satisfy the goals and requirements of SB 4 by implementing express statutory requirements regarding well stimulation permits, public disclosure, neighbor notification, and water well testing. The proposed regulations address the distinction between well stimulation treatment and other routine operations; the distinction between well stimulation and underground injection projects; and the acid concentration threshold at which an acid matrix stimulation treatment is subject to the requirements of SB 4.

The purpose of this document is to provide discussion and quantification of economic impacts that will result from the proposed regulation, as estimated by the Division. While this is not a comprehensive academic study, the quantified estimates are based on best available data as provided by the oil and gas industry, consultation with contractors, and the Division's experience in regulating all aspects of oil and gas production.

CURRENT WELL STIMULATION COSTS PRIOR TO THE IMPLEMENTATION OF THE PROPOSED REGULATIONS

The Divisions' best estimate is that each year approximately 800 wells in the State undergo some type of well stimulation treatment that would be subject to the requirements of the proposed regulations. This estimate is based upon data obtained from Frac Focus, which shows that approximately 600 wells were hydraulically fractured in 2012. Additionally, discussions with oil and gas operators indicates that in 2012 approximately 200 wells were subject to some other form of well stimulation treatment that would be subject to these regulations. The cost for well stimulation treatment of a well can vary greatly depending upon the depth of a well and the nature of the treatment. On the low end of the spectrum, conducting a one stage treatment on a shallow well can cost an operator around \$300,000. More involved treatments on a deep well with multiple stages can cost an operator \$1 million or more to complete.

While considering potential costs of the proposed regulations, the Department has assumed a representative operator that performs approximately 72 well stimulation treatments a year, complies with existing laws and regulations, and adheres to common and best practices in the oilfield.

POTENTIAL AREAS OF ECONOMIC IMPACT

The Department drafted the proposed regulations after careful consideration of current best practices instituted by operators when conducting the many forms of well stimulation. A majority of the requirements in the proposed regulations are consistent with common and best industry practices followed by operators, including American Petroleum Institute (API) standards, before, during, and after a well stimulation treatment. Additionally, the Department drafted the proposed regulations based on the requirements of SB 4, therefore, many of the proposed regulations simply implement express statutory requirements.

The following areas of the proposed regulations have been identified by the Department as potentially resulting in economic impact:

- 1. Well stimulation permitting.**
- 2. Required public disclosure.**
- 3. Neighbor notification / water well testing.**
- 4. Cement evaluation.**
- 5. Well stimulation treatment radius analysis.**
- 6. Pressure testing prior to the well stimulation treatment.**
- 7. Monitoring during a well stimulation treatment.**
- 8. Storage and handling of well stimulation fluids.**
- 9. Monitoring after a well stimulation treatment.**
- 10. Post well stimulation reporting.**

1. Well Stimulation Permitting

Public Resources Code (PRC) Section 3160, subdivision (d), requires an operator to apply for and obtain a permit from the Division prior to conducting a well stimulation treatment on a well. There may be costs incurred by operators as a result of the statutorily required well stimulation permit. However, the proposed regulations do not create this requirement, and the proposed regulations implementing this requirement do not create a new cost. The proposed regulations establish procedures that seek to clarify and streamline the permit process. It is the intent of the Department that the proposed regulations regarding well stimulation treatment permitting will reduce costs to a representative operator and statewide costs to comply with the statutory permitting requirements.

2. Required Public Disclosure

Public Resources Code section 3160, subdivision (b), requires the Division to adopt regulations requiring full disclosure of the composition and disposition of well stimulation

fluids, including, but not limited to, hydraulic fracturing fluids, acid well stimulation fluids, and flowback fluids. The statute provides detailed specification of the disclosure that the regulations must, at a minimum, require. Public Resources Code section 3160, subdivision (g), requires operators to publicly disclose this information on a website to be developed by the Division for the purpose. The proposed regulations reiterate the disclosures specified in the statute, with some minor additions and non-substantive revisions for the sake of clarity. There may be costs incurred by operators to comply with the statutorily required public disclosure. However, the proposed regulations do not create these requirements, and therefore do not create a new cost.

3. Neighbor Notification / Water Well Testing.

PRC Section 3160, subdivision (d), requires an operator to notify specified neighbors near the well subject to a well stimulation treatment, and provide for water well testing, if requested. There may be costs incurred by operators to comply with the statutorily required notification and water well testing. However, the proposed regulations do not create this requirement, and therefore do not create a new cost. In fact, the proposed regulations seek to clarify the notification and water well testing process, which will mitigate the burden of compliance. Although operators and suppliers will incur some cost in complying with the statutory neighbor notification and water well testing requirements, the proposed regulations will not increase those costs for a representative operator or on a statewide basis.

