October 31, 2016

Via Email and FedEx

Santa Barbara County Board of Supervisors
105 E. Anapamu St., Suite 407
Santa Barbara, CA 93101
Attn: Michael Allen, Clerk of the Board,
allen@co.santa-barbara.ca.us
sbcob@co.santa-barbara.ca.us

Re: Proposed Orcutt Hill Oil and Gas Expansion--Oppose

Dear Hon. Board Members:

On behalf of the Center for Biological Diversity and its members and supporters (2,200 of whom reside in Santa Barbara), I am submitting these written comments regarding the Orcutt Hill Oil and Gas Project Proposal in advance of your Nov. 1, 2016 meeting. We strongly oppose expanding oil and gas activities in the County through this project, and Center members have scientific and educational interests in the lands at issue, and are particularly interested in preventing the harm to water, air, habitats, and the climate that will result from this project.

The Planning Commission was correct in rejecting this disastrous project earlier this year, and the minor changes in the reintroduced proposal should not persuade the Board of Supervisors to reconsider this decision. Santa Barbara County has the opportunity to be a leader in environmental protection and move us toward a cleaner, sustainable future by choosing the No Project Alternative or the Seep Can Only Alternative. We urge you to do so.

I. The new proposal will still result in substantial harm to the environment

Despite Pacific Coast Energy Company's attempts to lessen the environmental harm that will result from this project, the simple fact remains that constructing and operating such a large number of new and reworked wells will compound the damage done to our air, water, and climate. The reasonably foreseeable impacts include further degradation of surface and groundwater, increased air pollution, and greenhouse gas emissions resulting from the production, refining, transport, and combustion of an additional 1.3 million barrels of oil per year.[1] Of particular concern is the planned use of cyclic steam injection, a dangerous "enhanced oil recovery" technique that introduces additional risks and increased harms.

A. Cyclic steam injection increases the risk of accidents and leaks.

In cyclic steam injection, the repeated soaking of the formation with very hot steam creates "large temperature variations and formation movements," putting extreme pressure on the ground and well

[1] FEIR 2-1 (estimating 3,600 additional barrels per day).

casing, which can cause well failure or the migration of fluids and steam.[2] Indeed, "[c]yclic steam injection presents some of the harshest conditions" under which a well can be placed.[3] Thus, it is not surprising that rates of well casing failure from "excessive deformation, buckling, and collapse" are especially high in cyclic steam injection wells.[4] Further, the injection of hot steam can deform the surrounding formation and overlying ground so much that cyclic steaming can result in the migration of fluids and steam. This can sometimes pollute underground aquifers. It can also result in "surface expressions," which is another way of saying that the steam, oil, gas, and whatever else might be mixed in underground have come bubbling to or even exploding out of the surface of the ground.[5]

Cyclic steam injection leads to changes in subsurface pressures. These changes are poorly understood and open the door to fluid migration. A scientist at Lawrence Berkeley National Laboratory explained:

> "As important as the subsurface is for U.S. energy strategy, our understanding of how the subsurface responds to common perturbations, such as those caused by pulling fluids out or pushing fluids in, is quite crude.…We're not able to manipulate the subsurface with the control that can guarantee that we're not only maximizing energy production or waste storage, but that we're also protecting our environment—including minimizing greenhouse gas emissions, impacts to groundwater, and induced seismicity. That's a significant gap."[6]

These are not just theoretical harms; they have occurred and with disastrous effects. On June 21, 2011, a Chevron worker was killed when investigating steam coming from a surface expression caused by cyclic steaming in Kern County's Midway-Sunset oil field.[7] When the worker approached the plume of steam the ground gave way and he fell into a sinkhole.[8] In May 2012, California's Division of Oil, Gas, and Geothermal Resources (DOGGR) issued a report on the tragedy.[9] As with the Project at issue, operations in the Midway-Sunset oil field were using cyclic steam injection to exploit shallow heavy oil deposits.[10] DOGGR's report describes the extensive damage the cyclic steaming of the deposit had done to the area. In an area of approximately one-half mile by one-quarter mile, roughly thirty surface expressions appeared.[11] Most of the surface expressions were

