WELL STIMULATION TREATMENT ANNUAL REPORT

Program Assessment
November 7, 2025

Reporting Period: January 1, 2023, to December 31, 2023
Prepared Pursuant to Senate Bill 4 (Ch. 313, Stats. of 2013)

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ABOUT THE CALIFORNIA GEOLOGIC ENERGY MANAGEMENT DIVISION

The California Geologic Energy Management Division (CalGEM) prioritizes the protection of public health, safety, and the environment in its oversight of the oil, natural gas, and geothermal operations in California. To do that, CalGEM uses science and sound engineering practices to regulate the drilling, operation, and permanent closure of wells associated with the discovery and production of oil, gas, and geothermal resources. CalGEM also regulates certain pipelines and facilities associated with production and injection. These regulatory duties include witnessing tests, inspections, and subsurface operations.

When CalGEM was established in 1915 (then known as the Department of Petroleum and Gas), the initial focus of regulation was the protection of oil and gas resources in the State from production practices that could harm the ultimate level of hydrocarbon recovery.

Early CalGEM regulations included well spacing requirements and authority to limit production rates. However, those regulations and the focus of CalGEM have evolved and come to include the protection of public health, safety, and the environment.

CalGEM has grown significantly since it was established in 1915 and has taken major steps to ensure it will be able to handle challenges in a manner consistent with public expectations for a modern, efficient, collaborative, and science-driven regulatory agency.

In 2019, the mission of CalGEM changed to include protecting public health and safety, environmental quality, and the reduction and mitigation of greenhouse gas emissions associated with the development of hydrocarbon and geothermal resources in a manner that meets the energy needs of the state.

CalGEM Districts

CalGEM operates out of three districts (Northern, Central, and Southern) to best serve the needs of the State. Each district has its own office(s) where staff are available to assist the public and stakeholders.

CalGEM districts are responsible for all field oversight of Well Stimulation Treatment (WST) operations, including witnessing pre-WST pressure tests and chemical spot-checks during stimulation. District duties also include a review of the 72-hour Notification form and a final review of all relevant well logs before the start of the treatment.

For more information about CalGEM, visit our website at:
https://www.conservation.ca.gov/calgem

Contact Information

For more information about WST, visit:
https://www.conservation.ca.gov/calgem/Pages/WST.aspx

For questions regarding the content of this report, contact the Department of Conservation (DOC) Public Affairs Office at pao@conservation.ca.gov.

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ACRONYMS, ABBREVIATIONS & UNITS

ADSA	Axial Dimensional Stimulation Area
BBLS	barrels
CalGEM	California Geologic Energy Management Division
CAP	Corrective Action Plan
CAS	Chemical Abstract Service
CARB	California Air Resources Board
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
DOF-OSAE	Department of Finance – Office of State Audits and Evaluations
EIR	Environmental Impact Report
FT	feet
IWSTN	Interim Well Stimulation Treatment Notice
LLC	Limited Liability Corporation
µg/L	micrograms per liter
mg/L	milligrams per liter
pCi/L	picocuries per liter
PRC	Public Resources Code
RF	Recovered Fluid Sample
SB 4	California State Senate Bill 4 (Pavley, Ch. 313, Statutes of 2013)
SOP	Standard Operating Procedure
SRIA	Standardized Regulatory Impact Assessment
TVD	True Vertical Depth
UIC	Underground Injection Control
WST	Well Stimulation Treatment
WellSTAR	Well Statewide Tracking and Reporting System

1.0 EXECUTIVE SUMMARY

This annual report satisfies the requirements of Senate Bill 4, which governs the regulation of well stimulation treatment (WST) activities in California. WST is a one-time, temporary well completion technique used to enhance oil and gas production. WSTs include, but are not limited to, hydraulic fracturing, acid fracturing, and acid matrix stimulation.

This report covers WST programmatic activities from January 1, 2023, through December 31, 2023, but also includes data collected since the initial implementation of interim SB 4 regulations beginning on January 1, 2014, and the permanent SB 4 regulations adopted July 1, 2015. WST data presented in this report are derived from operator disclosures (post-WST job reports) submitted to CalGEM in accordance with SB 4. No WST permits have been issued since 2021, and no stimulations have been conducted. As such, no relevant data are available for obligatory reporting of neighbor notifications or witnessed WST events during the 2023 calendar year.

As background, in April 2021, Governor Newsom directed CalGEM to initiate regulatory action to end the issuance of new permits for well stimulations, especially hydraulic fracturing, by 2024. In response to the Governor's order, CalGEM completed a rulemaking in 2024 to prohibit WST permitting, with the regulations having gone into effect on October 1, 2024. Since the permanent WST program was started in 2016 until the end of 2021, CalGEM issued a total of 790 WST permits, with a total of 710 stimulations completed. There has been no record of incidents, spills, or casing integrity losses related to any of the WSTs performed. In addition, no report of seismic events related to the stimulations has been recorded.

2.0 INTRODUCTION

A well stimulation treatment (WST) is a treatment of a well designed to enhance oil and gas production and recovery by increasing the permeability of geologic formations containing oil and gas. WST may include hydraulic fracturing, acid fracturing (hydraulic fracturing where acid is the primary WST fluid), and acid matrix stimulation (an acid treatment of a formation at low pressure that does not create fractures). However, stimulations that include acids are rarely completed in California and have only been performed 20 times (of 2,243 stimulations) since the beginning of the WST program in 2014. The last recorded acid fracturing stimulation was completed in August 2018.

Hydraulic fracturing is the most common type of WST used in California. The hydraulic fracturing process involves injecting a mix of fluids (primarily water), sand (proppant), and chemical additives at high pressure into an oil or gas reservoir. WSTs do not include steam flooding, water flooding, or cyclic steaming, which are Enhanced Oil Recovery (EOR) techniques. Instead, WST is a well completion technique typically completed before using the well to extract oil. Compared to EOR injections, WSTs are short-term, discrete injection operations designed to increase reservoir permeability.

