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*Via E-Mail and U.S. Mail*

Pat Abel  
Coastal District Deputy  
Geologic Energy Management Division  
1000 S. Hill Rd, Suite 116  
Ventura, CA 93003-4458  
E-Mail: pat.abel@conservation.ca.gov

Re: Carbon California Operating Company  
Expansion Application to UIC 6490007

Dear Ms. Abel:

My firm represents Climate First: Replacing Oil and Gas (“CFROG”) in matters related to oil and gas development in Ventura County. CFROG is concerned that the above-referenced Underground Injection Control (“UIC”) Expansion proposal (the “Project”) will result in a dramatic increase in wastewater injection into a formation bounded and intersected by numerous faults, including faults that may be capable of producing major earthquakes. Numerous published scientific articles—including recent studies from California—have linked increased wastewater injection to induced seismicity.

As discussed below, CalGEM’s statutory mandate explicitly includes protection of public health, safety, and property, and thus extends to prevention of seismic hazards that may be exacerbated by wastewater injection. Accordingly, CFROG requests that CalGEM carefully review and take steps to avoid potential seismic hazards posed by the Project, in addition to enforcing all applicable requirements under governing UIC regulations.

The Project and its Geological Context

Carbon California Operating Company (“Carbon California”) proposes to expand existing wastewater injection operations on the Hamp Lease east of Ojai. Carbon

California's operations currently rely on a single injection well ("Hamp 72"). The Project would convert three additional existing production wells ("Hamp 47," "Hamp 51," and "Hamp 99") to injection wells; together, the four wells could inject up to 3,000 barrels per day of wastewater. California Carbon Operating Company, Underground Injection Control Expansion Application to UIC 6490007 ("Application") at 1, 3. This would represent more than a fourfold increase compared to the observed injection rate of 705 barrels per day shown in the most recent mechanical integrity test record for the existing Hamp 72 injection well available on CalGEM's Wellstar website.<sup>1</sup>

The proposed injection zone is a fault block in the Lower Mohnian Sands. Application at 1. The Application and accompanying figures show that the injection area is adjacent to several faults, including the Big Canyon and San Cayetano faults, as well as numerous tear faults. Application at 4-5, 10; Figures 8, 11a, 15a. Two of the wellbores (Hamp 47 and 99) appear to intersect the Big Canyon fault, and two of the wellbores (Hamp 47 and 51) intersect at least one of the tear faults. Application Figures 11a, 11b, 11c, 11d. One wellbore (Hamp 51) appears to intersect both the San Cayetano and Big Canyon Faults, as well as several tear faults. Application Figures 11a, 12b.

The Project is located in proximity to active fault zones and in a mapped seismic hazard area.<sup>2</sup> According to the California Geological Survey, researchers have found evidence indicating that large earthquakes may have occurred along the San Cayetano fault in the relatively recent past.<sup>3</sup> Geologists also believe the San Cayetano

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<sup>1</sup> Well Analysis Corporation, Water Injection Survey, API No. 04111212710000 (August 11, 2017), available at [ftp://ftp.consrv.ca.gov/pub/oil/WellRecord/111/11121271/11121271\\_MIT\\_08-11-2017.pdf](ftp://ftp.consrv.ca.gov/pub/oil/WellRecord/111/11121271/11121271_MIT_08-11-2017.pdf) (visited April 14, 2020). The highest observed injection rate in the most recent five years of tests available on Wellstar was 1,465 barrels per day in 2014.

<sup>2</sup> See California Geological Survey, *Earthquake Zones of Required Investigation: Santa Paula Peak Quadrangle* (Oct. 17, 2003), available at [https://gmw.conservation.ca.gov/SHP/EZRIM/Maps/SANTA\\_PAULA\\_PEAK\\_EZRIM.pdf](https://gmw.conservation.ca.gov/SHP/EZRIM/Maps/SANTA_PAULA_PEAK_EZRIM.pdf) (visited April 14, 2020); California Geological Survey, *Seismic Hazard Zone Report 075: Seismic Hazard Zone Report for the Santa Paula Peak 7.5-Minute Quadrangle, Ventura County, California* (rev. Oct. 10, 2005), available at [https://gmw.conservation.ca.gov/SHP/EZRIM/Reports/SHZR/SHZR\\_075\\_Santa\\_Paula\\_Peak.pdf](https://gmw.conservation.ca.gov/SHP/EZRIM/Reports/SHZR/SHZR_075_Santa_Paula_Peak.pdf) (visited April 14, 2020).

