



10940 Wilshire Boulevard, Suite 1525
Los Angeles, CA 90024 USA
T 424 832 1303
F 424 248 2101
www.cardnoentrix.com



Frequently Asked Questions about the PXP Inglewood Oil Field Hydraulic Fracturing Study

*Daniel R. Tormey, Ph.D., P.G.
Hydrogeologist, Geochemist, & Civil Engineer*

The Study Process

1. Why did PXP fund the Study?

The Inglewood Oil Field Hydraulic Fracturing Study was funded by PXP as specified in Term 13 of the Settlement Agreement with the Natural Resources Defense Council, the City of Culver City, Mark Salkin, Concerned Citizens for South Central Los Angeles, Community Health Councils, and Citizens Coalition for a Safe Community.

2. If PXP paid for the study, how do we know that it was independent?

PXP's selection of the Independent Consultant was approved by the County of Los Angeles in accordance with the Settlement Agreement. In addition, the study was peer reviewed by two reviewers selected by the County of Los Angeles and PXP as specified by Term 13 of the Settlement Agreement. The professional qualifications and independence of the reviewers were two of the criteria used in selecting and approving their involvement. The reviewers reviewed the draft Study (submitted 15 July 2012 in accordance with the Settlement Agreement), made comments, and then approved the final study prior to its publication (10 October 2012). In developing the Study, data collected from in-field measurements were used wherever possible in order to minimize the use of best professional judgment alone.

3. Is the Peer Reviewers' analysis publicly available?

Yes. The peer reviewers' observations about the content of the Study are included as Appendix A of the Study. This is in accordance with Term 13 of the Settlement Agreement, which states that the "study and all supporting material, including comments by the peer reviewer, shall be forwarded to the County, Division of Oil, Gas & Geothermal Resources, the Regional Water Quality Control Board, Community Advisory Panel, and Petitioners and be available to the public, with any proprietary information redacted." PXP did not redact any information.

4. How does the focus and format of this study compare to other hydraulic fracturing studies that have been conducted?

The Inglewood Oil Field Hydraulic Fracturing Study is the first study, to our knowledge, that considered a broad range of topics (14 distinct environmental issues), and focused specifically on comprehensively monitored high-volume hydraulic fracture jobs at one location. Most of the other recent studies of hydraulic fracturing (for example, the USEPA 2011, Pavilion Study; Duke 2011, Pennsylvania Study; Ohio DNR 2008, Bainbridge Study; National Research Council induced seismicity study, among many others) have focused on a single topic, such as water quality,

induced seismicity, or chemical use. Most have considered a broad geographic range, such as an entire state, the USA, or the world. In addition, this Study is among the first to incorporate baseline data and compare it to data collected during a hydraulic fracture operation, and to data collected during six subsequent months of monitoring.

5. Some critics of the Study have charged that the scope of the study was too narrow; how do you respond?

The Study is the broadest of its type in that it evaluates 14 distinct environmental issues, and in most cases, uses measured data before, during, and after two specific high-volume hydraulic fracturing jobs. The duration of the Study was 12 months, which is longer than most other studies that have evaluated different aspects of hydraulic fracturing. In addition, the study incorporates the results of other more narrow studies from around the world in order to place the specific measurements into a broader context. The potential environmental impacts selected for testing and monitoring as part of the Study were chosen based on a review of all prior studies published and expanded to address input from community members collected during a public meeting and a subsequent public comment period.

Hydraulic Fracturing Operations at the Inglewood Oil Field

6. Is PXP currently performing high-volume hydraulic fracturing or planning to use high-volume hydraulic fracturing in the future?

PXP is not currently using high-volume hydraulic fracturing. The only high-volume hydraulic fracture operations that have ever been conducted by PXP on the Inglewood Oil Field are the two that are described in the Study. None of the wells proposed for the 2013 Drilling Plan require the use of high-volume hydraulic fracturing.

