PXP

Plains Exploration & Production Company

December 18, 2012

John McKenzie
Sr. Environmental Planner
San Luis Obispo County
Department of Planning and Building
976 Osos Street, Room 200
San Luis Obispo, CA 93408

Re: Response to Question on Hydraulic Fracturing
Reference: PXP Arroyo Grande Development Plan Application for Phase V Development

Dear Mr. McKenzie:

This letter is being submitted in response to your December 13, 2012 letter in which you requested a summary of "our current drilling, extraction, and reinjection (including steam component) practices and how that differs from hydraulic fracturing," and a discussion of "fracking as it relates to the proposed expansion."

PXP currently uses two "enhanced oil recovery" (EOR) techniques known as "steam flooding" and "cyclic steaming" in the Arroyo Grande Oil Field. These techniques have been used in the Arroyo Grande Oil Field since 1974 and we propose to continue to use these techniques during our Phase V development project. EOR is a production technique and refers to the manner in which the wells are produced.

"Steam flooding" and "cyclic steaming involve the injection of steam into the formation in order to heat the oil. This process reduces the viscosity of the oil to improve its flow from the formation into the well. Steam is continually injected into the reservoir during steam flooding, whereas during cyclic steaming, the formation is allowed to "soak" for a period of time, between periods of injecting steam into the formation. Neither of these EOR techniques involve the injection of chemicals, the creation of new subsurface fractures, or the use of proppant. Steam injection wells are regulated under the California Division of Oil, Gas, and Geothermal Resources' (DOGGR) Underground Injection Control (UIC) program.

Hydraulic fracturing, in contrast, is a type of well completion activity that is done to the production well once it has been drilled. The operation is specifically designed to stimulate the formation. The process is short in duration (less than an hour, usually 15 minutes) and in most cases is a one-time activity.

Conventional hydraulic fracturing has been used as a well completion and stimulation tool since the 1940's in formations with very low permeability. In the past ten years technological advancements have led to the development of a technology called "high volume hydraulic fracturing" (HVHF). HVHF is the type of well completion that is commonly used in shale formations and has been the topic of media attention based on shale developments in the

Northeastern United States. The key distinction between the two types of completion is the amount of water and energy used during the completions process. Conventional hydraulic fracturing is typically defined as a process using less than 80,000 – 120,000 gallons of water per stage. Both conventional and HVHF require the use of trace amount of chemicals along with proppant to create a fracture network capable of releasing the hydrocarbon molecules in the impermeable formation.

PXP has not employed hydraulic fracturing at the Arroyo Grande Oil Field. Furthermore, we are not proposing to conduct hydraulic fracturing during our Phase V development project. The oil formations underlying the Arroyo Grande Oil Field consist of sands with moderate to high degrees of permeability. The wells associated with PXP's Phase V development will be completed using standard historical gravel pack completion techniques approved by the DOGGR. These completions are designed to provide sand control which helps avoid clogging of the well bore.

Given the heightened national attention to the issue of hydraulic fracturing, DOGGR is currently revising their regulations to specifically address the use of hydraulic fracturing. A "discussion draft" of the proposed regulations was released on December 18, 2012 by DOGGR for public review. Formal workshops on the regulations will be held beginning in February 2013. The draft regulations provide the following definition for "hydraulic fracturing":

> "Hydraulic fracture means a technique used in stimulating a formation or zone that involves the pressurized injection of hydraulic fracturing fluid and proppant into an underground geologic formation in order to fracture the formation, thereby causing or enhancing, for the purposes of this division, the production of oil and gas from a well."

The heightened media attention to the issue of hydraulic fracturing has unfortunately led to the circulation of significant misinformation and confusion about the process. Too often the term "hydraulic fracturing" is used to describe all aspects of the oil drilling process. Again, as noted above, hydraulic fracturing is a distinct type of well completion process that is used strictly in specific types of geologic formations. Attached for your reference is a background sheet prepared by the California Independent Petroleum Association (CIPA) that provides some factual information about hydraulic fracturing, and its use in California.

Thank you for your inquiry. I hope the information provided above helps answer your question. Please do not hesitate to contact me at 805-934-8220 should you have any additional questions or require additional information.