4. Cement Evaluation

The proposed regulations requiring evaluation of the cement in the well prior to well stimulation treatment are designed to ensure the integrity of a well prior to commencing a well stimulation treatment. This is a performance-based requirement. Although by default, the regulation would require an operator to run a radial cement evaluation log, an operator may employ another cement evaluation method that is approved by the Division, and capable of demonstrating adequate cementing. Additionally, many operators have a good understanding of the geology near and around the wells subject to the well stimulation treatment and may forego cement evaluation for an individual well if the Division is satisfied that well construction practices in the area ensure well integrity.

Prudent operators are currently running some form of cement evaluation prior to a well stimulation treatment, and, based on discussions with operators, the Division's best estimate is that at least 95% of well stimulation treatments performed involve some form of cement evaluation. The proposed regulations make this standard practice a

requirement. A radial cement evaluation log test can cost \$3,000 for a shallow well to up to \$10,000 for a deep well. However, for a representative operator who already performs some effective form of cement evaluation costs will not increase as a result of the proposed regulations. Assuming that not more than 5% of well stimulation treatments do not involve a form of cement evaluation, statewide costs would be \$120,000 to \$400,000.

5. Well Stimulation Treatment Radius Analysis

The proposed regulations would require an operator to conduct a well stimulation treatment radius analysis to ensure the geologic and hydrological isolation of an oil and gas formation during and after a well stimulation treatment. According to research conducted by the Department, the cost to obtain the software to perform the modeling for a hydraulic fracturing treatment ranges from \$37,000 to \$100,000. Other forms of well stimulation that do not extend out very far into the formation would be far less costly, or, modeling would not be necessary. In addition, this analysis requires some research and analysis by professionals with appropriate expertise.

As previously discussed, operators have a good understanding of the geology near and around the wells subject to the well stimulation treatment. Operators either have, or already contract with, professionals with appropriate modeling software and expertise regarding the modeling necessary to understand the geology near the well subject to the well stimulation treatment. The proposed regulations simply make this standard practice a requirement. Representative operators who employ a contractor that already perform some type of modeling, and who have a good understanding of the geology near the well, would not be subject to new costs. The Division believes that it is unlikely that operators will elect to recreate well stimulation treatment modeling and engineering that service companies provide on a contract bases. However, assuming that as many as three operators, who do not currently perform some type of modeling prior to a well stimulation treatment, elect to purchase the modeling software and complete the modeling and analysis in-house, statewide costs would be \$100,000 - \$400,000. This estimate is based on the one-time cost to procure the software, and staff time to perform the analysis.

6. Pressure Testing Prior to a Well Stimulation Treatment

The proposed regulations would require that an operator pressure test the well and surface equipment prior to initiating a well stimulation treatment. It is a well-established industry best practice to pressure test the well and surface equipment prior to a well stimulation treatment. While the regulations set specific standards for the testing,

pressure testing is always completed by operators prior to a well stimulation treatment. In this discussion, the Department considered that operators sometimes set up a work-over rig to pressure test a well which may take up to eight hours at a cost of \$4,000 to \$8,000 for the day. This is generally the case if the well casing is perforated before the pressure testing is completed. These estimated costs could be avoided if operators plan to have the pressure testing completed before the well casing is perforated. However, the Division believes that for some small percentage of well stimulation treatments, probably not more than 2%, logistical needs will dictate bringing on a work-over rig to perform pressure testing.

The time and cost to run a well pressure test is nominal as the test often takes less than half an hour. Because pressure testing is standard practice and no prudent operator would perform well stimulation without pressure testing, the proposed regulations should not create new cost for a representative operator or on a statewide basis. Assuming that as much as 2% of the wells subject to a well stimulation treatment are pressure tested by bringing on a work-over rig, statewide costs could range from \$64,000-\$128,000.

7. Monitoring During a Well Stimulation Treatment

The proposed regulations would require an operator to monitor fluids and pressures during a well stimulation treatment. The regulations would require an operator to terminate operations if there is a significant change in pressure or fluid in excess of expectation close to the surface. An operator would be required to perform diagnostic testing on the well to determine whether a breach has occurred if any of the events listed in subdivision (b) occur. The operator would be required to notify the Division so that Division staff may witness the tests. If a well has been breached then the regulations require an operator to immediately shut-in the well, isolate the perforated interval, and notify the Division and the Regional Water Quality Control Board with information pertaining to the breach.