WSTs became regulated in California with the passage of SB 4, which was signed into law on September 20, 2013. On January 1, 2014, interim WST regulations were issued pending the development of permanent regulations. On July 1, 2015, permanent WST regulations went into effect, with new WST permit application requirements, including requirements for review by multiple state and local government agencies, neighbor notifications, CEQA review, advanced notification for witnessing by regulatory agencies, seismic monitoring, and submission of a comprehensive post-stimulation report including recovered fluid sampling. In September 2016, CalGEM issued its first WST permits under the permanent WST program.

Since the permanent WST program was started in 2016 until the end of 2021, CalGEM has issued a total of 790 WST permits, with a total of 710 stimulations completed. There has been no record of incidents, spills, or casing integrity losses related to any of the WSTs performed. In addition, no report of seismic events related to the stimulations has been recorded. No well stimulations have been conducted since the end of 2021.

3.0 WELL STIMULATION TREATMENT PROGRAM UPDATE

In April 2021, Governor Newsom directed CalGEM to initiate regulatory action to end the issuance of new permits for hydraulic fracturing by January 2024. On May 21, 2021, CalGEM released a pre-rulemaking draft of regulations for public comment to end the issuance of all WST permits by January 2024. Based on the initial review, CalGEM determined that this rulemaking action is a major regulation and, in December 2023, submitted a Standardized Regulatory Impact Assessment (SRIA) to the Department of Finance (DOF) for this rulemaking. Formal rulemaking is anticipated in 2024.

4.0 WELL STIMULATION TREATMENT DATA REVIEW

This section discusses WST data relative to the 2023 reporting period. It provides a summary of the entire period of WST regulation (beginning January 2014).

4.1 Permitting and Completions

In 2023, no WST applications were received, no permits were issued, and no well stimulations were conducted. This is the second consecutive year that no WST permits were issued or stimulations completed since the implementation of the WST regulations in 2014.

From the time CalGEM began collecting WST data in 2014, the data show that the maximum number of stimulations completed occurred in 2015, with 730 stimulations performed under Interim Well Stimulation Treatment Notices (IWSTNs). The largest number of stimulations completed annually under a WST permit during the permanent regulatory period was 245 WSTs in 2018. Overall, the number of wells stimulated annually had fluctuated throughout the regulated period but decreased significantly since the implementation of the WST regulations in 2014.

A total of 2,243 stimulations were completed since the implementation of WST regulations in 2014. A total of 1,533 stimulations (68.3% of the total) were completed under IWSTNs between January 2014 and June 2016. A total of 710 stimulations were completed under permits issued during the permanent WST program, which went into effect July 1, 2015. The first permit under the permanent WST program was issued in September 2016.

Figure 1 depicts permits issued annually from 2016 to 2023. This chart also includes counts of permits canceled by operators or denied by CalGEM. **Figure 2** depicts counts of well stimulations performed annually from 2014 through the present, including stimulations under IWSTN and WST permits.

Figure 1: Well Stimulation Treatment Permits Issued under Permanent Regulations: (2016 – 2023)