Sincerely,

Michelle Gibbs for

David Rose
Manager,
Environmental, Health & Safety

Enclosure (1)

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CIPA

Hydraulic Fracturing

White Paper Executive Summary from the California Independent Petroleum Association

- **Hydraulic fracturing has occurred safely in California since the 1950s.**
- **There is not one case of water contamination because of hydraulic fracturing**
- **There has been no cases of earthquakes caused by hydraulic fracturing**
- **Hydraulic fracturing has led to a significant increase in domestic energy, both oil and natural gas. This has created thousands of new jobs, billions in new tax revenues, and led to more energy security for America.**

Why would we ban a process that has been incredibly successful and has not had one proven case of environmental harm?

Hydraulic fracturing is NOT a drilling technique contrary to how it is routinely described in the media. In reality, hydraulic fracturing is a type of "completion" technique where high pressure water, sand, and chemicals are injected usually thousands of feet below the surface into low permeability rock to create microscopic fractures that allow oil and natural gas trapped in small pores to migrate to the wellbore and be produced. Hydraulic fracturing does not occur until after a well has already been drilled. While it may take a drilling rig 2-3 weeks to drill a well, the hydraulic fracturing process usually takes just 1-2 days. Hydraulic fracturing has occurred safely in California since the 1950s.

The injected fluid for each hydraulic fracturing job is typically 95% water, 4.5% sand, and 0.5% chemicals. A list of chemicals used in the process can be found at www.fracfocus.org.

While the words "hydraulic fracturing" do not specifically appear in current codes, every well in California, regardless of what completion technique is used, is highly regulated by the state and requires several permits, including a permit from the State's Division of Oil, Gas, and Geothermal Resources (DOGGR). Under existing regulations, before obtaining a permit from DOGGR, a producer must submit a comprehensive drilling application that includes a diagram of the proposed wellbore that is reviewed by state engineers. Wellbores in California have multiple barriers of protection between the inside of the well where the fluid flows, and the outer casing of the well. Cement and steel casings are used in each to form an impermeable barrier between the well and the surrounding geologic environment.

Existing regulations also require the operator to file the details of the drilling and completions process in the well file history. If a well is hydraulically fractured as part of the completion process, for example, details about the job will be documented in the well file history.

There has not been a single proven case of water contamination because of hydraulic fracturing:

- In 1995, as EPA Administrator under President Clinton, Carol Browner stated there was "no evidence that hydraulic fracturing resulted in any drinking water contamination."

- In 2009, at a Senate Committee on Environment and Public Works hearing on "Federal Drinking Water Programs," officials from the Environmental Protection Agency (EPA) under the Obama Administration said they were unaware of any documented cases of hydraulic fracturing contamination.

- As recently as May, 2011 during a House Oversight and Government Reform Committee hearing, EPA Administrator Lisa Jackson stated, "I'm not aware of any proven case where the fracking process itself has affected water."

- A. Scott Anderson, a senior policy adviser with the Environmental Defense Fund agrees. "The groundwater pollution incidents that have come to light to date have all been caused by well construction problems," he said.

No earthquakes have been linked to hydraulic fracturing. In attempting to connect hydraulic fracturing with seismic activity, some have tried to link a recent report from Ohio pertaining to an issue involving waste water injection – not hydraulic fracturing. In its report, the State of Ohio identified an issue where continual water injection over an extended period of time for disposal purposes had resulted in a small seismic event. California's existing regulations protect against the type of event that occurred in Ohio. In California, before obtaining a permit for an injection well, the producer must submit an analysis of all known fault lines and how injected fluids are prevented from interacting with those faults which is then reviewed by state engineers.

There have been significant benefits that have resulted from hydraulic fracturing including finding new, desperately needed domestic sources of oil and natural gas, creating new jobs, increasing tax receipts, and increasing the nation's energy security. In 2011, the country imported just 45 percent of the liquid fuels it used, down from a record high of 60 percent in 2005. This has led to a 20% decrease of imports from OPEC countries.

CIPA

California Independent Petroleum Association

Are Hydraulically Fractured Wells Regulated in California? YES!

There has been much discussion in the media about "hydraulic fracturing", sometimes referred to as "fracking." What is it? Is it safe? This paper presents facts about the use of hydraulic fracturing in California, what it is, and how it is regulated.