It is current industry practice to monitor fluids and pressures during well stimulation treatments, so monitoring would not result in an increase in cost to an operator. In the event that a well is breached an operator would incur costs for staff to report the breach and collect specified information to provide to the Division and the Regional Water Quality Control Board. Also, costs would be associated with the operator's required work with the Division and the Regional Water Quality Control Board to identify the appropriate response to the incident. The extent of these costs would depend on the nature of the incident, the amount of staff time, and any necessary testing performed. It must be noted that although the Department does not have comprehensive information

regarding well failures during well stimulation treatment, the Department believes that it is not a common occurrence. For this reason costs to a representative operator would be negligible. Statewide costs would be speculative and dependent on how often well stimulation treatments result in well failures.

8. Storage and Handling of Well Stimulation Fluids

The proposed regulations specify requirements for the storage and handling of well stimulation treatment fluids. The regulations would require that fluids be stored in compliance with current secondary containment requirements, except that secondary containment is not required for portable or temporary production facilities, and that operators make sure their spill contingency plans account for stimulation treatment fluids. These requirements restate existing requirements and to clarify their application to well stimulation treatment fluids. Assuming current compliance with existing laws and regulations, costs of compliance with these requirements will be negligible for a representative operator. Based on this assumption, these requirements will force some operators to address existing compliance issues. The Department estimates that compliance with the proposed regulations will result in total statewide costs in the range of \$500,000 to \$1,000,000.

The proposed regulations require operators to provide the Division a specified written report in the case of an unauthorized release of well stimulation fluids. In the event of an unauthorized release of fluids associated with a well stimulation treatment an operator would incur costs for staff to prepare the required report. Although the Department does not have comprehensive information regarding the number of unauthorized releases that specifically involve fluids associated with a well stimulation treatment, the Department believes that it is not a common occurrence. For this reason costs to a representative operator would be negligible. Statewide costs would be speculative and dependent on how often fluids associated with well stimulation treatments are spilled.

The proposed regulations would also require well stimulation treatment fluids to be stored in containers rather than sumps or pits. For operators that currently store well stimulation treatment fluids in containers this requirement will not result in new costs. For operators that store well stimulation treatment fluids in pits and sumps, costs to comply with the regulation would be approximately \$10,000 to rent tanks for the operations. The cost could be more or less dependent upon the volume of fluids and the number of tanks needed for storage of the fluids. Because the representative operator does not store well stimulation treatment fluids in pits or sumps, the representative operator will not incur costs as a result of this requirement. However, the

Department estimates that approximately 120 pits or sumps are used statewide to store well stimulation treatment fluids. Therefore, this requirement will result in statewide costs of \$1,200,000.

9. Monitoring After a Well Stimulation Treatment

The proposed regulations establish requirements for monitoring a well after it has undergone a well stimulation treatment. Required monitoring for a well that has had a well stimulation treatment 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, except that monitoring of the well output may be stopped once the operator has seen a 95% reduction in the amount of well stimulation treatment fluid in the produced fluid. Operators must report annular pressures to the Division on an annual basis, but must immediately inform the Division if annular pressure exceeds specified thresholds.

Many operators have workers check oilfields on a daily basis for routine maintenance and potential leaks and spills, however, according to discussions with the oil and gas industry, additional personnel and specified equipment (at a cost of \$3,000-\$7,000 per well) would be necessary to perform the required monitoring. The Division estimates that the increase in workload could result in a cost of \$216,000-\$504,000 for a representative operator and \$2,400,000-\$5,600,000 on a statewide basis.

10. Post Well Stimulation Reporting

The proposed regulations require an operator to submit a report regarding the results of the well stimulation treatment, the pressures encountered during the well stimulation treatment; and how the actual well stimulation treatment differs from what was anticipated in the well stimulation treatment design. The proposed regulations require an operator to collect information through the entire well stimulation treatment; this portion of the regulation is simply a report of that information. Costs to representative operators to combine this information into the form of a report are negligible. Statewide costs to perform the same report are also negligible.