---

[2] Xie, Jueren, Analysis of Casing Deformations in Thermal Wells (2008).
[3] Kulakofsky, David, Achieving Long-Term Zonal Isolation in Heavy-Oil Steam Injection Wells, a Case History (2008).
[4] Wu, Jiang, Casing Temperature and Stress Analysis in Steam-Injection Wells (2006); *see also* Wu, Jiang, Casing Failures in Cyclic Steam Injection Wells (2008).
[5] California Department of Conservation, Division of Oil, Gas, and Geothermal Resources, Report of Occurrences, The Chevron Fatality Accident, June 21, 2011, and Area Surface Expression Activity, Pre and Post Accident, Sections 21 & 22 T.32S./R.23E., Midway-Sunset Oil Field, Kern County (May 2012) ("Accident Report"); California Department of Conservation, Division of Oil, Gas, and Geothermal Resources, Reports of Occurrence: Surface Expressions in Bakersfield (2011) ("Spill Binder").
[6] Chao, J., "Underground Science: Berkeley Lab Digs Deep For Clean Energy Solutions," Lawrence Berkeley National Laboratory, Oct. 19. 2016, quoting Susan Hubbard, Associate Director, available at http://newscenter.lbl.gov/2016/10/19/berkeley-lab-digs-deep-clean-energy-solutions/.
[7] Accident Report at 2.
[8] Accident Report at 2.
[9] Id. at 1.
[10] Id. at 9.
[11] Ibid.

described as having a "seep-like characteristic," in which water and oil rose to the surface.[12] Some of the surface expressions, however, had more violent traits.

On June 22, 2011, a surface expression unexpectedly surfaced and spread within a few minutes, ultimately covering substantial areas of two terraces of land.[13] The surface expression produced about 500 barrels of fluid within the first twenty-four hours, and thousands of barrels of fluid in the subsequent months.[14] DOGGR found that the source of the surface expression was "[s]team injection into shallow diatomite reservoir resulting in surface break through of steam, water and oil."[15]

Later, two large eruptions occurred at a surface expression near the fatality site. First, at some point during the night before August 5, 2011, an existing "crater site" experienced "a sudden and large explosive eruption that had expelled large rocks and spray of water and oil a distance of 30 to 150 feet . . . ."[16] Second, on the morning of August 17, 2011, an even larger eruption occurred, "expelling fluid and spray to a height of approximately 100 feet, and releasing a steam plume to an even greater height."[17] The radius of the fluid spray was perhaps eighty yards.[18] Onsite personnel reported that the ground trembled.[19]

The Orcutt Hill Oil Field has had surface expressions as well. In 2011, a well now owned by PCEC caused multiple surface expressions.[20] Operators witnessed steam venting from the ground nearby after they had injected steam into the well.[21] Well integrity and pressure testing revealed a leak in the casing of the well, caused by "*repeated expansion and contraction as a result of cyclic steaming*."[22] Given these repeated leaks, from wells in the field, an expansion of cyclic steam will no doubt result is still more leaks and fluid migration.

B. Cyclic Steam operations are a threat to groundwater and surface water.

In addition to causing potentially deadly surface expressions, cyclic steaming can pollute groundwater aquifers. The EIR acknowledges that cyclic steam operations will lead to significant and unavoidable impacts for surface and groundwater.[23] This conclusion is consistent with harm occurring elsewhere. In the winter of 1995, six well casings in a field in Alberta, Canada, failed under the pressure of cyclic steam stimulation.[24] Similar to the Project at issue here, the operations were pursuing heavy oil at relatively shallow depths.[25] The failures released approximately 55,000

[12] Ibid.
[13] *Id.* at 4; Spill Binder part 3 at 16.
[14] Accident Report at 10; Spill Binder part 3 at 16.
[15] Spill Binder part 3 at 16.
[16] Accident Report at 7.
[17] Id. at 8.
[18] Spill Binder part 2 at 11.
[19] Accident Report at 8.
[20] BreitBurn Energy Company, LP, NewLove 212 Incident Report Nov. 14, 2011.
[21] Ibid.
[22] Id. at p. 7. (emphasis added.)
[23] EIR at ES-6.
[24] Kennedy, Alan and Calvin Sikstrom, Assessment and Remediation of a Heavy-Oil Spill into Groundwater Aquifers, International Oil Spill Conference Proceedings: April 1997, Vol. 1997, No. 1, pp. 347-363 (1997).
[25] Ibid.