7. Does the Study examine the cumulative impacts of hydraulic fracturing?

The measured data in the Study addresses the feasibility and impacts of high-volume hydraulic fracturing as measured at two specific wells. However, cumulative impacts are addressed in two ways:

- 1.) The conventional hydraulic fracturing that has been conducted since 2003 was considered. Multi-stage, conventional hydraulic fracturing has been conducted on 21 wells since 2003 at the Inglewood Oil Field. In total, 65 individual stages have been conducted. No existing or new environmental issues were identified in the Study as a result of this historic activity.

In addition, the Study includes a comprehensive analysis by Halliburton that examined the records and results of the previously conducted conventional hydraulic fracturing operations. Halliburton's analysis examined previous pressures recorded and fracture geometries as a way of validating if adverse conditions had materialized as a result of the activity.

2.) The baseline conditions observed as part of the Study take into account the totality of all development activity that has occurred at the Inglewood Oil Field since it was established in 1924, including the 65 documented individual stages of conventional hydraulic fracturing. The CSD used the cumulative impacts analysis from the EIR to establish restrictions on oil field operations. In addition, the Settlement Agreement provided further restrictions on operations, which also apply to hydraulic fracturing operations. The restrictions include limiting the number and type of vehicles operating on the field, the number of well drilling or workover operations that can occur, and other items. The Hydraulic Fracturing Study did not identify any new impacts that were not already analyzed in the EIR, nor does it identify impacts greater in significance than those analyzed in the EIR (Section 5.3.2).

8. The Study examined impacts from two single stage fractures. However, PXP may conduct more than one stage of hydraulic fracturing on a single well. How do the results of the Study apply to a multi-stage hydraulic fracturing operation?

The nature of hydraulic fracturing is that it occurs in individual stages. In hydraulic fracture jobs that consist of more than one stage, stages are fractured in sequence, not simultaneously. Prior to the first stage, all of the equipment arrives at the well pad, the first stage is sealed within the well itself, and the surface piping and control equipment is prepared. The setup is inspected to ensure that all specifications are met, and the hydraulic fracturing is initiated. After less than an hour, typically, the first stage is complete and the pressure is removed. The equipment setup is then moved to the second stage, that stage is isolated within the well, and the process is repeated (Study Section 3.2.2, p 3-7). Thus, each stage of hydraulic fracturing is a unique event and the areas that are fractured are done so in isolation of previously fractured areas, in order to properly maintain the applied pressure. Although, cumulatively, the amount of water and chemicals used would be greater for fracturing multi-stages than for a single-stage, the maximum anticipated applied pressure, water use, and monitored effects for the single-stage hydraulic fracturing jobs conducted in the study would be similar to the maximum observed effects observed at any one stage in a multi-stage hydraulic fracture job. Since the Study showed no detectable impacts from the single stage completion, we would expect no detectable impacts from each of the individual stages completed in the multi-stage operations.

9. The Study only examines vertical wells; how do the results apply to hydraulic fracturing of horizontal wells?

As discussed above in question 8, a horizontal well would consist of more stages than a vertical well, but each individual stage would be similar to the operations evaluated in the Study, and the amount of water, sand, and additives used would be similar, stage for stage, regardless of orientation (Study Section 3.2.2, p. 3-1 2). Vertical wells intersect less of the oil-producing zone than horizontal wells. The objective of

horizontal wells is to increase the area of the oil-producing zone that the well traverses.

As measured in the Study, the horizontal distance that was fractured within the Nodular Shale was approximately 750 feet from the well, and the height was approximately 200 feet high at a depth of approximately 8,500 feet below ground surface. In general, the height of a fracture is controlled by the surrounding geological units and by the state of stress in the crust. For a comparable stage in a horizontal well, the horizontal distance and vertical distance would be the same as observed in the Study wells since the direction is controlled by the natural stress regime in the vicinity of the shale.