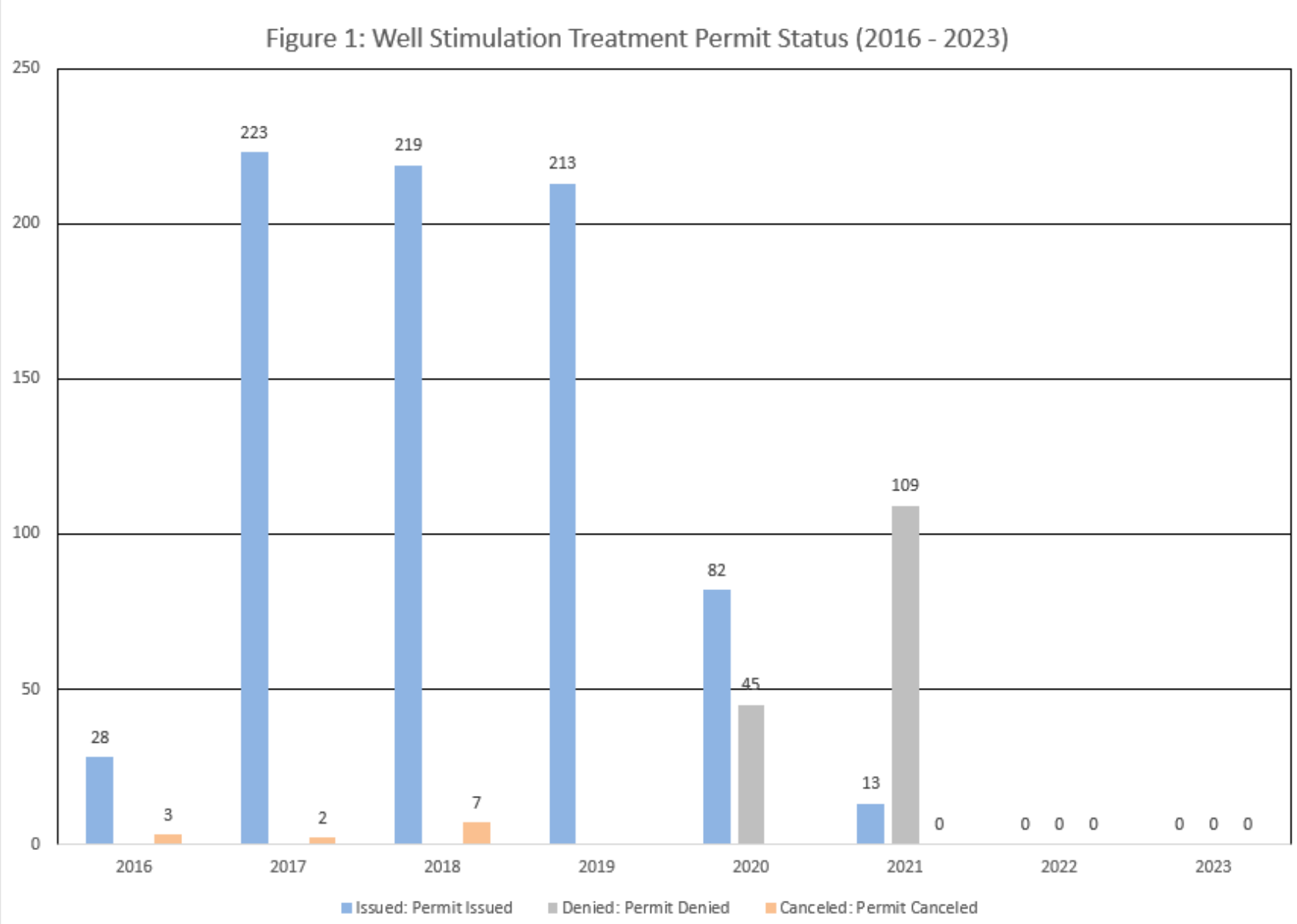
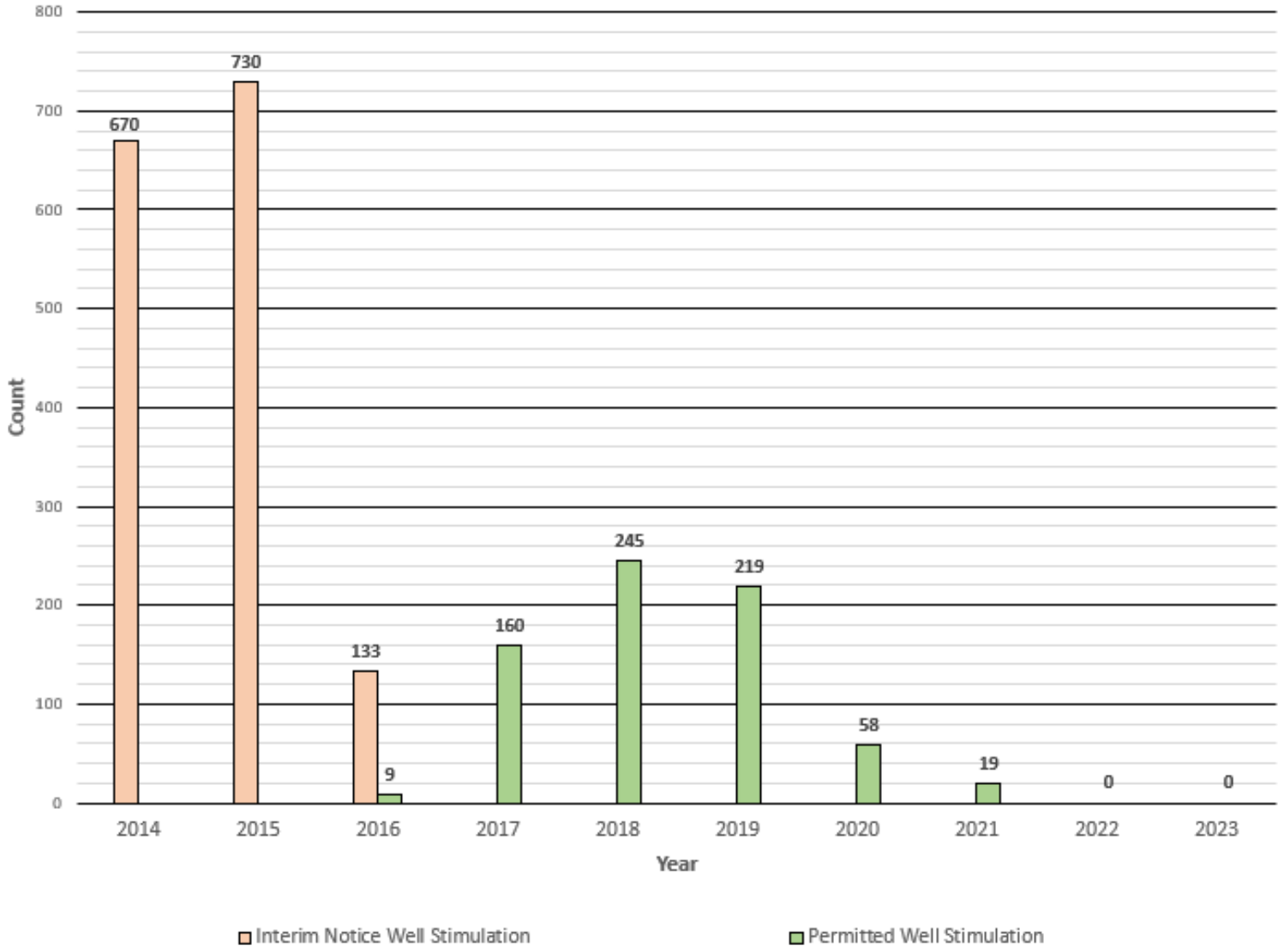


Figure 2: Well Stimulation Treatment Completions under Interim and Permanent Regulations (2014 – 2023)