What is hydraulic fracturing?

Hydraulic fracturing is NOT a drilling technique contrary to how it is routinely described in the media. In reality, hydraulic fracturing is a type of "completion" technique that is used to stimulate the reservoir after a well has already been drilled. Before hydraulic fracturing can begin, the drilling rig is removed from the well pad and replaced with highly specialized equipment designed to complete the well. While it may take a drilling rig 2-3 weeks to drill a well, the hydraulic fracturing process usually takes just 1-2 days.

The vast majority of wells in California are not hydraulically fractured because the geologic zones that have historically been targeted and explored are highly permeable and capable of yielding oil and gas without hydraulic fracture stimulation. The practice is strictly reserved for reservoirs where the geologic conditions are such that the oil and natural gas can't be commercially produced without the benefit of some form of stimulation. Hydraulic fracturing is a process by which high pressure water, sand, and chemicals are injected usually thousands of feet below the surface into low permeability rock to create microscopic fractures that allow oil and natural gas trapped in small pores to migrate to the wellbore and be produced. Depending on the amount of fluid and pressures used, the fractures can extend up to several hundred feet in length. Extensive computer modeling is run on each planned hydraulic fracturing job to calculate the precise amount of fluid and pressure needed to create the desired result. The length of the fracture required is driven entirely by the geologic conditions of the area where the work is being performed. The entire process is highly engineered and controlled to ensure the results of the hydraulic fracturing job remain consistent with the computer generated models.

The injected fluid for each hydraulic fracturing job is typically 95% water, 4.5% sand, and 0.5% chemicals. A list of chemicals used in the process can be found at www.fracfocus.org. Many of

the chemicals typically used are for eliminating bacteria, and inhibiting corrosion. The use of these additives will help to ensure the integrity of the well so the oil, gas, water, and recaptured chemicals stay confined within the wellbore and do not come in contact with drinking water or other geologic zones. It is important to remember that the design of every well is aggressively regulated, particularly at the point where the wellbore penetrates any water aquifer.

The use of the technique in California could increase in the future as industry begins to explore the Monterey Shale and other similar formations which are estimated to hold us much as 15 billion barrels of oil according to the Federal Energy Information Agency (EIA). Since 100% of the oil produced in California is refined and sold in the state, expanded production from these shales has the potential to significantly reduce the amount of oil California needs to import from foreign sources.

Are wells that are "fracked" permitted by the state?

Yes. While the words "hydraulic fracturing" do not specifically appear in current codes, every well in California, regardless of what completion technique is used, is highly regulated by the state and requires several permits, including a permit from the State's Division of Oil, Gas, and Geothermal Resources (DOGGR). CCR 1722.2 requires that wells are designed with "the appropriate design factor provided to obtain safe operations" and "to seal off fluids and segregate them for the protection of all oil, gas, and fresh water zones." These regulations are written broadly to ensure DOGGR can take action against negligent operators. If a producer violates this code section and damage to any resource occurs, they are subject to adverse action by the state. California's regulatory emphasis on wellbore integrity is historically in line with other oil and gas producing states.

Operators use a variety of completion techniques that are tailored to the specific geologic characteristics of the oil and gas reservoirs. Due to improvements in technology, these techniques continue to evolve and allow industry to become increasingly more efficient. Accordingly, DOGGR's regulations have also evolved with increasing emphasis on ensuring wellbore integrity. Existing regulations require the operator to design wells to be "leak proof" after it is drilled and completed. This approach, regardless of completion technique, ensures ground water is protected and fluids that are produced or injected are prevented from migrating to fresh water aquifers.

Under existing regulations, before obtaining a permit from DOGGR a producer must submit a comprehensive drilling application that includes a diagram of the proposed wellbore that is reviewed by state engineers. Wellbores in California have multiple barriers of protection between the inside of the well where the fluid flows, and the outer casing of the well. Cement and steel casings are used in each to form an impermeable barrier between the well and the surrounding geologic environment.