<sup>3</sup> Brian P. E. Olson, *California Geological Survey Fault Evaluation Report FER-257: Eastern San Cayetano Fault in the Piru Quadrangle* (March 28, 2012) at 6-7, 8-9 (attached as Ex. A).

fault may have some connection to the Ventura Fault, which runs through highly populated areas and has the potential to generate large, destructive quakes.<sup>4</sup>

### CalGEM Must Review Seismic Hazards Posed by the Application

CalGEM must carry out its statutory duties in a manner that protects public health, safety and welfare. For decades, state law has charged the oil and gas supervisor with supervising drilling, and operation of wells “so as to prevent, as far as possible, damage to life, health, property, and natural resources.” Pub. Resources Code § 3106(a). Last year, the Legislature amended Division 3 of the Public Resources Code to make even more clear that the purposes of the statutory scheme include “protecting public health and safety and environmental quality.” Pub. Resources Code § 3011. CalGEM’s UIC regulations focus primarily on well integrity and potential migration of injected fluids. However, CalGEM’s overriding statutory responsibility for protection of health, safety, and property also compels review of potential seismic hazards from wastewater injection, including the potential for fault lubrication that could induce earthquakes.

Geologists have long recognized that underground injection can induce seismic activity.<sup>5</sup> Increased pore pressure from fluid injection reduces the “effective normal stress” that resists shear movement along faults, allowing the release of elastic energy stored in the rock.<sup>6</sup> One recent study found that an increase in wastewater injection rates likely contributed to a 2005 earthquake swarm at the southern end of the Central Valley in California.<sup>7</sup> The same study noted that California has more wastewater injection wells than Oklahoma, “where induced seismicity is suggested to be widespread,” and that California has “experienced a systematic increase in injection volumes” in recent years.<sup>8</sup>

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<sup>4</sup> Kit Stoltz, *Ventura earthquake fault more dangerous than previously thought*, Ventura County Star (Jan. 5, 2014) (attached as Ex. B).

<sup>5</sup> See, e.g., Mark D. Zoback, *Managing the seismic risk posed by wastewater disposal*, Earth (April 2012) (“Zoback 2012”) at 39 (attached as Ex. C).

<sup>6</sup> Zoback 2012 at 39.

<sup>7</sup> T. H. W. Goebel, et al., *Wastewater disposal and earthquake swarm activity at the southern end of the Central Valley, California*, Geophysical Research Letters 43, 1092-1099 (2016) (“Goebel 2016”) (attached as Ex. D); see also T. H. W. Goebel, et al., *An objective method for the assessment of fluid injection-induced seismicity and application to tectonically active regions in central California*, J. of Geophysical Research: Solid Earth 120, 7013-7032 (2015) (attached as Ex. E).

<sup>8</sup> Goebel 2016 at 1092-93.

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To reduce the risk of earthquakes from fluid injection, Zoback 2012 recommends that regulators and operators must (1) “avoid injection into active faults and faults in brittle rock,” (2) select formations for injection and limit injection rates to minimize pore pressure changes, (3) install local seismic monitoring arrays, (4) establish pre-injection protocols defining how operations should be modified in response to triggered seismicity, and (5) prepare to reduce injection rates or abandon wells if seismicity poses hazards.<sup>9</sup>

Accordingly, in addition to reviewing the Project for compliance with applicable UIC regulations, CalGEM must review the potential for induced seismicity resulting from an increase in injection rates in an area crisscrossed by multiple faults, some of which may be capable of producing large earthquakes. CalGEM must not approve the Project unless and until a thorough review is carried out and measures are adopted to avoid seismic risk.

Thank you for your consideration of CFROG’s comments regarding the Application.

Very truly yours,

SHUTE, MIHALY & WEINBERGER LLP



Kevin P. Bundy

Attachments: See attached exhibit list

cc: John Brooks, CFROG

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<sup>9</sup> Zoback 2012 at 40.

Exhibits (submitted in PDF format with electronic copy of comments)

A	Brian P. E. Olson, <i>California Geological Survey Fault Evaluation Report FER-257: Eastern San Cayetano Fault in the Piru Quadrangle</i> (March 28, 2012).
B	Kit Stoltz, <i>Ventura earthquake fault more dangerous than previously thought</i> , Ventura County Star (Jan. 5, 2014).
C	Mark D. Zoback, <i>Managing the seismic risk posed by wastewater disposal</i> , Earth (April 2012).
D	T. H. W. Goebel, et al., <i>Wastewater disposal and earthquake swarm activity at the southern end of the Central Valley, California</i> , Geophysical Research Letters 43, 1092-1099 (2016).
E	T. H. W. Goebel, et al., <i>An objective method for the assessment of fluid injection-induced seismicity and application to tectonically active regions in central California</i> , J. of Geophysical Research: Solid Earth 120, 7013-7032 (2015).

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