10. Could hydraulic fracturing damage existing oil wells on the Inglewood Oil Field?

Wells that are to be hydraulically fractured are designed and constructed to withstand the pressures and forces applied during the fracturing operations. Design standards as outlined in DOGGR regulations and several different American Petroleum Institute (API) recommended practices and guidance documents are followed. Engineers design casing strings and the hydraulic fracture program to make sure that the maximum pressures applied do not exceed the allowable working pressure of the well casings. There are safety systems on the hydraulic fracturing equipment that are enabled to prevent an over-pressure situation from occurring during the operation.

Hydraulic fracturing will not damage other nearby wells either. As noted in the Study, the microseismic monitoring during the high-volume hydraulic fracturing operations showed that the fracture network extended a limited distance – about 750 feet from the well on which the fracture job was conducted (Study Section 3.2.2, p. 3-18). Any existing wells, which are also designed and constructed to DOGGR and API standards, within this 750 foot radius would see a dramatically reduced pressure as the energy (i.e., pressure) applied in order to fracture the reservoir rock dissipates rapidly the further it travels from its source. If the fracture network does reach a nearby well, the casing for said well would easily handle the reduced pressure at that particular point in the reservoir.

Environmental Concerns

Water

11. Could chemical additives affect groundwater and get into drinking water supplies?

The groundwater beneath the Baldwin Hills is not used for drinking water supply, and the very low yield of the groundwater monitoring wells that have been installed in the Inglewood Oil Field indicates that there are not sufficient supplies suitable for water supply in the future. In addition, the groundwater beneath the Baldwin Hills is

geologically disconnected from aquifers beneath the Los Angeles Basin that could be used as a source of drinking water.

Nineteen groundwater monitoring wells have been drilled on the Inglewood Oil Field, eight of which did not encounter any groundwater. The remainder encountered only thin, low-yielding water-bearing zones at variable elevations (Study Section 4.2.2 p 4-8). This sampling confirmed that the minor amounts of groundwater beneath the field occur in thin, isolated, disconnected zones (Study Section 4.2.2, p 4-24).

Drinking water is provided to the neighborhoods surrounding Baldwin Hills and the Inglewood Oil Field by the West Basin Water District and its member companies. By law, the water must be tested quarterly and publicly reported to demonstrate that the water supplied meets the drinking water standards.

12. What did the Study conclude about the impacts of hydraulic fracturing on groundwater quality?

The high-volume hydraulic fracturing conducted for the Study did not cause a detectable change to groundwater quality. Groundwater samples taken prior to the high-volume hydraulic fracturing were compared with two rounds of samples collected in 2012, after the high-volume hydraulic fracturing operations had occurred. None of the chemical additives used during hydraulic fracturing were detected. Fifteen compounds are routinely detected during groundwater monitoring at the Inglewood Oil Field. The detected compounds reflect approximately 90 years of active oil field operations as well as naturally occurring background conditions in the native rock and soil. All monitored compounds remained within the range of historic baseline levels; any variations were within the ranges detected over the course of monitoring. Moreover, groundwater analytical results indicate that no results for any constituent detected were above the California Maximum Contaminant Level, with the exception of arsenic. Arsenic, which was detected at high levels both before and after the hydraulic fracturing, is a naturally-occurring and is found in soil and rock formations throughout the Los Angeles Basin (Study Section 4.2.3, p 4-14).

13. What happens to the chemical additives that are injected into the ground during hydraulic fracturing?

Thirty percent or more of the fluid used for hydraulic fracturing, including the chemical additives, is recovered when it comes back up the well to the surface, immediately after the hydraulic fracturing. This fluid is known as flowback fluid. The amount recovered as flowback depends on the characteristics of the formation and the hydraulic fracturing fluid.

The fluid that does not flow out of the well as flowback remains in the formation until the well is brought on production to pump and recover oil and gas. Once the well is brought online, any remaining hydraulic fracturing fluids and chemical additives that did not return immediately as flowback are pumped out of the ground and captured (Study Section 3.1.2, p 3-7).