Once a well is drilled, DOGGR's regulations require operators to conduct mechanical integrity tests on a prescribed timeframe to ensure the condition of the well is holding as intended. In every instance, DOGGR's regulations require the operator to update the "well file history" with

the agency once the tests have been performed. Idle wells and injection wells are also subject to regular integrity testing requirements under the existing regulations.

Existing regulations also require the operator to file the details of the drilling and completions process in the well file history. If a well is hydraulically fractured as part of the completion process, for example, details about the job will be documented in the well file history. Significant maintenance work that is done to a well over its productive life must also be permitted by DOGGR and documented in the well's history file. This provides regulators additional tools by which they can verify if the well's integrity is remaining intact and what kind of work is being performed. These files are available for public review at each of DOGGR's district offices.

Does the Industry support disclosing where and when fracking occurs?

Yes. CIPA supports legislation which would require the disclosure of when and where hydraulic fracturing occurs, a list of chemicals injected, and the volumes of water used, consistent with the same approach taken by other states that have recently enacted reporting based regulations. Furthermore, several California companies have already begun to voluntarily report when and where fracking is occurring in California at www.fracfocus.org.

Has fracking been used in California?

Yes. Hydraulic fracturing has occurred safely in California since the 1950s.

Have there been documented cases of ground water contamination from fracked wells in CA?

No. The geologic zones that require hydraulic fracturing to release the oil and gas are, by definition, not sufficiently permeable to produce economically. Whereas groundwater is usually found at depths just a few hundred feet below the surface of the earth's crust, the impermeable zones where the hydraulic fracturing activity occurs is several thousands of feet below the surface. In most cases, more than a mile of impermeable rock and earth separate the hydraulically fractured zone and the groundwater zone making it impossible for even large fractures to migrate anywhere close to the groundwater zone.

Wells with inadequate downhole integrity can provide a potential conduit for fluid to migrate upward if the hydraulic fracturing job is conducted in close proximity to the damaged wellbore. However, there are no documented occurrences of this type of event in California and, as noted above, the scenario is a remote possibility given California's extensive design, drilling, and regular testing requirements and the fact that shale zones are typically located thousands of feet below the historic oil and gas zones that have been produced in California.

Nationally there are no known cases of ground water contamination due to hydraulic fracturing. This fact has been repeatedly stated by federal regulators as evidenced by the following quotes:

- In 1995, as EPA Administrator under President Clinton, Carol Browner stated there was "no evidence that hydraulic fracturing resulted in any drinking water contamination".

- In 2009 at a Senate Committee on Environment and Public Works hearing on "Federal Drinking Water Programs," officials from the Environmental Protection Agency (EPA) and the United States Geological Survey (USGS) under the Obama Administration said they were unaware of any documented cases of hydraulic fracturing contamination.

- As recently as May, 2011 during a House Oversight and Government Reform Committee hearing, EPA Administrator Lisa Jackson stated, "I'm not aware of any proven case where the fracking process itself has affected water."

- A. Scott Anderson, a senior policy adviser with the Environmental Defense Fund agrees. "The groundwater pollution incidents that have come to light to date have all been caused by well construction problems," he said.

It is worth noting that companies spend significant amounts of money fracturing wells and they would be financially irresponsible if they allowed fractures outside of the hydrocarbon bearing zone.

Didn't the U.S. EPA issue a study that claims groundwater contamination occurred in Wyoming?

Not quite. The EPA is currently investigating a case in the small town of Pavillion, Wyoming of alleged contamination associated with wells that used hydraulic fracturing. In December 2011 the EPA released a draft report detailing its investigation into the Pavillion case. At the time the report was released comments by the EPA were taken out of context and significantly misrepresented. The misrepresentation of the comments continues to persist today despite EPA attempts to clarify the truth.

Two months after releasing its draft report on Pavillion, the EPA and Department of Interior clarified the Administration's interpretation of the draft report in testimony before the House Subcommittee on Energy and Environment. During the hearing, EPA Region 8 administrator Jim Martin stated, "We make clear that the causal link [of water contamination] to hydraulic fracturing has not been demonstrated conclusively," adding that EPA's draft report "should not be assumed to apply to fracturing in other geologic settings." Two days later, during a hearing before the House Natural Resources Committee, Interior Secretary Ken Salazar stated of hydraulic fracturing, "From my point of view, it can be done safely and it has been done safely."