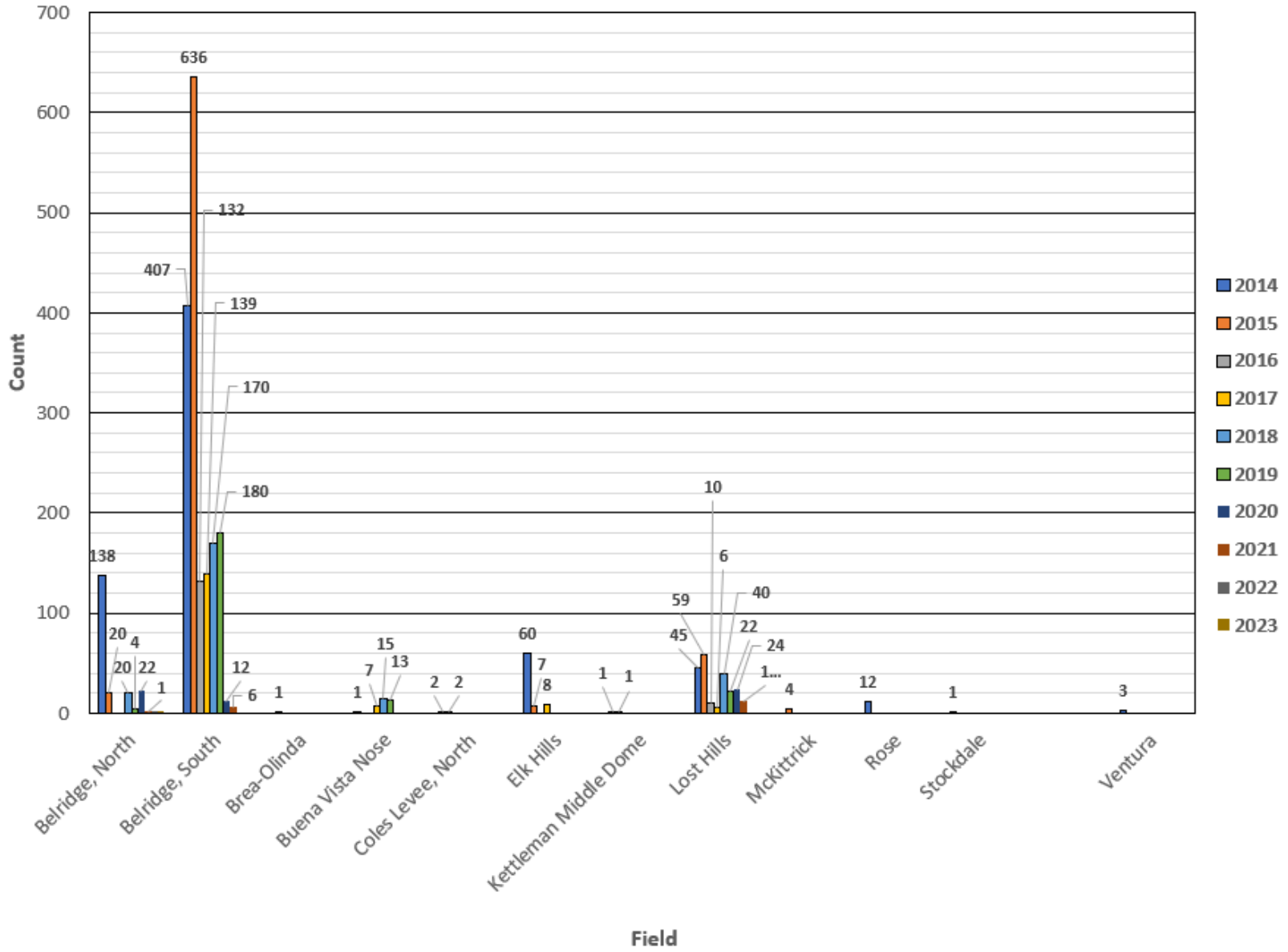


4.2 Well Stimulation Treatment Locations

No permitted well stimulations were conducted in any location in California during the year 2023.

Figure 3 graphically depicts the number of stimulations completed during the entire WST regulation period (beginning in 2014). As shown, the number of oil fields where WSTs were completed decreased since the implementation of SB 4 regulations. No stimulations occurred during the 2022 or 2023 reporting period.

Figure 3: Well Stimulation Treatment Completions by Field (2014 – 2023)

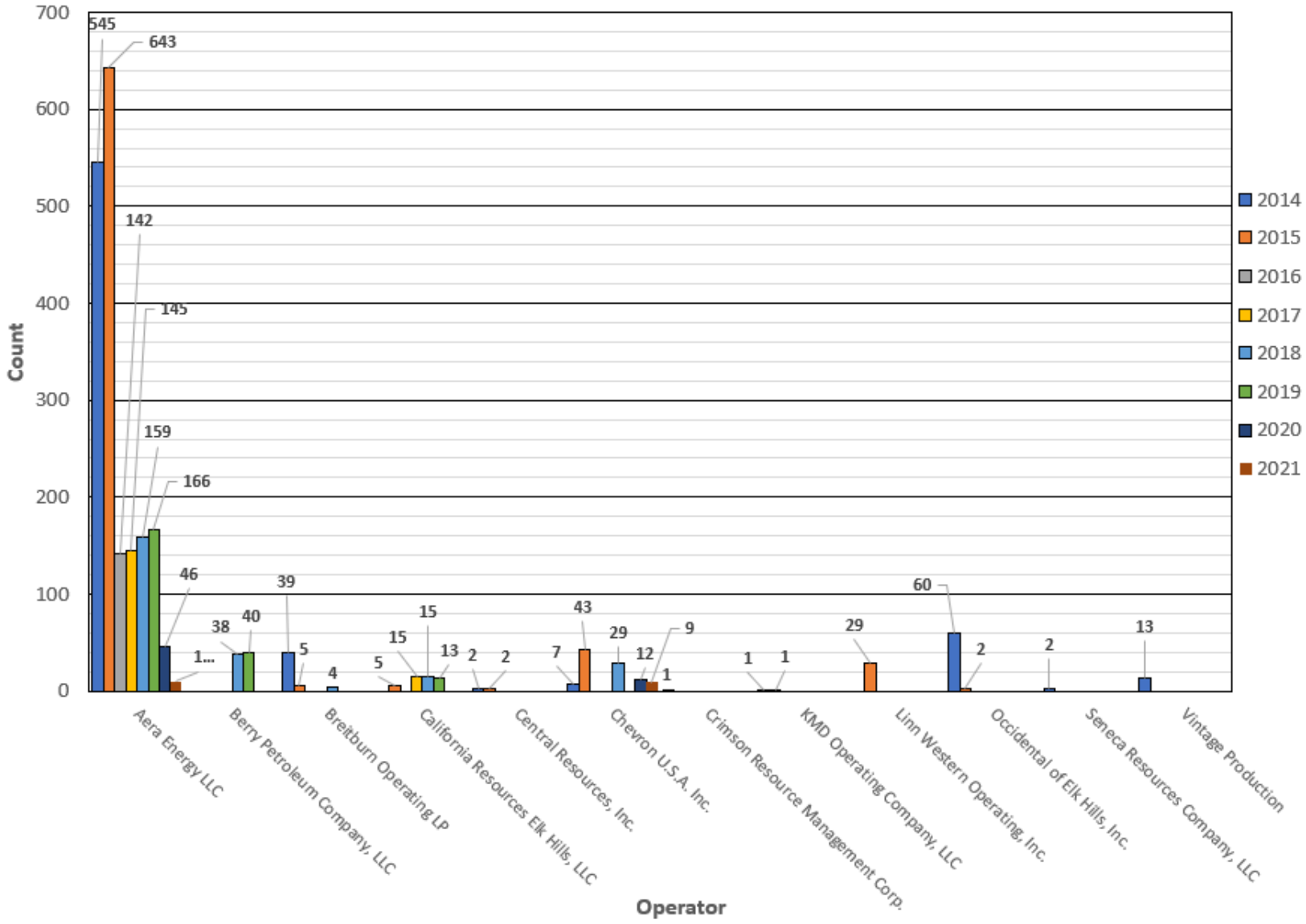


4.3 Well Stimulation Treatment Operators

No WST operations were completed by any operator during the 2023 reporting period.