Once at the surface, all recovered fluids are fully contained in tanks or pipelines as they go through the onsite treatment system. Once treated, the produced water is injected into the oil-bearing formations as part of the waterflood operation in accordance with Section E.2.(i) of the Baldwin Hills CSD.

14. Could a surface spill of chemical additives flow from the oil field onto neighboring land?

All produced water and oil at the Inglewood Oil Field is contained within closed systems at all times, in accordance with Section E.2.(i) of the Baldwin Hills CSD and the South Coast Air Quality Management District's Rule 1148.1 (more on this topic can be found in Question 18). Fluids injected into the formation and produced during operations are transported by pipeline through the field. This closed system will prevent any surface spills during hydraulic fracturing operations.

The potential for surface spills or leaks to impact the surrounding community is remote. All chemicals are stored in containment on the surface. Moreover, in the event of a release, any fluid would drain to one of six surface water detention basins on site. As regular practice, water in these basins is visually inspected for sheen and petroleum prior to discharge. In addition, water in these basins is sampled and analyzed during discharge to the Los Angeles County stormwater system, in accordance with PXP's National Pollutant Discharge Elimination System permit (Study Section 4.2.5). Any exceedance of a standard is reported to the RWQCB for action. The surface water detention basins drain directly into the Los Angeles County storm drain system, which flows to Ballona Creek and the Pacific Ocean without affecting any surrounding lands.

Seismicity

15. Could hydraulic fracturing at the Inglewood Oil Field cause an earthquake?

The Study included measurements of microseismicity associated with the fracturing. The magnitudes recorded were 100,000 times less than those that are felt by most people. For context, an earthquake capable of being felt at the surface measures at approximately magnitude 3, while during hydraulic fracturing, the microseismic events are of magnitude -4 to -2 on the Richter scale (Section 7.4.1).

Review of the accelerometer data on the Inglewood Oil Field by a Senior Research Associate at the California Institute of Technology (CalTech) before, during and after the high-volume hydraulic fracturing operations showed that no seismic events above background levels were recorded. While the Study focused on two specific single-stage events, it also examined two years of monitoring data collected at the Inglewood Oil Field in accordance with the CSD. These monitoring results show no connection between oil field operations (including high-volume hydraulic fracturing test wells, waterflood, and high-rate gravel packs) and seismicity, vibration, or ground movement (Study Section 4.5.6, p 4-36).

Taking a broader context, recent studies by the United States Geological Service (USGS) and the National Research Council (NRC) both conclude that the microseismicity recorded during hydraulic fracturing is clearly not enough to trigger larger earthquakes. The Southern California Earthquake Center has determined that the epicenters of most large earthquakes on the Newport-Inglewood Fault zone are generally located between 3.5 and 12 miles below ground surface, much deeper than the deepest hydraulic fracturing operations that would occur on the field (less than 2 miles below ground surface).

According to the NRC, worldwide there have only been two cases of hydraulic fracturing potentially triggering earthquakes that could either be felt by most people (magnitude 3) or just below this level (magnitude 2). One was in Blackpool, England, and the other was in British Columbia. The NRC report cites a third incident in Oklahoma that registered at 2.8 magnitude; however, the NRC notes that the event's link to hydraulic fracturing is strictly theorized and not confirmed. More than one million wells have been completed with hydraulic fracturing in the United States since the 1940s. Taken together, the weight of evidence indicates that hydraulic fracturing at the Inglewood Oil Field is not expected to trigger further seismic activity. Even in the worst case scenario, the induced seismicity would be at the limit of human perception. In no case would hydraulic fracturing lead to any change in the existing seismic risk level for the area.