cubic meters of "oil, saline produced water, and solids" to the environment, polluting two groundwater aquifers in the process.[26]

Contaminating nearby aquifers would be an irreversible disaster, especially when California is experiencing its sixth year of record drought. The State Water Resources Control Board explained to the state legislature last year that injection wells across the state have already contaminated scores of aquifers: "any injection [from injection wells] into the aquifers that are not exempt has contaminated those aquifers."[27] And once contaminants reach an aquifer, according to the Water Board, "you don't clean up aquifers, you contain the spread of contamination."[28]

Orcutt Hill's many oil seeps, which pose a threat to habitats and water, would be exacerbated if new wells are added to PCEC's operations. Though some seeps occur naturally, the director of the County's planning and development department acknowledged that "it is likely that shallow steaming is enhancing the seeps."[29] The California Department of Fish and Wildlife expects the project to result in 225 additional seeps if the project is approved. This is supported by PCEC's own presentation, which shows seeps and emergency seep can installations reached their highest level in 2008—one year after the company began cyclic steam operations. If PCEC is allowed to expand its operations and inject substantially more steam and chemicals into the ground, creating more conduits for oil to migrate, it is very likely that the oil seep problem will get worse. Given the potential harm of increased oil seeps, and the fact that it is impossible to predict where these oil seeps will occur, the County must reject any proposal that would add new wells and increased injections in this area.

C. Chemicals used in used in oil well drilling and operations are harmful yet will not be disclosed.

All oil and gas wells, cyclic steam wells included, use a host of chemicals that are harmful to the environment and human health.[30] Operators use them in drilling muds to facilitate the drilling process, in powerful cleaning solvents, or in chemical mixtures designed to maintain the well. Oil and gas operations emit large amounts of VOCs and NOx.[31] VOCs make up about 3.5 percent of the gases emitted by oil or gas operations.[32] The VOCs emitted include the BTEX compounds—benzene, toluene, ethyl benzene, and xylene—which are Hazardous Air Pollutants.[33] There is substantial

---

[26] Ibid.
[27] Transcript: Joint Oversight Hearing: Senate Natural Resource and Water and Environmental Quality Committees, "Ensuring Groundwater Protection: Is the Underground Injection Control Program Working?" Jonathan Bishop speaking, March 10, 2015, p. 74.
[28] Id. at 73.
[29] Cooper, L., "Emergency Permit Issued to Energy Company to Contain Onshore Orcutt Oil Seep," Noozhawk (July 3, 2015), available at: https://www.noozhawk.com/article/emergency_permit_issued_to_oil_company_contain_onshore_orcutt_oil_seep
[30] See Shonkoff, S., "Hazard Assessment of Chemical Additives Used in Oil Fields that Reuse Produced Water for Agricultural Irrigation, Livestock Watering, and Groundwater Recharge in The San Joaquin Valley of California: Preliminary Results." PSE Health Energy Technical Report (Sept. 2016).
[31] Sierra Club et al. comments on New Source Performance Standards: Oil and Natural Gas Sector; Review and Proposed Rule for Subpart OOOO (Nov. 30, 2011) ("Sierra Club Comments") at 13.
[32] Brown, Heather, Memorandum to Bruce Moore, U.S.EPA/OAQPS/SPPD re Composition of Natural Gas for use in the Oil and Natural Gas Sector Rulemaking, July 28, 2011 ("Brown Memo") at 3.
[33] Each has also been identified as a carcinogen. Mall, Amy, Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act Concerning the Regulation of Wastes Associated with the Exploration,

evidence of the harm from these pollutants.[34] One analysis found that 37 percent of the chemicals used during natural gas drilling, fracturing, and production were volatile and that of those volatile chemicals, 81 percent can harm the brain and nervous system, 71 percent can harm the cardiovascular system and blood, and 66 percent can harm the kidneys.[35] Exposure to benzene has been associated with increased incidence of leukemia and other serious health conditions; exposure to toluene can damage the nervous system; and xylenes can cause dizziness, headaches, and loss of balance.[36]

Unfortunately, neither state nor federal regulations require companies to disclose the chemical identities or volumes used. While some chemicals have been identified, a substantial portion of chemicals remain secret. This is worrisome because enhanced oil recovery operations like cyclic steam injection commonly employ harmful chemicals acting as surfactants, polymers, caustics, or biocides to facilitate the operation. Implying that cyclic steam injection is simply the reuse of "water" is a gross mischaracterization that hides real risks from these high-intensity operations.