Since the congressional hearings, the EPA has further acknowledged that the Pavillion draft report had not been peer reviewed before it was released and that there were potential problems with the testing the agency had conducted for the report. New testing is being conducted in cooperation between the State of Wyoming and the EPA and the EPA continues to maintain that the Pavillion investigation is still ongoing and no formal conclusions have been established. The draft report is undergoing public commentary and peer-review by independent scientists. A final

report is expected to be released in 2014. Assertions that the EPA has linked hydraulic fracturing to groundwater contamination in Wyoming are not accurate.

How much water is used to hydraulically fractured wells in California?

While other states may use millions of gallons of water for each fracture job, in California wells are typically 80,000 to 300,000 gallons of water for an individual well. Keep in mind this is a one-time occurrence. Once a well is fractured, it may produce for decades without any additional stimulation. To put this water usage in perspective, the average American golf course uses 312,000 gallons per day. In a place like Palm Springs, where there are 57 golf courses, each course uses up a million gallons a day. There are 1,200 golf courses in California while there are typically less than 700 wells that are hydraulically fractured each year. This means that all the wells in California that are fractured use about a half day's worth of water in a year when compared to in-state golf courses.

Have there been documented cases of earthquakes being caused by fracking in the United States?

No. The amount of energy used in the hydraulic fracturing process is much smaller than the amount recorded during actual seismic events that can be felt. In the Barnett Shale in Texas, the amount of energy used in a large hydraulic fracture treatment is equivalent to 1 gram of explosive charge, the approximate size of a single blasting cap. By contrast, the equivalent explosive charge of an earthquake event that can actually be felt is approximately 30 tons.

In the United Kingdom, there was a report that suggested hydraulic fracturing may have contributed to minor seismic activity. The report concluded however that the "combination of geological factors was rare" and "unlikely to occur together again at future well sites." There was no structural impact at the surface in the UK case study.

In attempting to connect hydraulic fracturing with seismic activity, some have tried to link a recent report from Ohio pertaining to an issue involving waste water injection – not hydraulic fracturing. In its report, the State of Ohio identified an issue where continual water injection over an extended period of time for disposal purposes had resulted in a small seismic event. The area where the well was injecting into was deemed unsuitable for injection and the State of Ohio forced the operator to close its well. The issue in question had nothing to do with hydraulic fracturing.

California's existing regulations protect against the type of event that occurred in Ohio. Wells utilized for continuous injection are regulated by US EPA's Class II Injection Well Program which is administered in California by DOGGR. In California, before obtaining a permit for an injection well, the producer must submit an analysis of all known fault lines and how injected fluids are prevented from interacting with those faults. State engineers review those applications to ensure no damage to the environment will occur. This review process helps the regulators ensure that the injection will be done safely and not result in an adverse seismic condition. The fact that water injection has been occurring routinely throughout the state, including the Los

Angeles Basin, without any documented occurrences of seismic events is further proof that California's regulations have worked.

Is fracking a "Class II Well"?

No. As was stated earlier, hydraulic fracturing is a completion technique, not a type of well or drilling technique. Class II wells are injection wells that continuously inject water, gas, or steam for purposes of disposal or enhanced oil recovery. Producers submit monthly reports of the chemical makeup of all fluids injected into a Class II well.

Do the chemicals used in the fracking process stay in the ground?

No. Once the well is put "on production", the chemicals used in the stimulation process are pumped back to surface through the well bore and captured by the operator with other produced fluids including oil, gas, and water. The captured fluids are separated, treated where necessary, and disposed of in a variety of regulated methods.

Is fracking in CA the same as in other states?

Typically, no. The types of hydraulic fracture jobs that have been conducted in California use significantly less water and energy than the types of jobs commonly conducted in Pennsylvania, Texas and other shale producing states. These types of jobs are "smaller" in nature because the geologic characteristics of the shales in California are significantly different than that of shales found in other parts of the country.

Hydraulic fracturing jobs in Pennsylvania and Texas can typically use 2 million gallons of water or more per stage whereas the average California job uses less than 10% that amount. Additionally, water disposal regulations in California are much more stringent than other states. Contamination that has occurred by disposal of waste water into streams and creeks is against the law in California.