Figure 4 depicts the number of stimulations completed by individual operators annually from 2014 to 2023, with Aera performing the most significant number of stimulations year over year. On average, Aera accounted for more than 83% of stimulations completed since 2014. The number of operators with completed stimulations since the WST regulation started decreased from nine in 2014 to two in 2021 and zero in 2022 and 2023.

Figure 4: Well Stimulation Treatment Completions by Operator (2014 – 2023)



4.4 Base Fluids

This section discusses the sources, volumes, and suitability for domestic or irrigation purposes of water used for WST. No WST was completed during this reporting period; therefore, no water was used, and no relevant data are available for obligatory reporting of base fluid.

4.4.1 Base Fluid Sources

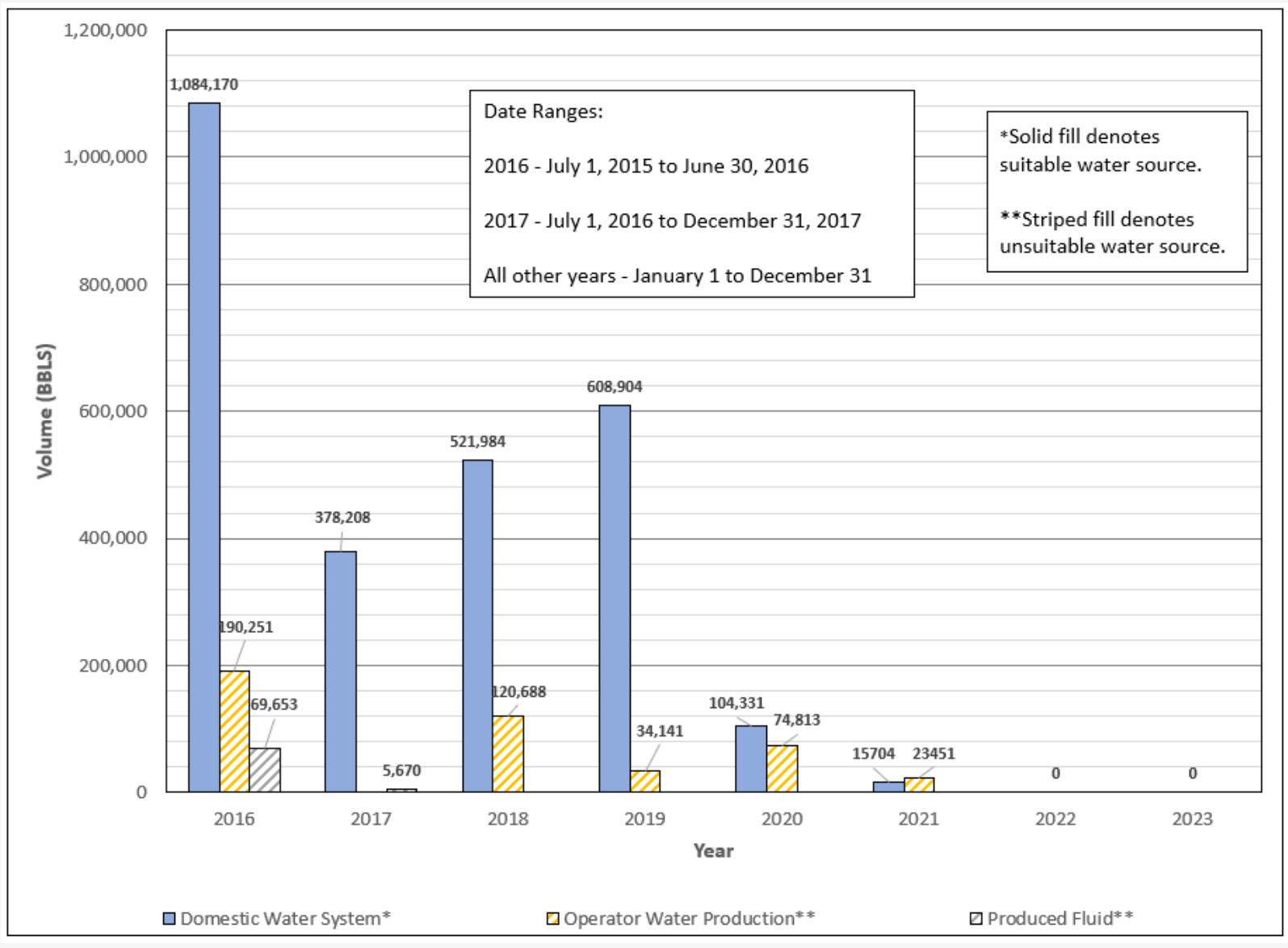
In 2023, no WST permits were issued, nor were stimulations completed.

Figure 5 illustrates the volumes of base fluids used in well stimulations by water source throughout the WST regulatory period. The total fluid volumes displayed for prior years are based on previous CalGEM annual reports. Note that the 2016 and 2017 reports covered periods greater than one calendar year, as detailed in the chart.

4.4.2 Base Fluid Composition

To satisfy CalGEM's reporting requirements, operators must submit base fluid composition data from chemical analyses performed on water sources used as a base fluid for a WST. For base fluid water sources used in multiple WSTs within a proximal time frame, CalGEM accepts a representative sample of the water source collected and analyzed on a biannual basis (twice per year). In 2023, no WSTs were completed; therefore, no relevant data are available for obligatory reporting of base fluid composition.

Figure 5: Water Usage in Well Stimulation by Water Source (2016 – 2023)



4.5 Additive and Chemical Usage

PRC section 3150 defines an additive as a substance or combination of substances added to a base fluid for purposes of preparing a WST fluid. An additive may, but is not required to, serve additional purposes beyond the transmission of hydraulic pressure to the geologic formation. An additive may be of any phase and includes proppant. Each additive is comprised of a unique combination of chemical constituents. Therefore, a full disclosure of the chemical constituents is required for each WST. No WST was completed during this reporting period; therefore, no relevant data are available for obligatory reporting of additive and chemical usage.

