

Joint Informational Hearing

**Senate Committee on Natural Resources and Water
Senate Committee on Environmental Quality**

**“The Regulation of Hydraulic Fracturing in Oil
and Gas Production in California”**

Tuesday, February 12, 2013
John L. Burton Hearing Room (4203)
9:30 AM

**The Regulation of Hydraulic Fracturing in Oil and Gas Fields in
California**

**I. Overview of Oil and Gas Production in California and the Innovation of Hydraulic
Fracturing**

California’s Oil and Gas Industry and the Potential of Hydraulic Fracturing

California is the fourth largest oil and gas producing state, and natural resources extraction is an important contributor to the state’s economy. According to 2009 data provided by the Western States Petroleum Association, approximately 100,000 people were directly employed in oil and gas production in California and the state received a combined \$5.8 billion in fuel excise, corporate and personal income taxes. The technological innovation of hydraulic fracturing, by itself and in combination with advanced drilling techniques, has allowed unconventional reservesⁱ to be developed. One of the largest unconventional shale reservoirs in the United States is California’s Monterey Shale formation, estimated to contain 15.4 billion barrels of recoverable oilⁱⁱ. This is equivalent to the amount of petroleum the United States imports every five yearsⁱⁱⁱ. Because of potential adverse impacts to the environment and public health, hydraulic fracturing

has been a controversial practice, with critics calling for careful examination and regulation of its environmental impacts.

Hydraulic Fracturing: a Technical Overview

Hydraulic fracturing, commonly known as fracking, is a strategy for stimulating oil and gas production whereby water and chemicals are pumped into the well under high pressure to create or enlarge cracks in the rock formations surrounding the well. Sand is also injected to help keep the cracks open after the fracturing process is completed. It is often used in conjunction with horizontal drilling, in which a well bore runs horizontally through the production zone to increase the zone of contact between the well bore and the hydrocarbon producing formation. Hydraulic fracturing is used to extract oil and gas from unconventional sources such as shale rock. Shale rock may contain large reservoirs of oil and gas, but the hydrocarbons are difficult to extract because they are trapped in the relatively impermeable rock. The innovation of horizontal drilling combined with hydraulic fracturing has made shale fossil fuel development economically feasible in recent decades.

History of Hydraulic Fracturing in California

Hydraulic fracturing has been employed in California since the 1950s^{iv}. With no systematic public tracking of its use, estimates of how many wells in California have been fracked vary. Informal reports from industry sources suggest that a majority of wells in the state are fracked. However, the Western States Petroleum Association (WSPA) voluntarily reported to DOGGR in 2012 that its members fracked 628 new and existing oil and gas wells in California in 2011, which represents about 27% of the 2,300 new wells drilled or 1% of the more than 50,000 existing wells. Industry voluntarily report fracked wells on the website, FracFocus.org, although the terms of use of the site restrict the use of the data.

II. Environmental and Public Safety Concerns Associated with Hydraulic Fracturing

The Water Cycle in Hydraulic Fracturing

The process of hydraulic fracturing uses large volumes of fluid, ranging from tens of thousands to millions of gallons per well.^v The fluid is typically composed of 95-99.5% water and .5 – 5% chemical additives. Although the chemical additives are a small proportion of the mixture, they nonetheless represent many millions of gallons of chemicals used across the nation each year. While most of the chemicals used are relatively benign, some are quite toxic. Well operators reported using 750 components in hydraulic fracturing fluids; 29 were known or possible human carcinogens, regulated under the Safe Drinking Water Act for their risks to human health, and/or listed as hazardous air pollutants under the Clean Air Act^{vi}. The underground injection of fluids for the purpose of hydraulic fracturing is exempt from the federal Clean Water Act, unless the fluid includes diesel fuel (SDWA §1421(d)(1)).

After fluids are used to open cracks in the rock, the majority of hydraulic fracturing fluids return to the surface, referred to as flowback. Flowback is mixed with formation water, which is released from the rock formation and includes dissolved salts and organic and inorganic compounds and may include hydrocarbons, mercury and arsenic; and naturally occurring radioactive material^{vii}. Wastewater is the combination of flowback and formation water; it is stored either at the surface. Wastewater can be treated for reuse in hydraulic fracturing jobs, disposed of belowground in a Class II underground injection control well, discharged to nearby surface water, or transported to wastewater treatment facilities. The staff of the California Division of Gas and Geothermal Resources and the State Water Resources Control Board believe that the majority of wastewater is eventually disposed of in injection wells, but California does not track the final disposal method for hydraulic fracturing wastewater.