Both the USGS and the NRC studies conclude that induced seismicity is more likely related to fluid injection, or less commonly fluid withdrawal. The most common cases involve the injection of wastewater into zones that have not previously been pumped and therefore are not at reduced pressures. Procedures at the Inglewood Oil Field will not include this practice. At the Inglewood Oil Field, the injection of produced water is into the oil-bearing formation that has already been depressurized by pumping. As such, the produced water injection does not overpressure the formation as in the cases identified by the USGS and NRC.

16. What if there is an earthquake while hydraulic fracturing is taking place?

If an earthquake and hydraulic fracturing occur at the same time, their energies would be additive and would not increase the magnitude of larger earthquakes by a reportable amount. Therefore, there would be no greater seismic risk due to hydraulic fracturing. A tectonic earthquake that can be felt by people must be a magnitude 3 or greater, while microseismic energy released during hydraulic fracturing is generally less than magnitude -2 or -3, which is approximately 100,000 times less than the smallest felt earthquake of magnitude 3.

There is an accelerometer on the Inglewood Oil Field to monitor seismic activity and trigger safety measures as needed (as mandated by Section E.4.g of the Baldwin Hills CSD). The accelerometer is part of CalTech's seismicity monitoring program and is regularly monitored by CalTech. The CSD has threshold levels of seismic activity that would require field shutdown and inspection of pipelines, storage tanks and other infrastructure for earthquake-related damage. Field activities cannot be resumed until

it is determined that all oil field infrastructure is structurally sound (Study Section 4.5.5).

Air Quality

17. How were emissions from truck traffic and other mobile sources calculated?

Non-road equipment emissions were calculated from detailed fuel consumption estimates specifically for each engine and its Tier (1, 2 or 3) for each item of oil field equipment that was used on the project site during the high-volume hydraulic fracturing operations. This accounting provided the following diesel fuel consumption estimates based on gallons per hour multiplied by hours of operation for the hydraulic fracturing operation:

Tier 1 engines: 198 gallons

Tier 2 engines: 204 gallons

Tier 3 engines: 9 gallons

Total: 411 gallons diesel fuel

These quantities were applied to respective nonroad Tiered emission factors per 40 CFR 89.112 (USEPA) and 13 CCR 2423 (California Air Resources Board). To convert from units of grams per brake horsepower hour (g/BHP-hr) to pounds per 1,000 gallons (lbs/mgal), the USEPA (AP-42) default heat rate of 7,000 BTU/BHP-hr and fuel energy content of 130,030 BTU per gallon were used. Since the nonroad Tiers represent upper regulatory limits, calculated emissions for a given amount of fuel were considered not-to-exceed quantities. Sulfur dioxide emissions were calculated for ultra-low sulfur diesel fuel (15 ppmw) on a mass balance basis. Greenhouse gas emissions were calculated using USEPA emission factors and global warming potentials for carbon dioxide, methane, and nitrous oxide to yield carbon dioxide equivalents.

Further, the Baldwin Hills CSD EIR analyzed project specific and cumulative impacts of oil field operations, and based upon this analysis, placed limits on the number of mobile sources. Based on our analysis, emissions associated with hydraulic fracturing operations are below the specified limits.

18. What does it mean that the Inglewood Oil Field is in “basic compliance with 40 CFR 63, notwithstanding particulars and details...”

South Coast Air Quality Management District (AQMD) Rule 1148.1, which took effect in January 2006, regulates air emissions associated with oil and gas production to ensure that natural gas and produced gas are not vented into the atmosphere. Although the “flowback” process is not specifically called out in the regulations, the requirements of the rule do in fact prohibit operators from venting flowback emissions as allowed in other states.

In general, South Coast AQMD Rule 1148.1 puts forth two options to control gas emissions. “Option A” requires gas emissions, including flowback, to be managed in a closed-loop system. The rule requires the emissions to be captured and used as fuel,

sold, or injected underground. “Option B” calls for gas emissions to be burned using a flare or some other approved tool that yields minimal emissions. Under Rule 1148.1 both options are equally viable. The Inglewood Oil Field captures and sells all natural gas developed from the field using a closed-loop system, and is therefore in compliance with SCAQMD Rule 1148.1.