Conclusions

Well stimulation treatments have been a useful tool implemented by oil and gas operators for decades. Through the years, many best or standard practices have

become common for operators and contractors. These standard practices are aimed at the protection of the well and formation, thereby increasing the protection of the resource. The Department's proposed regulations make many of the standard practices a requirement. Therefore, to a typical operator, the economic impacts of the proposed regulations, although significant, are not onerous. However, those operators that have failed to implement the standard practices will face greater adverse economic impact from compliance with the proposed regulations.

The estimated added costs as a result of the proposed regulations to conduct individual well stimulation treatments would be \$5,840 to \$10, 910 (statewide costs divided by the estimated number of well stimulation treatments). The added costs equate to an estimated increase of 1.83% to 1.11% on the total cost to conduct a well stimulation treatments. This marginal, relative increase will not affect the profitability of drilling or stimulating a well. Therefore, given the overall costs and economic context of well stimulation treatments, the added economic impacts associated with complying with the proposed regulations will not deter operators from performing future well stimulation treatments. For these reasons, the Department has made the following determinations:

- The proposed regulations will not affect the creation or elimination of jobs within the State of California.
- The proposed regulations will not affect the creation of new businesses or the elimination of existing businesses with the State of California.
- The proposed regulations will not affect the expansion of businesses currently doing business in the State of California.
- The proposed regulations will not affect the ability of businesses within California to compete with businesses in other States.

The proposed regulations satisfy the Division's statutory mandate to prevent damage to life, health, property, and natural resources by ensuring that wells are properly drilled, operated, repaired, and plugged and abandoned; and to allow, with Division approval and oversight, the oil and gas industry to utilize all methods and practices known to the oil industry for the purpose of increasing the ultimate recovery of underground hydrocarbons. Also, the proposed regulations satisfy the statutory goals of SB 4 by addressing the well stimulation permit application process, acid concentration thresholds, construction of wells and well casings to ensure integrity of wells, well casings, and the geologic and hydrologic isolation of the oil and gas formation during and following well stimulation treatments, and full disclosure of the composition and disposition of well stimulation fluids, including hydraulic fracturing fluids, acid well stimulation fluids, and flowback fluids, and the distinction between well stimulation and underground injection projects. Further, the Department has determined that the proposed regulations will result in nonmonetary benefits such as protection of public

health and safety, worker safety, environmental safety, and transparency in business and government. Specifically, the benefits are as follows:

- Clarity for the Division, operators, and the public regarding which set of regulations oversee a specified oil and gas operation.
- A better informed public that will know when and where well stimulation is occurring, and be able to obtain information specific to a completed well stimulation treatment.
- The Division will receive comprehensive information regarding the integrity of a well, information regarding the integrity of wells near a well stimulation treatment, and geologic information regarding the area around the well prior to a well stimulation treatment, which will result in assurances that well stimulation will be completed safely.
- Operators will be provided with clear directives regarding when to terminate a well stimulation treatment, how to respond in the case of a well failure, and what information must be collected to ensure that future well failures are preventable.
- Assurances that all well stimulation fluids will be handled safely and that spills and incidents will be responded to effectively and proactively.

The estimated annual costs are as follows:

Summary of Estimated Costs	Representative Operator			Statewide Cost		
	Low	High	Average	Low	High	Average
Well Stimulation Permitting	N/A	N/A	N/A	N/A	N/A	N/A
Required Public Disclosure	N/A	N/A	N/A	N/A	N/A	N/A
Neighbor Notification / Water Well Testing	N/A	N/A	N/A	N/A	N/A	N/A
Cement Evaluation	N/A	N/A	N/A	\$120,000	\$400,000	\$260,000
Well Stimulation Treatment Radius Analysis	N/A	N/A	N/A	\$100,000	\$400,000	\$250,000
Pressure Testing Prior to the Well Stimulation Treatment	N/A	N/A	N/A	\$64,000	\$128,000	\$96,000
Monitoring During a Well Stimulation Treatment	N/A	N/A	N/A	N/A	N/A	N/A
Storage and Handling of Well Stimulation Fluids	N/A	N/A	N/A	\$500,000	\$1,000,000	\$750,000
Storage in Tanks	N/A	N/A	N/A	\$1,200,000	\$1,200,000	\$1,200,000
Monitoring After a Well Stimulation Treatment	\$216,000	\$504,000	\$360,000	\$2,400,000	\$5,600,00	\$4,000,000
Post Well Stimulation Report	N/A	N/A	N/A	N/A	N/A	N/A
Totals	\$216,000	\$504,000	\$360,000	\$4,384,000	\$8,728,000	\$6,556,000