The Environmental Protection Agency has attributed two cases of ground water contamination to hydraulic fracturing: one in Pavilion, Wyoming^{viii} and another in Jackson County, West Virginia^{ix}. There is no comprehensive list of surface spills associated with hydraulic fracturing, but there have been a few dozen documented cases in academic papers and the popular press^{xxi}.

The U.S. Environmental Protection Agency has identified five stages to the hydraulic fracturing water cycle and the potential impacts on drinking water associated with each (Table 1)^{xii}.

Table 1.

Water use in hydraulic fracturing operations	Potential drinking water issues	State agency with statutory authority
Water acquisition	Water availability, impact of water withdrawal on water quality	State Water Resources Control Board
Chemical mixing	Release to surface and ground water via spills or leaks, chemical transportation accidents	Department of Toxic Substances Control
Well injection	Accidental release to ground or surface water via well malfunction, fracturing fluid migration into drinking water aquifers, formation fluid displacement into aquifers, mobilization of subsurface formation materials into aquifers	Division of Oil, Gas and Geothermal Energy regulates well; State Water Resources Control Board monitors and regulates drinking water aquifers
Flowback and produced water	Release to surface and ground water, leakage from onsite storage into drinking water resources, improper pit construction, maintenance, and/or closure	Department of Toxic Substances Control regulates spills, Division of Oil, Gas and Geothermal Resources regulates onsite chemical storage, State Water Resources Control Board monitors and regulates water quality
Wastewater treatment and waste disposal	Surface and/or subsurface discharge into surface and ground water, incomplete treatment of wastewater and solid residuals, wastewater transportation accidents	Division of Oil, Gas, and Geothermal Resources regulates underground injection wells, State Water Resources Control Board regulates discharge to water bodies, Department of Toxic Substances Control regulates spills

Hydraulic Fracturing and Air Emissions

Oil and gas production wells, regardless of whether they are hydraulically fractured, can emit air pollutants such as greenhouse gases, volatile organic compounds, particulate matter, hydrogen sulfide, and carcinogenic BTEX compounds^{xiii}. Air emissions from hydraulically fractured wells are of particular concern for two reasons. First, hydraulically fractured wells on average release larger quantities of greenhouse gases per unit of energy extracted than conventional wells^{xiv}. Second, the chemicals used in hydraulic fracturing include toxic air contaminants. Toxic

contaminants can be released to the atmosphere either by evaporation from open pits or through leaks from closed systems, known as fugitive emissions.

In California, the Air Resources Board (ARB) oversees emissions from mobile sources, such as the trucks used in oil and gas production. The ARB and local air districts divide authority over stationary sources such as oil wells, pipes, and fracturing fluid storage containers. The ARB has statutory authority to limit greenhouse gas and toxic air contaminant emissions from oil and gas producers. The local air districts enforce the ARB's regulations, can pass tighter restrictions on toxic air contaminants at their discretion, and regulate all other types of air emissions from stationary sources, such as Volatile Organic Compounds (VOCs) and particulate matter.

Induced Seismicity, Hydraulic Fracturing and Waste Disposal

One of the significant public concerns regarding hydraulic fracturing is the risk of earthquakes caused by hydraulic fracturing or related activities, particularly the use of injection wells. Injection wells are distinct from hydraulically fractured production wells. They are a common means of disposal for hydraulic fracturing wastewater as well as wastes from other sources. The risk of induced seismic activity depends largely on the proximity of wells to a fault. In 2012, the National Research Council released a draft study exploring the potential for induced seismicity or "earthquakes attributable to human activities" associated with energy technologies. The study noted that:

- The process of hydraulic fracturing, as currently implemented, "does not pose a high risk for inducing felt seismic events," and
- Wastewater disposal in injection wells "does pose some risk for induced seismicity, but very few events have been documented over the past several decades related to the large number of disposal wells in operation."

It can be difficult, particularly where numerous earthquakes of small magnitude regularly occur, to attribute earthquakes to hydraulic fracturing. However, small earthquakes in two locations where seismic activity is unusual have been attributed to the process of hydraulic fracturing – England and British Columbia. The larger of two earthquakes was of magnitude 2.3: strong enough to be felt slightly by people but not cause damage to buildings. The U.S. Geological Survey has found an increase in earthquakes over magnitude 3 in the proximity of injection wells in Colorado, Texas, Arkansas, Oklahoma and Ohio. Arkansas and Ohio have since revised their regulations governing waste injection wells to address seismic risks.