In April 2012, the USEPA released new Federal Regulations, 40 CFR 63, for reducing air pollution from hydraulic fracturing during oil and natural gas production. Given the ground-breaking nature of the regulation, the federal government has elected to implement it in two phases. During Phase I, emissions must be managed through the same two options set forth in the South Coast AQMD Rule, capture or burning. Compliance with Phase I must be achieved by January 1, 2014. During Phase II, only capture (equivalent to South Coast AQMD rule’s “Option A”) is permitted. Phase II compliance must be achieved by January 1, 2015. Because the Inglewood Oil Field captures and sells all natural gas in line with South Coast AQMD Option A, it is already essentially in compliance with Phase II provisions of the Federal Rule. A flare is only used in an emergency condition.

While the new USEPA regulations are largely similar to South Coast AQMD Rule 1148.1, the regulation deviates from the South Coast AQMD rule with regard to monitoring, recordkeeping, and reporting protocols, hence the “particulars and details” wording used in the Study. In essence, the production-related air emissions at the Inglewood Oil Field are in compliance with both the South Coast AQMD Rule and Federal Regulations, but since there are administrative differences related to recordkeeping, monitoring and reporting (Study Section 5.4.1, p. 5-6) between the two rules it is not appropriate to describe the rules as being precisely the same.

The table below provides a more detailed explanation of the regulations.

South Coast AQMD Requirements	Federal Requirements
Rule 1148.1 (d)(6) states that “Effective January 1, 2006, the operator of an oil and gas production facility shall not allow natural gas or produced gas to be vented into the atmosphere. The emissions of produced gas shall be collected and controlled using one of the following:	USEPA released new regulations for reducing air pollution from hydraulic fracturing under the National Emissions Standard for Hazardous Air Pollutants for oil and natural gas production in April 2012.
(A) A system handling gas for fuel, sale, or underground injection; or	Compliance with Phase I is required by January 1, 2014. During this phase a combustion device or flare is to be used to reduce VOC emissions.
(B) A device, approved by the Executive Officer, with a VOC vapor removal efficiency demonstrated to be at least 95% by weight per test method of paragraph (g)(2) or by demonstrating an outlet VOC concentration of 50 ppm according to the test method in paragraph (g)(1). If the control device uses supplemental natural gas to control VOC, it shall be equipped with a device that automatically shuts off the flow of natural gas in the event of a flame-out or pilot failure.	Compliance with Phase II is required by January 1, 2015, and requires the capture of all natural gas for sale (Study Section 5.4.1, p. 5-6).

Methane

19. Could hydraulic fracturing elevate the risk of methane explosion?

Hydraulic fracturing is not correlated with the release of soil gas (methane) at the Inglewood Oil Field. Soil gas (methane) is monitored on the Inglewood Oil Field on an annual basis. In addition, soil gas samples were collected before and after the high-volume hydraulic fracturing operations. There was no detected relationship between the hydraulic fracturing operation and the detected soil gas on the field based on the results of the samples. Based on the great depth at which hydraulic fracturing occurs and the existing hydrocarbon seal zone that is in place, it is not expected that hydraulic fracturing would have an impact on soil gas levels (Study Section 4.6.4, p 4-40).

An explosion at the Ross Department Store in the Wilshire-Fairfax district of Los Angeles triggered the California Division of Oil, Gas & Geothermal Resources (DOGGR) to identify areas with the greatest potential for gas migration into structures. The Inglewood Oil Field was not identified as a high risk area in the DOGGR study; however, it is located near areas known to have high concentrations of methane at shallow depths in the City of Los Angeles. These areas within the City limits require enhanced building and foundation designs to accommodate the high levels of shallow methane and minimize associated risks. The shallow soil gas levels typically measured at the Inglewood Oil Field are well below the levels requiring enhanced building design.