4.6 Recovered Fluids

Fluids produced from wells that undergo WST include petroleum, formation water, base fluid, and residual chemical additives. Produced fluids are predominantly composed of hydrocarbons and formation water, which occur in greater quantities than fluids associated with the stimulation, such as base fluid or additives. Operators are required to collect, when possible, two recovered fluid samples for analysis after a WST has been completed. The first recovered fluid sample (RF1) is collected after a calculated wellbore volume has been produced from the well but before three calculated wellbore volumes have been produced, typically after the well is placed on production. The second sample (RF2) is collected after the stimulated well has been producing for 30 days. No WST was completed during this reporting period; therefore, no relevant data are available for statutory reporting of recovered fluid.

4.7 Stimulation Dimensions

Well operators may estimate fracture zone lengths and heights according to sophisticated hydraulic fracturing models or previous field-measured data. These estimations provide the basis for the ADSA boundaries used during risk assessment reviews. One of the key factors in estimating the fracture zone is the type of formation involved at the point of stimulation. In 2023, no WST permits were issued or WSTs completed; therefore, no relevant data are available for obligatory reporting of stimulation dimensions.

4.8 Stimulated Formations/Zones

Oil and gas "zones" refer to the areas within a geologic formation where oil, gas, and water are trapped due to a geologic structure such as a fault, variable stratigraphy, or other feature that traps a resource in an area. During this reporting period, no WST was completed. Therefore, no relevant data are available for statutory reporting of stimulated formations/zones.

5.0 NEIGHBOR NOTIFICATIONS

After receiving a WST permit, but before stimulation, operators are required to provide neighbor notification to landowners and tenants of properties either located within a 1,500-foot radius of the wellhead receiving WST or within 500 feet of the surface projection of the horizontal path of the subsurface parts of the well. If the neighbor notification requirement is triggered, operators are required to hire an independent third party to perform the notification. Notified individuals who have an existing water well or surface water body on their parcel determined suitable for drinking or irrigation purposes may request water quality testing. Operators are required to send a copy of the water quality testing results to CalGEM.

The third-party notice provider also sends information to CalGEM identifying the landowners and tenants notified, the date of notification, and the delivery method. Operators cannot perform a stimulation on a well until after 30 calendar days from the date landowners and tenants are notified. CalGEM retains neighbor notification data and checks for reporting compliance before the well stimulation. The performance of the third-party notice providers is reviewed and subject to random audits conducted by CalGEM.

In 2023, no WST permits were issued or stimulations completed; therefore, no relevant data are available for obligatory reporting of neighbor notifications.

6.0 SEISMIC MONITORING

Pursuant to the provision of the California Code of Regulations (CCR), Title 14, section 1785.1, operators are required to monitor the California Integrated Seismic Network during and 10 days after the well stimulation for any indication of an earthquake of magnitude 2.7 or greater within a radius of the five times the ADSA. If an earthquake of a specified 2.7 magnitude or greater is detected, the operators must notify the Division for further evaluation.

No stimulation was completed in 2023. Therefore, no WST-related seismic activity reports were generated during the current period.

7.0 ENFORCEMENT

CalGEM's enforcement office works to identify, confirm, and respond to violations, and to bring violators into regulatory compliance. Enforcement actions may include issuing notices of violation, taking civil or criminal enforcement action, and assessing violation penalties. In the absence of WST activities, no enforcement actions are reported for 2023.

7.1 Well Stimulation Treatment Witnessing

Witnessing is the term used for a site visit made by CalGEM district staff to evaluate the performance of a WST operation, including, but not limited to:

- Casing and tubing pressure testing to ensure well integrity prior to WST
- WST surface equipment pressure testing prior to WST and
- General observation of WST activities on the day of stimulation.

In 2023, no WST permits were issued, nor were stimulations completed; therefore, no data were generated.

7.2 Chemical Spot-Checking

Spot-checking is an onsite assessment made specifically to verify that the WST fluid additives conform to the additive composition approved by CalGEM during the application review.

In 2023, no WST was completed; therefore, no chemical spot checks were performed.

8.0 REPORTS OF INCIDENTS/EVENTS

For public health and safety purposes, any observed loss of well or casing integrity of an oil or gas well in California must be reviewed and reported. For wells that have undergone a WST, any observed loss of well or casing integrity must be reviewed and reported by CalGEM in this annual report. Spills and releases associated with WSTs are also reported per the requirements stated in PRC section 3215(c).

A loss of well or well casing integrity in wells that have undergone WST is defined as a breach in any casing string utilized in WST operations or a breach of the geologic or hydrologic isolation of the formation. Loss of well or well casing integrity for all other wells is identified by any incident involving damage to a well's permanent construction indicated by inspection and/or mechanical integrity testing (MIT). Integrity losses typically develop over time, making it challenging to identify the precise point at which a loss first occurs. A failure of an integrity test is not always conclusive evidence of casing integrity loss. A determination of actual loss may require additional testing and review.

Any well that has possible loss of casing integrity is not allowed to be operated until it passes additional inspections/testing, or the well is reworked to remediate the issue. If a major casing loss is identified, the well may be plugged and abandoned according to the standard set in the regulations.

No WST was completed during this reporting period; therefore, no relevant data was generated for obligatory reporting of such incidents/events.

APPENDICES

APPENDIX A – REFERENCES/DATA SOURCES

The following were used as data sources for this report:

CalGEM Statutes and Regulations (January 2023): https://www.conservation.ca.gov/index/Pages/California-Geologic-Energy-Management-Division-Statutes-and-Regulations.aspx

Well Statewide Tracking and Reporting System (WellSTAR): https://wellstar-public.conservation.ca.gov/

CalGEM WST Unit's *WST Tracker.xlsx*. This is an internal Excel workbook developed by WST unit staff specifically to track the progress of requests to perform WSTs through notices/applications, actual stimulations, and disclosing of stimulations.

CalGEM Inland District's *WST_Tracking1.xlsx*. This is an internal Excel workbook developed by Inland District staff to schedule and track staff witnessing WST-related operations.