III. The Regulation of Hydraulic Fracturing

Regulation of Oil and Gas Production in California

The Division of Oil, Gas, and Geothermal Resources' (DOGGR's) Supervisor (supervisor) has extensive and broad authority to regulate activities associated with the production and removal of hydrocarbons (e.g. oil and gas) from the ground (Public Resources Code §3106). This includes the subsurface injection of water and other fluids. The supervisor's authority is granted in order to prevent damage to life, health, property, natural resources, and to underground and surface water suitable for irrigation or domestic purposes.

DOGGR's Regulations

In January 2011, Senator Pavley wrote to the DOGGR supervisor, Elena M. Miller, to inquire about hydraulic fracturing activity in California. In the February 2011 reply, the division supervisor replied and acknowledged that DOGGR had no reliable information on the extent of hydraulic fracturing activities and had imposed no reporting or permitting requirements specific to the practice despite having the authority to do so. In 2012, DOGGR conducted seven public fracking workshops across the state, culminating in the issuance of a discussion draft of proposed hydraulic fracturing regulations in December 2012. Their website states that the formal rulemaking process "probably will begin in early 2013."

DOGGR issues permits for drilling new wells or re-working old ones and has 10 working days to respond to each application. There are specified reporting requirements to DOGGR after the well has been drilled. DOGGR does not charge individual permit fees. Instead, a fee is assessed on each barrel of oil or equivalent amount of gas produced in California. The current fee is approximately 14¢ per barrel.

In the discussion draft, DOGGR proposed to incorporate regulations specific to hydraulic fracturing within their existing regulatory framework. The discussion draft regulations would require:

- The well owner or operator to ensure that all required hydraulic fracturing data be reported, suitable water protected, and the integrity of the well and well casing maintained.
- The operator to submit a form DOGGR HF1, containing specified data on planned hydraulic fracturing operations, to DOGGR and the appropriate regional water board at least 10 days prior to starting hydraulic fracturing.
- DOGGR to publically post the form DOGGR HF1 within seven days of its receipt.

- The operator to provide DOGGR 24-hour advance notice of hydraulic fracturing starting so DOGGR can witness it.
- The operator to perform specified mechanical integrity tests prior to hydraulically fracturing a well, continuously monitor several well properties during hydraulic fracturing operations, and perform additional daily monitoring for 30 days post-hydraulic fracturing and monthly thereafter. Monitoring data must be maintained for five years and provided to DOGGR upon request.
- The operator to immediately suspend hydraulic fracturing operations or production from hydraulically fractured wells if well integrity is not maintained.
- The operator to update its existing Spill Contingency Plans to include hydraulic fracturing fluids and that hydraulic fracturing fluids be stored appropriately.
- The operator to report specified fracturing fluid information to the FracFocus.org website within 60 days after hydraulic fracturing is completed. FracFocus.org is maintained by the Ground Water Protection Council and the Interstate Oil and Gas Compact Commission. Non-trade secret chemical information must be disclosed as well as certain information about the fracturing fluids, including how much flowback was recovered. If FracFocus.org is not working, the operator shall provide the required information to DOGGR, but DOGGR makes no commitment to obtain data reported directly to FracFocus.org.
- The operator to notify DOGGR if trade secret protection for any chemical additive is claimed and upon what basis. DOGGR would not be given the chemical identity of proprietary chemicals.
- The operator to disclose trade secret information in specified situations (e.g. upon request by a physician attending a medical emergency) if a confidentiality agreement is signed.

Local Government Laws and Regulations on Hydraulic Fracturing in California

County land use and zoning requirements govern what local limitations, if any, are placed on the siting of oil and gas wells. In Kern County, drilling is governed by various ordinances, however it is allowed more than 100 feet from any residence without a permit in specific cases, or within 100 feet of a residence with a permit or if the resident has given written permission. In December 2011, the County of Santa Barbara passed two ordinances to explicitly include fracking within its existing land use planning process for wells. In 2008 Los Angeles County created the Baldwin Hills Community Standards District, a set of regulations that governs operations in the Inglewood field. The district's community advisory panel participates in the approval process for drilling and hydraulic fracturing.