Human Health

20. What is the impact of hydraulic fracturing on human health?

The Study relied on the findings presented in the Community Health Study and Survey for communities surrounding the Inglewood Oil Field prepared by the Los Angeles County Department of Public Health to address this question. Los Angeles County prepared the Study and Survey in response to concerns voiced by community members during the EIR process for the CSD. Although the work was prepared prior to the high-volume hydraulic fracturing operations, it does take into account the baseline conditions of high-rate gravel pack and conventional fracturing operations that have occurred at the Inglewood Oil Field since at least 2003.

The Health Study indicates that there is no detectable relationship between activities at the Inglewood Oil Field and the health of the surrounding community, including cancer, low birth weights, and mortality. The Health Study found that the occurrence of a wide range of illnesses, including cancer, were nearly identical in the area surrounding the Inglewood Oil Field and the rest of the Los Angeles Basin. This Health Study is summarized in Section 4.9 of the Study.

Other Issues

21. Would the oil produced on the Inglewood Oil Field through hydraulic fracturing reduce the cost of gasoline at the pump in California?

The price of oil and gasoline is a globally-driven product and not controlled or influenced by the Inglewood Oil Field operations (Study Section 2.4, p 2-7). All of the oil from the Inglewood Oil Field is sold to local refining operations and directly offsets a corresponding amount of oil supplies that would otherwise be imported by tanker. Economic impacts of hydraulic fracturing activity are outside of the scope of the Study.

22. Is hydraulic fracturing used in California the same as in the eastern United States?

The hydraulic fracturing used in California's existing *oil* fields is a much lower intensity than in the shale-hosted *natural gas* (also known as "shale gas") fields outside California. There are several important differences. Primarily, hydraulic fracturing in many places outside California is seeking to help find and develop new sources of natural gas from relatively impermeable shale deposits. In California, however, hydraulic fracturing is used to enhance existing, mature, oil fields by allowing extraction from low permeability sandstones and shales. Oil is much less mobile in the subsurface than natural gas.

Hydraulic fracturing has been used for more than 40 years in California at existing oil fields with a long-established land use. Less than 10 percent of all new wells drilled in California are completed by hydraulic fracturing. On average, wells completed with hydraulic fracturing in California typically use between 80,000 – 300,000 gallons in total water per well (one time basis). To put this water usage in perspective, the average American golf course uses 312,000 gallons per day.

In contrast, the areas of new shale gas development that are occurring outside California involve new gas fields and significant changes in land use. High volume hydraulic fracturing is utilized in almost every new well that is drilled in the new shale gas fields. The operations use millions of gallons of water per well as well as more completion stages per well. Although hydraulic fracturing in shale gas wells occurs on a one time basis when the well is initially drilled, overall chemical and water use is higher than what is observed on average in California wells completed with hydraulic fracturing.

Other secondary differences are that older California oil fields use water injection to enhance oil recovery and counteract subsidence. In essence, the majority of California oil fields beneficially reuse the produced water. This differs significantly from the new shale gas fields where enhanced oil recovery is not used; instead, new

dedicated injection wells that do not balance subsidence and produced water management result in greater water management challenges. Many areas outside California with shale gas development have rural water supplies with wells that do not required testing after installation. This is an important distinction since all potable water supplies in California must be tested quarterly by the water purveyor and private wells are rare in areas of oil field development.

23. How do the risks associated with hydraulic fracturing that are presented in the film *Gasland* relate to hydraulic fracturing at the Inglewood Oil Field?

The Study provides an analysis of each of the key issue areas raised in the film. The primary concerns in *Gasland* are related to the chemical additives used in hydraulic fracturing and their effect on water quality (Questions 11 through 14 above); health effects (Question 20 above); surface impacts from development of new gas fields (Inglewood Oil Field has been producing since 1920, and surface impacts are addressed in the Baldwin Hills CSD); methane in water supplies (Question 19); and air quality (Questions 17 and 18).