D. DOGGR routinely allows steam injection at dangerously high pressures.

Injecting at high pressures can increase the risk of leaks, well failure, and fluid migration. When the pressure is high enough to fracture the surrounding formation, it creates additional risk that new pathways for fluid migration will be created, allowing contaminants to escape to other subsurface areas.

Compounding the risk of leaks and fluid migration is DOGGR's refusal to limit the pressures under which steam is injected into the well. An investigation by the state legislature found that the agency allows operators to inject steam at pressures high enough to fracture the formation as a matter of "routine."[37] This directly violates DOGGR's own regulations, which state, "Maximum allowable surface injection pressure *shall be less than the fracture pressure.*"[38] DOGGR's project approval conditions for the PCEC proposal do not include thus restriction either, indicating that DOGGR has no intention of enforcing this regulation. DOGGR only limits pressure during injection but is silent on other phases, and the maximum pressure prevents the steam from migrating out of the intended zone.[39]

Development, or Production of Crude Oil or Natural Gas or Geothermal Energy at 13 (Sep. 8, 2010); 42 U.S.C. § 7412(b).

[34] Colborn, Theo et al., Natural Gas Operations for a Public Health Perspective, 17 Human and Ecological Risk Assessment 1039 (2011) ("Colborn 2011"); McKenzie, Lisa et al., Human Health Risk Assessment of Air Emissions form Development of Unconventional Natural Gas Resources, Sci Total Environ (2012), doi:10.1016/j.scitotenv.2012.02.018; Food & Water Watch, The Case for a Ban on Fracking (2012).

[35] Colborn 2011 at 8.

[36] Mall, Amy, Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act Concerning the Regulation of Wastes Associated with the Exploration, Development, or Production of Crude Oil or Natural Gas or Geothermal Energy at 7 (Sep. 8, 2010).

[37] Oversight Hearing of the Senate Natural Resources and Water and Environmental Quality Committees, *Ensuring Groundwater Protection: Is the Underground Injection Control Program Working?: Background Information*, 12 (Mar. 10, 2015) ("Oversight Hearing Background Information") *available at* http://sntr.senate.ca.gov/sites/sntr.senate.ca.gov/files/3_10_14_uic_background.pdf.

[38] 14 Cal. Code of Regs. § 1724.10(i) (emphasis added).

[39] California Department of Conservation, Division of Oil, Gas, and Geothermal Resources. June 9, 2016 letter, p. 1-2.

E. Greenhouse Gas Emissions will not be offset by the proposed mitigation measures

Despite promises that the project will not result in any net greenhouse gas emissions, PCEC's mitigation measures fall far short of stemming this project's true carbon footprint. The offsets appear to only apply to the emissions resulting from the operations themselves.

Thus, even if PCEC purchases enough greenhouse gas credits to account for its operations, it will not be nearly enough to offset all of the foreseeable emissions that follow. Greenhouse gases have the same effect on climate change regardless of where they are emitted, be it at the well pad, refinery, or tailpipe. The true damage to the climate resulting from this project will not be mitigated by the credits PCEC claims it will obtain.

F. The impact to habitat extends beyond the well pad.

The EIR's estimates for land disturbance do not take into account the impacts on adjacent habitat. Oil and gas activities produce air, water, noise, light, and vibration pollution that extend beyond the boundaries of the well pad and affect nearby habitat. One study found that an active oil and gas well pad of 8.8 acres actually disturbed 30 acres of surrounding habitat.[40] Similarly, in the Big Piney-LaBarge field in Wyoming, a study found that while the overall area of oil and gas infrastructure covered 4% of the total area, 97% of the total area fell within one-quarter mile of oil and gas infrastructure.[41] As a result, oil and gas infrastructure impacted all the habitat of the greater sage-grouse in the area and road densities adversely affected elk. Numerous studies have also documented density effects whereby wildlife species decrease use of preferable habitat areas or avoid habitat areas altogether in areas with increasing densities of oil and gas development, leading to indirect habitat loss.[42] For example, mule deer are significantly less likely to occupy areas in proximity to well pads than those farther away.[43] One study found that mule deer have a significantly lower likelihood of using habitat within 2.7 to 3.7 kilometers of well pads, concluding that "indirect habitat losses may be substantially larger than direct habitat losses."[44] In addition, changes in habitat selection appeared to be immediate with no evidence of acclimation, forcing wildlife to increase their use of non-preferred habitats.