Hydraulic Fracturing Laws and Regulations in Other States

New York, North Carolina and New Jersey have established fracking moratoriums until new regulations are developed to address potential risks to public health. Vermont has banned fracking, despite having little or no oil and gas. Other states, including Texas, Colorado, West Virginia, Wyoming, Arkansas, Louisiana, Pennsylvania, Maryland and Ohio have revised their laws and regulations to add safety and protective measures specifically for fracking and related operations. While the specific measures vary by state, they include advance public notice, additional ground water monitoring, disclosure of chemicals used, and limitations on hydraulic fracturing in some areas. Trade secret law allows the chemical composition of proprietary hydraulic fracturing fluids to remain confidential, but some states require disclosure of that information to government agencies. Although under challenge, local governments in New York, Pennsylvania, Colorado and other states have passed ordinances to ban hydraulic fracturing within their jurisdictions. In contrast, South Dakota and Utah have passed legislation urging Congress to limit federal regulation of hydraulic fracturing and delegate the responsibility to the states.

California Legislation

In the last two budgets, the Legislature approved 35 additional positions and increased funding for DOGGR. The Legislature authorized DOGGR to direct some of the personnel to work on hydraulic fracturing. The additional funds were also intended to bolster the underground injection control well monitoring program. DOGGR's injection well oversight program was criticized in a 2011 audit by the US Environmental Protection Agency for a lack of qualified personnel and unsophisticated risk evaluation techniques.

Three bills related to hydraulic fracturing were introduced in the last session: AB 591 (Wieckowski, 2011), AB 972 (Butler, 2012) and SB 1054 (Pavley, 2012). AB 591 would have required disclosure of the chemical composition of hydraulic fracturing fluids. AB 972 proposed a moratorium on hydraulic fracturing until regulations were in place. SB 1054 would have required notification to neighbors in advance of hydraulic fracturing operations. None of the bills passed; both Assembly bills were held on the Senate Appropriations Suspense file, and the Senate bill failed on the Senate floor.

Two hydraulic fracturing regulation bills have been introduced in the current session: SB 4 (Pavley), and AB 7 (Wieckowski) both of which place specified requirements on DOGGR and well operators when a well is hydraulically fractured.

IV. Conclusion

Hydraulic fracturing may allow petroleum producers to tap previously inaccessible fuel reservoirs, stimulating the nation and California's economy. However to date, there has been a

lack of conclusive scientific investigation and research of the potential environmental impacts that have left open questions about the process of hydraulic fracturing.

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- ⁱ Conventional reservoirs are located under impermeable cap rock and the oil and gas will flow relatively unimpeded to the wellbore for recovery. In unconventional reservoirs the oil and gas is effectively trapped within the formation.
- ⁱⁱ U.S. Energy Information Administration (2011). *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays*.
- ⁱⁱⁱ Estimate based on the U.S. Energy Information Administration figure of 8.4 million barrels per day of net petroleum imports in 2011.
- ^{iv} W.K. Ghauri, Shell Oil Company. "Results of Well Stimulation by Hydraulic Fracturing and High Rate Oil Backflush." *Journal of Petroleum Technology* (1960): Volume 12, Number 6, pages 19-27.
- ^v US Environmental Protection Agency Office of Research and Development (2012). *Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources Progress Report*.
- ^{vi} U.S. House of Representatives Committee on Energy and Commerce Minority Staff (2011). *Chemicals Used in Hydraulic Fracturing*.
- ^{vii} National Petroleum Council (2011). *Management of produced water from oil and gas wells, working document of the National Petroleum Council North American Resource Development Study*.
- ^{viii} US Environmental Protection Agency Office of Research and Development (2011). *Investigation of Ground Water Contamination near Pavilion, Wyoming: Draft*.
- ^{ix} U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response. *Management of Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy, Vol.1*.
- ^x Bamberger, Michelle, and Robert E. Oswald. "Impacts of gas drilling on human and animal health." *New Solutions: A Journal of Environmental and Occupational Health Policy* 22.1 (2012): 51-77 AND US Environmental Protection Agency (2011). Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources. EPA/600/R-11/122.
- ^{xi} U.S. Environmental Protection Agency (2011). Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources. EPA/600/R-11/122.
- ^{xii} Ibid.
- ^{xiii} Canadian Association of Petroleum Producers (2004). *Technical Report on a National Inventory of Greenhouse Gas, Criteria Air Contaminant, and Hydrogen Sulphide Emissions by the Upstream Oil and Gas Industry, Vol 2*.
- ^{xiv} Howarth, Robert W., Renee Santoro, and Anthony Ingraffea. "Methane and the greenhouse-gas footprint of natural gas from shale formations." *Climatic Change* 106.4 (2011): 679-690.