Has the Division of Oil, Gas, and Geothermal Resources expanded their staff to aggressively regulate oil and gas drilling in CA?

Yes. Just since 2008, the size of DOGGR staff has grown by over 50%. 69 new DOGGR personnel have been added by the legislature through the annual state budgets. These new staff members were primarily hired to implement new regulations on surface facilities and work on a backlog of Class II injection project permits that had piled up in 2009-2010. However, the presence of the additional staff allows the Division to more thoroughly review drilling permits and inspect facilities. As has been stated, state engineers' and inspectors' review of the integrity of wellbore designs and drilling programs ensures that injected fluids cannot migrate to water aquifers. Industry pays 100% of DOGGR's operating budget through an annual barrel tax.

Is diesel fuel injected during fracking?

No. While diesel fuel had been used in the past, the practice has been curtailed throughout the country and does not occur in California. The EPA holds regulatory jurisdiction over the use of diesel fuel in hydraulic fracturing.

Has fracking been successful in the United States?

Yes. There have been significant benefits that have resulted from hydraulic fracturing including finding new, desperately needed domestic sources of oil and natural gas, creating new jobs, increasing tax receipts, and increasing the nation's energy security. In 2011, the country imported just 45 percent of the liquid fuels it used, down from a record high of 60 percent in 2005. This has led to a 20% decrease of imports from OPEC countries. California continues to hover between 35% and 38% of crude produced to meet in-state demand. Consumers have also benefited from the dramatic fall in natural gas prices by saving billions in home energy costs thanks in large part to the success of hydraulic fracturing.

The Bakken Shale in North Dakota is an example of the how domestic producers can radically increase domestic oil and gas production. In 1995, the U.S. Geological Survey estimated 150 million "technically recoverable barrels of oil" from the Bakken Shale. In April 2008 that number had increased to an estimated four billion barrels, and in 2010 geologists at Continental Resources (the major drilling operation in North Dakota) placed actual estimates at eight billion. Recently, given the discovery of a lower shelf of oil, Continental revised its estimates and now predict that 24 billion barrels of recoverable oil are in place thanks in large part to completion techniques like hydraulic fracturing.

North Dakota's oil production has tripled since 2007 and it surpassed California this year as the third largest oil producing state. The Census found that North Dakota led the nation in job and income growth in 2011. It has the nation's lowest unemployment rate, at 3.3% (California's is 11.1%). North Dakota is also flush with cash and has a budget reserve of at least $1 billion, out of a $3.5 billion biennial budget. The state has already cut income taxes, and it is building thousands of miles of "shovel ready" infrastructure projects—roads, bridges, railroads, and pipelines. Other oil and gas producing states have experienced similar booms.

A recent analysis by the consulting firm Wood Mackenzie found that the development of new and existing oil and gas resources could, by 2030, increase domestic oil and natural gas production by over 10 million barrels a day, support an additional 1.4 million jobs, and raise over $800 billion of cumulative additional government revenue.

How can we ensure that fracking is done safely in California?

DOGGR's historic focus on regulating wellbore integrity has worked well and is appropriate, as evidenced by industry's safe track record. CIPA maintains that the Division's first and primary focus should continue to place an emphasis on wellbore integrity. DOGGR's request to add 18 positions will help strengthen the agency's ability to ensure all wells are constructed properly from the outset.

Oil and gas producing states throughout the nation are adopting disclosure based regulations and CIPA believes California should follow suit. These regulations generally allow the public to identify the well's location and the types of chemicals used in a hydraulic fracturing job. Rather than "recreate the wheel" however, CIPA believes the State of California would be well served to strive for regulatory consistency and adopt a disclosure model that is consistent with other leading oil and gas states.

Each hydraulic fracturing job is extensively modeled and engineered to ensure the operation is conducted in a safe manner and will not create environmental impacts. New regulations should reflect this reality so that California can experience the prospective benefits an increase in state oil production would bring to our state.

Two recent articles have been published regarding this issue:

"EPA Backpedals on Fracking Contamination," Wall Street Journal, April 1, 2012.

"California faces increasing dependence on high-priced oil imports," Los Angeles Times, March 30, 2012

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