Here, PCEC's well pads, 10,000 additional feet of pipeline, and ancillary activities will cause degradation to the adjacent land as well.

---

[40] Johnson, N. 2010. "Pennsylvania energy impacts assessment: Report 1: Marcellus shale natural gas and wind," Nature Conservancy – Pennsylvania Chapter,

[41] Weller, C. et al. 2002. Fragmenting Our Lands: The Ecological Footprint from Oil and Gas Development. The Wilderness Society 80221(303):1-30.

[42] Beckmann, J.P. et al. 2012. Human-mediated shifts in animal habitat use: Sequential changes in pronghorn use of a natural gas field in Greater Yellowstone. Biological Conservation 147(1): 222-3; Dzialak M.R. et al. 2011. Prioritizing conservation of ungulate calving resources in multiple-use landscapes. Plos One 6(1): e14597; Doherty, K.E. et al. 2008. Greater sage-grouse winter habitat selection and energy development. Journal of Wildlife Management 72: 187-195.

[43] Sawyer, H. et al. 2006. Winter habitat selection of mule deer before and during development of a natural gas field. Journal of Wildlife Management 70(2): 396–403; Sawyer, H. et al. 2010. Influence of well pad activity on winter habitat selection patterns of mule deer. Journal of Wildlife Management 73: 1052-1061, page 1058 (*citing* Bureau of Land Management. 2006. Supplemental environmental impact statement for the Pinedale Anticline Oil and Gas Exploration and Development Project. Wyoming State Office, Cheyenne, USA.)

[44] Sawyer, H. et al. 2006.

G. Confining new wells to existing well pads does not ensure decreased impacts.

PCEC's revised proposal includes a commitment to drill new wells only strictly on existing well pads. While this reduces the area of land disturbance, it does not necessarily lessen the overall environmental impact. Consolidating wellheads at the surface may lead to more directional or horizontal drilling in order to reach the desired formations. Directional and horizontal wells may require more extensive or intensive drilling, more use of drilling mud chemicals, and more truck traffic to support the operations. Studies have shown that such wells are more likely to have well failures over time compared to vertical wells.[45] Thus, using existing pads may introduce new and more severe risks. Without more evaluation, this change cannot be considered an improvement in the project.

Conclusion

The Board should stand reaffirm the sound decision to protect Santa Barbara County's water, air, and health by rejecting the revised project proposal. It offers few benefits and in some ways could worsen the impact of the project. Santa Barbara residents, both present and future, deserve to have clean and air water. The Board can also take a significant step towards battling climate change and making a sustainable climate possible.

Thank you for your consideration to this important issue.

Respectfully submitted,

Hollin Kretzmann
Staff Attorney
Center for Biological Diversity
1212 Broadway, Suite 800
Oakland, CA 94612

[45] See, e.g., Watson, "Evaluation of the Potential for Gas and CO2 Leakage Along Wellbores," March 2009 SPE Drilling & Completion, at p. 122, available at https://www.researchgate.net/publication/254526287_Evaluation_of_the_Potential_for_Gas_and_CO2_Leakage_Along_Wellbores

REFERENCES CITED AND ATTACHED

Aquifers, International Oil Spill Conference Proceedings: April 1997, Vol. 1997, No. 1 (1997)

Beckmann, J.P. et al. 2012. Human-mediated shifts in animal habitat use: Sequential changes in pronghorn use of a natural gas field in Greater Yellowstone. Biological Conservation 147(1): 222-3