APPENDIX B – STATUTORY REQUIREMENTS FOR ANNUAL REPORT

As defined in PRC section 3157(a), "Well stimulation treatment" means a treatment of a well designed to enhance oil and gas production or recovery by increasing the permeability of the formation. Well stimulation is a short-term and non-continual process for the purpose of opening and stimulating channels for the flow of hydrocarbons. WSTs include but are not limited to hydraulic fracturing, acid fracturing, and acid matrix stimulation.

The data presented in this report are derived from operator disclosures submitted to CalGEM per the requirements stated in PRC section 3160(b)(2). Operators have one year from the date of issuance of a WST permit to begin a stimulation and 60 days from the completion of the well stimulation to submit the WST disclosure form to CalGEM (PRC sections 3160(d)(4) and 3160(g)).

PRC section 3215(c)(1)-(8) requires that this report address the following items:

1. Aggregated data detailing the disposition of any produced water from wells that have undergone WST.
    - Review Section 4.6 of this document.

2. Aggregated data describing the formations where wells have received WSTs, including the range of safety factors used and fracture zone lengths.
    - Review Section 4.8 of this document

3. The number of emergency responses to a spill or release associated with a WST.
    - Review Section 8.0 of this document.

4. Aggregated data detailing the number of times trade secret information was not provided to the public in the preceding year by county and company.
    - Review Section 4.5 of this document.

5. Data detailing the loss of well and well casing integrity for wells that have undergone WST in the preceding year. Data detailing the loss of well and well casing integrity in the preceding year for all wells shall also be provided for comparative purposes. The cause of each well and well casing failure, if known, shall also be provided.

- Review Section 8.0 of this document.

6. The number of spot-check inspections conducted pursuant to PRC section 3160(l), including the number of inspections where the composition of well stimulation fluids was verified and the results of those inspections.
   - Review Section 7.2 of this document.

7. The number of WSTs witnessed by CalGEM.
   - Review Section 7.1 of this document.

8. The number of enforcement actions associated with WSTs, including, but not limited to, notices of deficiency, notices of violation, civil or criminal enforcement actions, and any penalties assessed.
   - Review Section 7.0 of this document.

PRC section 3215(c) also calls for the inclusion of "aggregated data of all the information required to be reported" under PRC section 3160, consisting of the provisions described under PRC 3160(b)(2)(A)-(G) which are addressed in this report:

A. The date of the WST.
   - WSTs completed between January 1, 2023, and December 31, 2023. This is the reporting period covered in this report.

B. A complete list of the names, Chemical Abstract Service (CAS) numbers, and maximum concentration, in percent by mass, of every chemical constituent of the WST fluids used.
   - Review Section 4.5 of this report.

C. The trade name, the supplier, concentration, and a brief description of the intended purpose of each additive contained in the WST fluid.
   - Review Section 4.5 of this report.

D. The total volume of base fluid used during the WST and the identification of whether the base fluid is water suitable for irrigation or domestic purposes, water not suitable for irrigation or domestic purposes, or a fluid other than water.
   - Review Section 4.4 of this report.

E. The source, volume, and specific composition and disposition of all water, including, but not limited to, all water used as base fluid during the well stimulation treatment and recovered from the well following the well stimulation treatment that is not otherwise reported as produced water pursuant to PRC section 3227. Any repeated reuse of treated or untreated water for well stimulation treatments and well stimulation treatment-related activities shall be identified.

- Review Section 4.6 of this report.

F. The specific composition and disposition of all WST fluids, including waste fluids, other than water.

- Review Section 4.6 of this report.

G. Any radiological components or tracers injected into the well to evaluate the WST need to be properly recovered. A description including the recovery method, the recovery rate, and specific disposal information for recovered components or tracers should be provided.

- Review Section 4.5 of this report.

H. The radioactivity of the recovered well stimulation fluids.

- Review Section 4.6 of this report.

I. The location of the portion of the well subject to the WST and the extent of the fracturing or other modification, if any, surrounding the well induced by the treatment.

- Review Section 4.7 of this report.

APPENDIX C – GLOSSARY

TERM	DESCRIPTION
Acid Fracture Stimulation	The combined use of acid and fracturing to increase the permeability of (stimulate) a portion of rock or sediment formation intercepted by a well.
Acid Matrix Stimulation	The use of acid to dissolve mineral material to increase the permeability of (stimulate) a portion of rock or sediment formation intercepted by a well.
Additive	One or more substances added to a base fluid to make up a WST fluid.
Base Fluid	A liquid (or potentially a gas) into which additives are mixed to make up a WST fluid.
Base Fluid Source	The source or origin of a base fluid.
Base Fluid Suitability	The suitability of the water used as the base fluid for domestic use (e.g., human or livestock consumption) or irrigation (e.g., agricultural use).
California Code of Regulations (CCR)	The official compilation and publication of the regulations adopted, amended, or repealed by state agencies pursuant to the Administrative Procedure Act. WST is regulated within Title 14, sections 1751 through 1789 of the California Code of Regulations.
Chemical Abstract Service Registry Number	A unique identification number assigned by the Chemical Abstract Service (CAS) for every chemical compound or mixture of chemical compounds described in scientific literature.
Class II (Injection) Well	Class II wells in California are approved and regulated by CalGEM for the injection of fluids produced as byproducts of the recovery or production of oil or gas, or for storage of hydrocarbons pursuant to CalGEM's UIC program. See *Underground Injection Control (UIC)*.
Confidential Well	A temporary well status approved by CalGEM to protect certain information about a well from disclosure to the public and presumably competing operators.

TERM	DESCRIPTION
Constituent	A chemical used in a WST additive or base fluid; a chemical component of a WST fluid.
Diatomite	A rock of very high porosity and usually low permeability that may contain oil or gas. Diatomite is found within the Monterey Formation and other petroleum-bearing rock formations in California and elsewhere.
Directionally Drilled Well	A well that has been intentionally constructed away from vertical, on or close to a pre-planned pathway. Some directionally drilled wells are curved upward during drilling to be finished as horizontal wells.
Disclosure	The electronic report of a WST submitted to CalGEM under WST regulations.
Disposition	Term used in WST statutes for the management or disposal of water or other wastes from WST operations.
District	An administrative regional CalGEM office.
Gas	Natural gas. Natural gas consists of methane and other simple hydrocarbon molecules that are gasses rather than liquids at room temperature and pressure. Natural gas is present both dissolved in oil and in pore space above oil within the Earth.
Hydraulically Fracture Stimulation	Refers to the intentional, short-term injection of fluid at sufficient pressure to break apart rock to enhance the permeability of (stimulate) a portion of rock or sediment formation intercepted by a well.
Measured Depth	The distance along the actual path of the wellbore from the ground surface, drilling mat, kelly bushing, drill floor, or other aboveground reference point used during drilling. Measured depth can be thought of as the total length of drill pipe in the ground to reach the end of a wellbore, no matter how curved and twisted the wellbore path may be from the reference point.
Monterey Formation	The name used in much of California for a portion of the Miocene-aged, fine-grained sedimentary rock (i.e., commonly shale) deposited and still present along the margin of the Pacific Ocean.

TERM	DESCRIPTION
Neighbor Notification	The requirement and process to notify landowners and occupants of parcels of property located within specified distances of a well where a WST is to be performed. The notification allows landowners or occupants to request that ground or surface waters that are suitable for drinking or irrigation be sampled and tested to assess the possible impact of WST.
Notice of Violation	Written notification made to an oil or gas well operator from the State Oil and Gas Supervisor of violation of a regulation or statute. A Notice of Violation is commonly the first formal correspondence to an operator preceding an Order or other potential enforcement action.
Notice to Operators	A written clarification, transmission of, or request for information made by CalGEM to oil and gas well operators about a specific topic.
Notification	The process of providing information about an upcoming action, an opportunity, or an action taken, made in writing, to a party. See *Neighbor Notification* for one example of a notification required by SB 4.
Operator	A party that owns or has legal responsibility for the maintenance and operation of an oil or gas well or other well that falls within the jurisdiction of CalGEM.
Permeability	The property of or rate at which a solid can or does transmit oil, water, air, or other fluids. See *Porosity*.
Porosity (Pore Space)	The presence within and amount of a solid that is void (potentially empty) space. Pore space within rocks and soil is filled with oil, water, air, or other gasses or fluids. See *Permeability*.
Pressure Testing	The requirement implemented on July 1, 2015, that an operator notify CalGEM of and record pressure tests of all well casings and tubings to be used in a WST operation. See *Zonal Isolation* and *Well Integrity*.

TERM	DESCRIPTION
Produced Water	Water that is extracted from beneath the ground surface as a byproduct of oil or gas production. In mature oil fields such as those common in California, most of the fluid that is pumped from the ground is produced water. In California, most produced water is naturally salty.
Public Resources Code (PRC)	One of 29 groupings of California statutes (laws). The Public Resources Code contains key statutes affecting oil and gas resources, wells, and operations. SB 4 added language primarily to the PRC to give CalGEM greater authority and responsibility to regulate WST.
Recovered Water or Fluid	Fluids (e.g., water, oil, and gas) that come out (either naturally or by pumping or other assistance) of an oil or gas well after WST and prior to the routine production or other stabilized use and flow of fluids from a well. SB 4 requires operators to chemically test and provide information to CalGEM about recovered fluids.
Rulemaking Process	The procedure used by any component of the Executive Branch (of the State of California government) in adopting regulations and rules that will have the force of law. CalGEM followed both the emergency rulemaking process and regular rulemaking process in implementing SB 4.
Senate Bill 4 (SB 4)	California State Senate Bill 4 (Pavley, Chapter 313, Statutes of 2013) was passed by the Legislature and signed by Governor Jerry Brown in September 2013 to better regulate WST.
Spot-Check (Inspection)	The term used in SB 4 to describe a visit by CalGEM staff to a WST operation for the specific purpose of comparing the additives, chemicals, and base fluid at the WST location with the information about the additives, chemicals, and base fluid that was supplied in the Notice.
Stage	A subset or smaller portion of the total interval or portion of a well that is stimulated. A typical WST has several to more than ten stages that are performed in rapid succession in a single effort.

TERM	DESCRIPTION
Trade Secret	The withholding of certain information about one or more WST additives from the public and presumably competitors. SB 4 allows an operator to request trade secrecy from CalGEM through a rigorous and formal process.
True Vertical Depth	The straight-line extent of a well vertically down into the Earth, calculated without regard to actual twists, curves, or intentional deviations of the well bore. It is measured from the ground surface, drilling mat, kelly bushing, drill floor, or other aboveground reference points used during drilling.
Underground Injection Control (UIC)	CalGEM has the responsibility and authority to regulate the injection of any fluid into the ground via any oil, gas, or other well under its jurisdiction. CalGEM's UIC regulations and authority conform to, and were granted by, federal authority in compliance with the federal Safe Drinking Water Act of 1974. See "Class II well."
Wellbore	A hole that is drilled to aid in the exploration and recovery of natural resources, including oil, gas, or water.
Well (Casing) Integrity	The reliability of a well in performing its functions. This includes intact and functioning casing and cement that can durably resist all foreseeable changes (such as pressures, corrosive fluids, earth settlement, or lateral shift) in conditions within and outside the well and ensure zonal isolation. See *Zonal Isolation*.
Well Stimulation	The brief and intentional application of pressure, chemicals, or other method to rock or sediment intercepted by a well to increase the rock or sediment permeability to enhance oil or gas production or potentially to increase water production or the ability of rock or sediment to accept injection water or other fluid.
Well Stimulation Treatment (WST)	Any treatment of a well designed to enhance oil and gas production or recovery by increasing the permeability of the formation. WSTs include, but are not limited to, hydraulic fracturing treatments and acid well stimulation treatments.
Witnessing (Inspection)	The term used in SB 4 to describe a general or all-purpose visit by CalGEM staff to a WST operation to observe, monitor, or verify any regulated or required aspect of the WST.

TERM	DESCRIPTION
Zonal Isolation	The principle of constructing, verification-testing, and maintenance of a well to ensure that fluids are not migrating along or inside a well from one zone to another. Zones of concern that are protected from contamination of one another include oil or gas-bearing zones, zones of abnormally high pore pressures, zones of fresh water, zones of water of actual or potential beneficial use, zones of saline water, and zones of water contaminated by human activity.

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