BreitBurn Energy Company, LP, NewLove 212 Incident Report Nov. 14, 2011

Brown, Heather, Memorandum to Bruce Moore, U.S.EPA/OAQPS/SPPD re Composition of Natural Gas for use in the Oil and Natural Gas Sector Rulemaking, July 28, 2011 ("Brown Memo")

California Legislature, Oversight Hearing of the Senate Natural Resources and Water and Environmental Quality Committees, Ensuring Groundwater Protection: Is the Underground Injection Control Program Working?: Background Information, 12 (Mar. 10, 2015)

Chao, J., "Underground Science: Berkeley Lab Digs Deep For Clean Energy Solutions," Lawrence Berkeley National Laboratory, Oct. 19. 2016, quoting Susan Hubbard, Associate Director

Colborn, Theo et al., Natural Gas Operations for a Public Health Perspective, 17 Human and Ecological Risk Assessment 1039 (2011)

Cooper, L., "Emergency Permit Issued to Energy Company to Contain Onshore Orcutt Oil Seep," Noozhawk (July 3, 2015)

Department of Conservation, Division of Oil, Gas, and Geothermal Resources, Report of Occurrences, The Chevron Fatality Accident, June 21, 2011, and Area Surface Expression Activity, Pre and Post Accident, Sections 21 & 22 T.32S./R.23E., Midway-Sunset Oil Field, Kern County (May 2012)

Department of Conservation, Division of Oil, Gas, and Geothermal Resources, Reports of Occurrence: Surface Expressions in Bakersfield (Spill Binder) (2011)

Doherty, K.E. et al. 2008. Greater sage-grouse winter habitat selection and energy development. Journal of Wildlife Management 72: 187-195.

Dzialak M.R. et al. 2011. Prioritizing conservation of ungulate calving resources in multiple-use landscapes. Plos One 6(1): e14597

Food & Water Watch, The Case for a Ban on Fracking (2012)

Johnson, N. 2010. "Pennsylvania energy impacts assessment: Report 1: Marcellus shale natural gas and wind," Nature Conservancy – Pennsylvania Chapter

Kennedy, Alan and Calvin Sikstrom, Assessment and Remediation of a Heavy-Oil Spill into Groundwater (1997)

Kulakofsky, David, Achieving Long-Term Zonal Isolation in Heavy-Oil Steam Injection Wells, a Case History (2008)

Mall, Amy, Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act Concerning the Regulation of Wastes Associated with the Exploration, Development, or Production of Crude Oil or Natural Gas or Geothermal Energy (Sep. 8, 2010)

McKenzie, Lisa et al., Human Health Risk Assessment of Air Emissions form Development of Unconventional Natural Gas Resources, Sci Total Environ (2012), doi:10.1016/j.scitotenv.2012.02.018

Sawyer, H. et al. 2006. Winter habitat selection of mule deer before and during development of a natural gas field. Journal of Wildlife Management 70(2): 396–403

Sawyer, H. et al. 2010. Influence of well pad activity on winter habitat selection patterns of mule deer. Journal of Wildlife Management 73: 1052-1061

Shonkoff, S., "Hazard Assessment of Chemical Additives Used in Oil Fields that Reuse Produced Water for Agricultural Irrigation, Livestock Watering, and Groundwater Recharge in The San Joaquin Valley of California: Preliminary Results." PSE Health Energy Technical Report (Sept. 2016)

Sierra Club et al. comments on New Source Performance Standards: Oil and Natural Gas Sector; Review and Proposed Rule for Subpart OOOO (Nov. 30, 2011)

Transcript: Joint Oversight Hearing: Senate Natural Resource and Water and Environmental Quality Committees, "Ensuring Groundwater Protection: Is the Underground Injection Control Program Working?" Jonathan Bishop speaking, March 10, 2015

Watson, "Evaluation of the Potential for Gas and CO2 Leakage Along Wellbores," March 2009 SPE Drilling & Completion

Weller, C. et al. 2002. Fragmenting Our Lands: The Ecological Footprint from Oil and Gas Development. The Wilderness Society 80221(303):1-30

Wu, Jiang, Casing Temperature and Stress Analysis in Steam-Injection Wells (2006); also Wu, Jiang, Casing Failures in Cyclic Steam Injection Wells (2008)

Xie, Jueren, Analysis of Casing Deformations in Thermal Wells (2008)